Technische Universität München
TUM School of Engineering and Design

Blockchain Technology for a Transparent Land Administration System: Feasibility Assessment for Adoption in Ghana's Land Sector

Prince Donkor Ameyaw

Vollständiger Abdruck der von der TUM School of Engineering and Design der Technischen Universität München zur Erlangung eines **Doktors der Ingenieurwissenschaften (Dr.-Ing.)** genehmigten Dissertation.

Vorsitz: Prof. Dr. rer. nat. Martin Werner

Prüfende der Dissertation:

1. Prof. Dr. ir. Walter Timo de Vries
2. Prof. Serena Coetzee

Die Dissertation wurde am 01.07.2024 bei der Technischen Universität München eingereicht und durch die TUM School of Engineering and Design am 24.10.2024 angenommen.

Dedication

I specially dedicate this PhD dissertation to my father, Mr. John Evans Donkor (MASTER DONKOR) of blessed memory (7th Oct 1941 – 14th Jan 2014). Your selfless support, guidance, and nurture has been the inspiration, keeping me resilent and motivated all through to achieving this milestone. This is for you Daddy. Rest on in peace and pride

Acknowledgement

First and foremost, I greatly thank the Lord God Almighty for bringing me to this point. His promises are always yes and amen. All glory and honour to his Holy name for this milestone **(1 Samuel 7:12)**.

To my Doctoral father and supervisor, Prof. Dr. Ir.-Walter Timo de Vries, I say a big thank you for believing in me, and accepting to supervise me for this PhD studies. You created avenues for self-learning, networks, opportunities. Your in-depth and sound guidance contributed to this success story, and the associated publications. Prof. you did a great job. Ayekoo. Next is to my big brother and mentor, Prof. Dr. Ir.-Uchendu Eugene Chigbu, I appreciate your crucial role in my academic journey and personal life balance. Your time, energy, advice, guidance, and comments since 2016 to date have fueled me in climbing this academic ladder. Thank you for making me see, and believe in myself. Also, to Dr. Arc. Pamela Duran Diaz, my Doctoral mother as I call you. You have been exceptional. Your ever-readiness to support me both academically, and with my personal life in diverse ways is well appreciated. To Ms. Christine Schwarz, thank you so much for everything; creating a welcoming environment at the Chair of Land Management (LM) and facilitating my access to all necessary documentations I ever needed, and for logistics for my teaching, and persentations at all times. To all my PhD colleagues at LM Chair, you guys are the best. Thank you for your insightful comments on my work during colloquiums. Special mentions to; Walter Dachaga for being my go-to discussion partner on this study-work balance journey in Munich, Vineet Chaturvedi for assisting me with my maps and GIS related issues, Pierre Damien, and Dr. Anthony Agboeze for guiding me at beginning stage of my PhD studies.

Secondly, this studies could never have been possible without the financial support of the KAAD scholarship scheme. This is to let you know that you did not only support the dream of one young boy, but also the vision of a Ghanaian local community that sought to see its children grow to make impacts. I will remain a committed ambassador to the KAAD values of knowledge transfer for positive impacts on society. Myself and other KAAD scholars appreciate the love and family bond you create amongst us all both as scholars and alumni. It fosters and holds a sustainable impact creation. TUM-KHG Tuesday Stay-Pray & Eat, with Ms. Sabine Gerhard and the team was the best. It built us spiritually and created a home-away from home for us in Munich. Thank you.

Furthermore, I thank all the staff of my case study institutions for their willingness, and openness to provide me with all the necessary data for this PhD studies. It could not have been successful without you. Special mentions to Mr. Egyam Emmanuel (LVD), and to Dr. Benjamin Armah Quaye, and Mr. Michael Appiah of the (PVLMD) Accra Lands Commission.

Also, to Dr. Abedi Asante Lewis, I thank you for your support, advice, and reading through my manuscripts, giving constructive comments to improve them. Dr. Emmanuel Kofi Gavu, thank you for your support and guidance.

To my brother Surv. Emmanuel Egyam, and the wife Mrs. Hectoria Aduse Poku for your unwavering support during this PhD journey, especially during my fieldwork stay in Accra. You are gold.

To Adane Michael, and Emmanuel Boateng Antwi, thank you both for the constant encouragement

Also, to the Holy True Teaching Church of Christ, Munich, I thank you all and most especially, Ps. Robert Jojo Gardener, and the wife, Md. Victoria Parkie Brewster. God bless you.

To my family; Comfort Abena Sakyiwaah mymother, and all my siblings, Alex Adinkrah, Patricia Ansuah, Patience Amoah Donkor, and Bright Boamah Ameyaw. Thank you all for always believing in me and motivating me, supporting me, and motivating me on through all my education up to this level. I appreciate you all and may God richly bless you

Finally and like the saying that 'the best is always reserved for the last', to my dearest beautiful wife, Mary Adwoa Kintor. I thank you so much for everything. Your unflinching love, and support through the lows and highs of this journey motivated, kept and pushed me this far. We made it my Love.

Abstract

In an era of digital normalcy and advocation, Ghana's land administration system still remains predominantly analog despite over two decades of digitalization vision, and attempts. Digital transformation of the sector has been, and remains somewhat dormant, allowing for a generally low level of transparency in land dealings with its attendant challenges of unscrupulous acts, and other opportunistic behaviors. Contemporary policies, and scholarly discourses have focused on the need to streamline digitalization of the sector to address the challenges. No study has however holistically assessed the digitalization trajectory of the sector to inform a way forward for a sustainable digitalized land administration system. Using the Accra Lands Commission, Kumasi Lands Commission, and the Otumfuor Customary Land Secretariat as study cases in a mixed research approach, this thesis relies on sectorial experiences of previous technology uptakes, and other expert views in a bid to learn from contextual lessons to guide a possible Blockchain uptake for land administration services and proceses. It contends that Blockchain technology stands to address the low transparency level and its associated challenges in Ghana's land administration.

Findings show that digitalization initiatives in the land sector have generally been in the form of piecemeal projects that are largely disconnected. There is no holistic land digitalization vision plan, and specific policy document as blueprints for charting the land digitalization, or digital transformation agenda. Also, sectoral institutions work in a more automnomous, and or seclusion approach than in close coordination although the interface between their different mandates necessitates the latter than the former. A maturity assessment result shows that the sector is at a digitally Emerging stage although Integrated at few areas for especially the Accra Lands Commission. This study identifies that the way forward revolves around a framework of some eight focus areas holistically embracing political, socio-cultural, economic, institutional, and technical capacitites that are necessary for the transitioning to a sustainable digitalized land sector. Conceptual contribution of the study lies in; situating Blockchain technology as an enabling tool for transparency within the land administration functions of land tenure, land valuations, land use, and land development processes. Also, socio-cultural elements as additional analytical dimension to the TOE framework; and a designed Blockchain-based land transaction framework.

Implications of the study results for Blockchain uptake for land administration transparency include; the formulation of a National Land Digitalization Delta Plan that encapsulates the visions, goals, mandates, and expected deliverables over a specified long term. There should also be a consolidated national land digital policy document on land sector digitalization. And again, efforts must be made towards Digital Leadership and Governance in the sector among others. These can help revive, and redirect towards an efficient, and sustainable digitalized land sector. Future research should investigate the activities, and impacts of BenBen, and other firms involved in Blockchain for land services in Ghana to help elicit more insights both for validation, and extension of this studies results, and frameworks.

Keywords: Blockchain Technology, Land Administration Transparency, Ghana, Lands Commission, Customary Land Secretariat

Zusammenfassung

Im Zeitalter der digitalen Normalität und des digitalen Fortschritts ist das ghanaische Landverwaltungssystem trotz mehr als zwei Jahrzehnten Digitalisierungsvisionen und -versuchen immer noch überwiegend analog. Die digitale Transformation des Sektors war und ist eher schlafend, was zu einem allgemeinen Mangel an Transparenz bei Landgeschäften und den damit verbundenen Herausforderungen durch skrupellose Handlungen und andere opportunistische Verhaltensweisen geführt hat. Aktuelle politische und wissenschaftliche Diskurse haben sich auf die Notwendigkeit konzentriert, die Digitalisierung in diesem Sektor zu rationalisieren, um die Herausforderungen zu bewältigen. In keiner Studie wurde jedoch der Verlauf der Digitalisierung des Sektors bewertet, um einen Weg für ein nachhaltiges digitalisiertes Landverwaltungssystem zu finden. Anhand der Accra Lands Commission, der Kumasi Lands Commission und des Otumfuor Customary Land Secretariat als Fallstudien in einem gemischten Forschungsansatz stützt sich diese Arbeit auf die Erfahrungen des Sektors mit früheren Technologieeinführungen und auf andere Expertenmeinungen, um aus dem Kontext zu lernen und eine mögliche Blockchain-Einführung für Landverwaltungsdienste und -prozesse zu unterstützen. Es wird behauptet, dass die Blockchain-Technologie den Mangel an Transparenz in der Landverwaltung und die damit verbundenen Herausforderungen beseitigen kann. Die Ergebnisse zeigen, dass Digitalisierungsinitiativen im Landsektor im Allgemeinen in Form von Einzelprojekten durchgeführt werden, die weitgehend unzusammenhängend sind. Es gibt keinen ganzheitlichen Plan für die Digitalisierung des Bodens und auch kein politisches Dokument, das als Blaupause für die Agenda der digitalen Transformation des Bodens dienen könnte. Außerdem arbeiten die sektoralen Institutionen eher automatisiert und/oder abgeschottet als in enger Abstimmung, obwohl die Schnittstelle zwischen ihren verschiedenen Mandaten eher Letzteres als Ersteres erfordert. Die Ergebnisse der Reifegradbewertung zeigen, dass sich der Sektor in einem digitalen Anfangsstadium befindet, obwohl die Accra Lands Commission allmählich in ein aufstrebendes Digitalisierungsstadium übergeht. Diese Studie zeigt auf, dass der Weg nach vorne sich um einen Rahmen von etwa acht Schwerpunktbereichen dreht, die politische, soziokulturelle, wirtschaftliche, institutionelle und technische Kapazitäten umfassen, die für den Übergang zu einem nachhaltigen digitalisierten Landsektor notwendig sind. Der konzeptionelle Beitrag der Studie besteht darin, die Blockchain-Technologie als Instrument zur Schaffung von Transparenz innerhalb der Landverwaltungsfunktionen des Landbesitzes, der Landbewertung, der Landnutzung und der Landentwicklungsprozesse zu verorten, soziokulturelle Elemente als zusätzliche analytische Dimension des EVG-Rahmens zu betrachten und einen Blockchain-basierten Rahmen für Landtransaktionen zu entwerfen. Zu den Implikationen der Studienergebnisse für die Einführung von Blockchain für die Transparenz in der Landverwaltung gehören die Formulierung eines nationalen Delta-Plans für die Digitalisierung von Land, der die Visionen, Ziele, Mandate und erwarteten Ergebnisse über einen bestimmten Zeitraum zusammenfasst. Es sollte auch ein konsolidiertes nationales Dokument über die Digitalisierung des Landsektors geben. Und auch hier müssen Anstrengungen unternommen werden, um u. a. eine digitale Führung und Governance in diesem Sektor zu erreichen. Diese können dazu beitragen, einen effizienten und nachhaltigen digitalisierten Landsektor wiederzubeleben und neu auszurichten. Zukünftige Forschungen sollten die Aktivitäten und Auswirkungen von BenBen und anderen Unternehmen, die sich mit

Blockchain für Landdienstleistungen in Ghana beschäftigen, untersuchen, um Erkenntnisse zu gewinnen, die für die Betrachtung der Technologie aus der Perspektive des breiteren ghanaischen Landverwaltungssystems nützlich sind.

Stichworte: Blockchain-Technologie, Transparenz der Landverwaltung, Ghana, Lands Commission, Customary Land Secretariat

Table of Contents

List of Figures

List of Tables

List of Acronyms

AI	Artificial Intelligence
ALC	Accra Lands Commission
ALS	Asantehene Lands Secretariat
AMA	Accra Metropolitan Assembly
ANT	Actor Network Theory
API	Application Interface
ARPS	Aborigines Rights Protection Society
BT	Blockchain Technology
CAQDAS	Computer Assisted Qualitative Data Analysis Software
CERT	Computer Emergency Response Team
CLS	Customary Land Secretariat
CIDA	Canadian International Development Agency
CPD	Continuous Professional Development
CPP	Convention People's Party
CSAU	Client Service Access Unit
CSF	Critical Success Factors
DGRA	Digital Governance Readiness Assessment
DLT	Distributed Ledger Technology
DM	Digital Maturity
DMA	Digital Maturity Assessment
ELIS	Enterprise Land Information System
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FELA	Framework for Effective Land Administration
FIG	International Federation of Surveyors
FOLA	Focus on Land in Africa
GELIS	Ghana Enterprise Land Information System
GIS	Geographic Information System
GIZ	Gesellschaft für Internationale Zusammenarbeit
GPS	Geographic Positioning System
GTZ	German Technical Assistance Corporation
HE	His Excellency
ICT	Information Communication Technology
IGF	Internally Generated Funds
ISO	International Organization for Standardization
IT	Information Technology
KAAD	Katolischer Akademischer Auslanderdienst
KADGIS	Kaduna Geographic Information System
KLC	Kumasi Lands Commission
KMA	Kumasi Metropolitan Assembly
KNUST	Kwame Nkrumah University of Science and Technology
LA	Land Administration
LAO	Land Administration Officer
LAP	Land Administration Project
LAS	Land Administration System

LC	Lands Commission
LCIMS	Lands Commission Information Management System
LGAF	Land Governance Assessment Framework
LI	Legislative Instrument
LTR	Land Title Registration
LTRP	Land Tenure Regularization Program
LUSPA	Land Use and Spatial Planning Authority
LVD	Land Valuation Division
MAST	Mobile Application to Secure Tenure
MIS	Management Information System
NAPR	National Agency for Public Registry
NDF	Nordic Development Fund
NDPC	National Development Planning Commission
NFT	Non-Fungible Token
NLC	National Lands Commission
NLM	National Liberation Movement
NLP	National Land Policy
NRCD	National Redemption Council Decree
OASL	Office of the Administrator of Stool Lands
OCLS	Otumfuor Customary Land Secretariat
OECD	Organization for Economic Co-operation and Development
PKI	Public Key Infrastructure
PNDCL	Provincial National Defense Council Law
PPP	Public and Private Partnership
PVLMD	Public and Vested Land Management Division
QGIS	Quantum Geographic Information System
RLMUA	Rwandan Land Management and Use Authority
SDG	Sustainable Development Goals
SEC	Security and Exchange Commission
SMD	Survey and Mapping Division
SPSS	Statistical Package for Social Scientists
SSA	Sub-Saharan Africa
ST	Structuration Theory
STDM	Social Tenure Domain Model
SWOT	Strengths Weaknesses Opportunities and Threats
TCPD	Town and Country Planning Department
TOE	Technological-Organizational-Environmental
TOES	Technological-Organizational-Environmental, and Socio-Cultural
TUM	Technical University of Munich
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNECE	United Nations Economic Commission for Europe
UN-GGIM	United Nations Global Geospatial Information Management
VE	Video Elicitation
WB	World Bank

Chapter 1.

Research Introduction

1.0 Research Background

In the year 2013 when I was in my second year of the BSc. Land Economy program at Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana, I had the opportunity to work as an intern Land Administration Officer at the then Brong Ahafo Regional Branch of the National Lands Commission (NLC), Ghana. During this internship, one of my everyday tasks was the scanning of hardcopy documents into softcopy formats. This was an initiative that came as part of the Land Administration Project (LAP) that happened in two phase; LAP 1, (2003 – 2011) and LAP 2, (2011 – 2019). There were four main components of this project. 1. Land Policies and Regulatory Framework 2. Institutional Reform and Development 3. Land Titling, Registration, Valuation and Information Systems, and 4. Project Coordination. One of the sub-components of component 3 (*Land Titling, Registration, Valuation and Information Systems*) was to design and implement a computerized land information system (World Bank, 2013). It was in respect of this sub-component that a nationwide scanning of hardcopy paper documents into softcopy formats across the Lands Commission branches had started. At the end of LAP 1, the Project Performance Assessment Report published in 2013, stated that an estimated two million land documents had been scanned into softcopy formats and handed over to the Lands Commission (World Bank, 2013 pp. 22). This component of the project was the first major move in the history of Ghana's land sector towards digitization and possible digitalization, to support land administration services and processes in the country.

Based on my internship experience, I developed interest in the data capture and conversion task and in the general digital processes in support of land administration services. Consequently, my interest led me to reading extensively in this area of digital land administration systems. It turns out that there is a growing interest in this direction with about one third of countries across the world 'estimated to have some type of digital land records system' including some countries in Africa (Rodima-Taylor, 2021). It is interesting to know that in many of the land policy documents across Africa, mentions are made of the need to embrace computerization, and or digitalization, in support of land administration services (Tanzania National Land Policy, 1997; Republic of Rwanda, National Land Policy, 2004; Kenyan National Land Policy, 2009; Uganda National Land Policy, 2013; Land Act, 2020). The opportunities, and benefits of these have been well presented (Lemmen, 2020). Generally, there has been an increasing awareness on the need for computerization, or digitalization of public administration services in Africa in the last two decades. Nevertheless, Okembo et al., (2022) identifies that many countries in Africa are still stuck with the traditional paper based records, and manual processes. This situation rather seems paradoxical especially, given that it's been over two decades of ICT, or computerization in land administration awareness in the region. I was therefore intrigued to look into the issue from the Ghanaian perspective, especially knowing for a fact that the attempt to transition from the manual land administration processes into a computerized, or digitalized one started some two decades ago with the LAP in 2003. Interestingly, a preliminary overview of the Ghanaian system turned

out that Ghana's land administration system is still largely manual with a piecemeal digitalization interventions. There still exist the problem of sustainability, scalability and evaluation as identified by Brown & Grant, (2010) to be the challenges of many developing countries integrating ICT for public services delivery (Oberdorf, 2017). This increased my curiosity to want to find how, and why after about two decades, Ghana had still not achieved a sustainable digitalized land administration system across the country. However, Abolade et al., (2018) note that digitalization of land systems and especially in many developing countries have not been without challenges and that these challenges have militated against the progressions, scalability, and sustainability of same systems across Africa.

1.1 Research Problem

The United Nation's Sustainable Development Goal (SDG) number nine (G9) partly borders on technological improvement across all sectors of development. It highlights the need to foster innovation in addition to building resilient infrastructures, and promoting inclusive and sustainable industrialization. Specifically, target 6 (T6) of G9 states '*Support domestic technology development, research and innovation in developing countries…'* and G9 (T9C) states '*Significantly increase access to information and communications technology*…' Also, Goal 16(T5) maintains the need to substantially reduce corruption and bribery in all forms, and again, (T6) directs the development of effective, accountable and transparent institutions at all levels. All of these goals aim to enhance digital technologies in support of public administration services and processes for efficiency, and transparency. This relates to all public administration sectors including the land sector. Therefore, an efficient, effective, and sustainable digital land administration system stands to immensely contribute towards achieving these goals.

Land administration in Ghana is classified into Statutory, and Customary. Both systems can however be described as a quasi-digital system although most part of the system is predominantly manual, and based on hardcopy paper documents and manual processes. These manual processes limit openness, easy coordination, and information exchange among land stakeholders leading to a generally low level of transparency in the Ghanaian land sector (Ehwi & Mawuli, 2021). The situation allows for several associated challenges in the sector which are well documented to include; unjustifiable loss of land data, double sales of same piece of land to different parties, long processing times for land transactions and registrations, unofficial charges for land services, and dearth of credible land data among other corrupt deals (Ameyaw & de Vries, 2021). For instance, Ehwi & Mawuli, (2021) identified that the low level of coordination between urban planning officials and traditional authorities, contributes to 'landguardism' (a phenomenon where thugs are used and kept on land to scare or ward off counter claimers to the same piece of land due to multiple sales). This phenomenon has led to several fatal clashes amongst different parties which have often resulted in injuries, and sometimes death in worse cases. The 3news.com reported on 1st May 2024 of the shooting and killing of a military officer by a supposed chief and landguard in Kasoa in the central region of Ghana on April 30th 2024 (http://3new.com). This and other challenges, all of which boil-down to a generally low transparency level in land processes and services militate against the sanity, efficiency, and effectiveness in land services delivery.

To this end, and to enhance transparency amongst land services delivery professionals, and recipients, and to help address the associated challenges, different research works, and policy documents have proposed computerization, and or digitalization of land administration system (Land Act, 2020; Adeyinka, 2020; Arthur, 2022). Proponents of this approach share the view that digital systems that allow automation of processes, contactless services, openness, ease of access to, and sharing of land data stands at the center for the elimination of corrupt land deals (World Bank, 2015). Consequently, a migration, and or conversion from manual to digital land processes has become an integral part of Ghana's land initiatives, policies, and projects in the last two decades. The Land Administration Project (LAP) of the Government of Ghana, and the World Bank with support from other development partners including; the Canadian International Development Agency (CIDA), British Department for International Development (DfID), the then German Technical Assistance Corporation (GTZ) but now Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Kreditanstalt fuer Wiederaufbau (KfW), and Nordic Development Fund (NDF) both in Germany (World Bank, 2008). This prject, which started in 2003 is the pioneer initiative in land digitalization in Ghana. Part C of the project components which focused on land titling, registration, valuation, and information systems had the first objective to design and implement a computerized land information system (World Bank, 2008). Other general objectives included; establishing customary land secretariats (CLSs) and resourcing these, and the Lands Commission (LC) offices with such tools as computers, scanners, photocopier machines, and printers among others to support the transition from manual operation systems to digital systems (World Bank, 2008). Consequently, the project introduced a digital land information system called the Ghana Enterprise Land Information System (GELIS) at the Accra LC which was later scaled up to some few other LC offices in Koforidua (Eastern Region), Sekondi-Takoradi (Western Region),Tamale (Northern Region), Bolgatanga (Upper East Region), Savelugu (Northern Region) and Tema (Greater Accra Region) (Deane et al., 2017). Apart from the LAP initiative, other complementary initiatives in the land sector towards transitioning into a digital land system have included; the implementation of the Lands Commission Integrated Management System (LCIMS), the Enterprise Land Information System (ELIS), and the LC online portal. From a policy perspective, there has also been the enactment of the Land Act, 2020, Act 1036 which provides for electronic conveyancing in Ghana (Land Act, 2020).

Notwithstanding these initiatives, the reality remains that the largest part of Ghana's land administration system still remains manual after about two decades of digitalization vision. Scalability, and expansion of the digital initiatives already mentioned has also been sluggish, while still, most of the initiatives have evolved slower than expected to accommodate modern digital systems, and new land sector functionalities (Ansah, 2022). This greatly weighs against the quest to improve land transparency, and efficiency. The digital transformation of the land sector has therefore been somewhat dormant over the years. Some scholars, and policy analysts have cited financial capacity as the challenge for this situation (Deane et al., 2017). Nontheless, despite finance being a contributory factor, it is only a part of the whole. That is, assessment of the situation requires critical look into the broader land sector issues to provide a full view, and valid understanding of the limiting factors, to help know how we can advance digitalization of land administration in the face of modern digital land-supported technologies like Blockchain. In this

study, I contend that the core to the challenge of achieving an efficient, effective, and sustainable digital land administration system for land administration transparency lies in the lack of broader conceptualization, assessment and preparation for digital systems' uptake. This manifest by failure, or inadequacy in identifying; the main land administration challenges needing redress, the right digital tools or technologies available and ideal for the Ghanaian challenges (contextually fit-for-purpose), the specific service areas of application, researched and expert-based contextual guidelines or frameworks to guide adoption or uptake of the tools, and importantly, a better understanding of the maturity and readiness level of the sector's digital systems to help know how to expand and or improve to more advanced functionality technologies. This problem largely accounts for the failures, and or unrealized expectations, expansions, and growth of the digitalization vision in Ghana's land sector.

As a way forward, I posit that Blockchain Technology (BT) as a digital tool improves transparency amongst stakeholders in transactions, and as such, can ideally improve and support transparency of Ghana's land administration system (Niloy et al., 2021; Sahoo et al., 2022). Many studies have appraised the technology in same regard based on pilot projects and results from other land administrations systems that have taken up the technology (Goderdzishvili et al., 2018; Niloy et al., 2021). Some land systems have piloted Blockchain technology in diverse ways and have shown demonstrable positive results (Shang & Price, 2019). In countries like; Georgia, and Sweden, it is applied in support of land registration, Brazil piloted it for land registry in 2017 to help resolve the long land transaction times, Ukraine has a decentralized land registry system on Ethereum Blockchain, Rwanda has a public Blockchain underlying their Ubutaka App which is responsible for securely receiving, processing, and transmitting data for land transactions, in Kenya, Land Layby, a Blockchain company developed an Ethereum Blockchain land registry to resolve mutability and corruption (Sullivan et al., 2019). These provide demonstrable positive experiences of Blockchain for land administration. BT has been recognized to contribute towards achieving the SDGs through its distributed, incorruptible and transparent data by way of reducing fraud to (SDG 8), improving food trust (SDG 2,3&12), and also supply chain traceability (SDG 14&15) (Schinckus, 2020). Despite these potentials, it is important to point that adoption of the technology comes with requirements and considerations. That is, there are precursors to the uptake of Blockchain for land administration. As has been indicated already, there is a general lack of broader conceptualization, assessment and preparation for digital systems, and technologies' uptake in Ghana and this results in diverse challenges that limit the land sector digitalization growth, and sustainability. To this end, this study's objective is to assess the feasibility of Ghana's land sector for Blockchain technology adoption, or uptake in support of land administration transparency. To achieve this objective, it is crucial to answer the main question; ***how can Ghana sustainably adopt Blockchain technology in support of land administration services, and processes to enhance land administration transparency?*** To achieve the study objective by way of answering the study question, I set out specific research objectives, with crucial questions in the subsequent sub-sections.

1.2 Research Objectives and Questions

The research objective is to assess the feasibility of Ghana's land sector for Blockchain technology adoption and or uptake in support of land administration transparency. To operationalize this, specific research objectives, with specific research questions have been posed to help address the study objective as shown in table 1 below.

No	Research Objective	Research Question	
		Main Question	Sub-questions
1	To conceptualize BT and land administration transparency	How does Blockchain technology relates to land administration transparency?	• What are the essential elements and relations between BT and land administration transparency? • How can Blockchain technology improve the transparency of land administration functions—based on the Ghanaian land administration context?
2	To assess land acquisition, and registration processes in Ghana, and the potentials of Blockchain technology towards these	How can Blockchain technology potentially enhance land acquisition, and land registration processes in Ghana?	• What are the main challenges of the current land acquisition, and registration processes in Ghana? • What opportunities, and ways exist to address the land acquisition, and registration challenges in Ghana? • How can we conceptualize a smart land acquisition process that can help to eliminate the identified challenges in the land acquisition, and registration processes in Ghana?
3	To develop a contextual guide of reference based on lessons from a previously adopted digital system (GELIS) that can support the consideration of digital tools like BT for the land sector	How can we develop a contextual reference guide for use by the land sector in the possible consideration of Blockchain technology uptake?	• What could be the underlying reasons why Lands Commission did not fully achieve the expected outcomes on land services delivery with the adoption of GELIS? • What experiences exist in the GELIS project, and how can these shape future adoption of a technology like Blockchain? • How can we develop a guide for the Commission, and similar land administration systems to make use of a technology adoption procedure in a possible future adoption of Blockchain technology?
4	To assess the digital readiness of Ghana's land administration system towards a possible Blockchain technology uptake for a transparent land administration system	To what extent is Ghana's land administration system digitally ready towards a possible Blockchain technology uptake for a transparent system?	• What is the current level of digitalization of the Ghanaian land sector for possible advancement? • What is the way forward given the current level of digitalization of the Ghanaian land sector?

Table 1. Research objectives and corresponding research questions

Source: Author's construct

1.3 Structure of the Dissertation, and Overview of Publications Status

This dissertation is a cumulative one. It is therefore organized into three main parts. Part one covers the chapters, one to three. Part two covers the publications (both published, and those under review) from the research study, and part three focuses on the synthesis, conclusions, and recommendations.

In part one, chapter one begins by setting the tone for the entire research by giving background to the study. It highlights where the interest in the study topic area kicked off, how this interest instigated further readings, leading to the need to further delve into the topic. Subsequent to the background, statement of the research problem is made. This identifies the land digitalization challenge in the Ghanaian land sector, and how that has allowed for a general low level of transparency in land administration services delivery leading to a plenitude of land sector challenges. Accordingly, the main research question is framed, *how can Ghana sustainably adopt Blockchain technology in support of land administration services and processes to enhance land administration transparency?* This question gives the study an objective, that is, to assess the feasibility of Ghana's land sector for Blockchain technology adoption, and or uptake in support of land administration transparency. Pursuant to answering the main research question, and to achieve the objective leads to four sub-objectives with four corresponding sub-questions as highlighted in table 1 above. Chapter two conceptualizes the study. Here, land administration concept is explained, and the perspective of land administration in the Ghanaian context presented. Land administration is then captured within the digitalization, and or the introduction of Information Communication Technology (ICT) tools into land administration system. The evolution of ICT in land administration, and the imports have been highlighted. Following this, Blockchain technology, and its operation is explained. The link is then established for Blockchain and land administration system, and the effects thereof. Finally, Chapter three of part one touches on the research methodology. This chapter identifies the entire approach to the research, and the profile of the case study areas used in the study.

Part two deals with the publications from the research. It mainly starts from chapter four to chapter 7 dealing with, and answering the various research questions to address the objectives. Table 2 below shows the publication status of these empirical chapters. Finally, chapter eight which makes the final part (Part three) presents the synthesis of all the publications, making reflections from their results, and arguments, to conclude the study, and give recommendations on the way forward both for policy, and further research studies.

Chapter	Manuscript title	Publication status
4 Conceptualizing Blockchain-Land Administration Transparency	Transparency of Land Administration and the Role of Blockchain Technology, a Four-Dimensional Framework Analysis from the Ghanaian Land Perspective	Published: 3 December 2020 in Land doi: http://doi:10.3390/land9120491
5 Blockchain-based land acquisition and registration framework and its potentials	Toward Smart Land Management: Land Acquisition and the Associated Challenges in Ghana. A Look into a Blockchain Digital Land Registry for Prospects	Published: 1 March 2021 in Land doi: https://doi.org/10.3390/land10030239
6 A guiding framework for Blockchain adoption based on TOES elements	Blockchain technology adaptation for land administration services: The importance of socio-cultural elements Prince	Published: 6 December 2022 in Land Use Policy doi: https://doi.org/10.1016/j.landusepol.2022.106485
7 Digital maturity status, and or readiness level of Ghana's land sector for BT uptake possibility	Digital Readiness of Ghana's Land Administration System for Blockchain Technology Uptake. Empirical Assessment of Three Land Sector Institutions	Submitted on 13 January, 2024 to Land Use Policy. Submission id: LUP-D-24-00086 Second round revision

Table 2. Overview of publications' status

Chapter2.

Conceptual Framework

2.0 The Concept of Land Administration

Land has different connotations to different people in different parts of the world. Williamson et al., (2010) simply put it that 'the concept of land includes properties, utilities, and natural resources, and encompasses the total natural and built environment within a national jurisdiction, including marine areas'. Land is globally considered an important resource that plays pivotal role in all economies around the world, and in achieving the sustainable development goals (Okembo et al., 2022). For this reason, the need for an efficient land administration cannot be overemphasized. Reiterating this need, Williamson et al., (2010) draw attention that hitherto the 2008 world economic crunch, the developed world paid little attention to land administration, taking it for granted. However, the economic breakdown redirected attention on mortgage policies and processes, and related commodities, and on the need for adequate and on-time land information which can only be derived from effective land administration systems.

Land administration has been explained, and defined from diverse perspectives, fields, and contexts although they all direct towards a common understanding (Fateye et al., 2020). The United Nation Economic Commission for Europe (UNECE) views it as a processes for 'determining, recording, and disseminating information about the ownership, value and use of land, when implementing land management policies' (Williamson et al., 2010). Dale and McLaughlin (1999) also explain it from a broader view as 'regulatory processes on land and landed property, its use and conservation, revenue generation, authentication of sales, leases, taxation and also land conflict resolution and to determine land ownership structure' (Fateye et al., 2020). Land administration according to them is a process that revolves around three key attributes; land ownership (tenure), land value, and land use. The UNECE extends these to include land development, and captures them as the operational component of the land management paradigm. Land management as defined by the UNECE is the 'processes by which a country's resources are put into good effect' (Williamson et al., 2010). Land administration functions (which have been well elaborated in chapter four) are thus performed within the broader scope of land management. They entail all activities related to managing land and natural resources and which are necessary to meet political objectives and to achieve sustainable development (Williamson et al., 2010). These relate to land tenure (securing and transferring rights in land and natural resources); land value (valuation and taxation of land and properties); land use (planning and control of the use of land and natural resources); and land development (implementing utilities, infrastructure and construction planning) and these must support sustainable development; economic, social and environmental sustainability (Enemark et al., 2005; Williamson et al., 2010). Every land administration system (LAS) therefore has a mandate of achieving socio-cultural, economic, and political objectives. Hence, UNECE views LAS as 'concerned with the social, legal, economic and technical framework within which land managers and administrators must operate' to achieve these objectives (Enemark et al., 2005). Land administration systems are different in different countries, or regions, and are dynamic. They have evolved over the years in both the developed

and developing countries to embrace, and accommodate modernity, and new societal needs, or issues. Williamson et al., (2010) note that a LAS could be an advanced one that is underlined with sophisticated ICT models as usually found in developed countries, or could be a fragmented one with basic analogue systems, or approaches as found in many less developed countries. Modern land administration system should facilitate sustainable development; economic, social and environmental while allowing for citizenry participation and accountability in the State decisions relating to the built and natural environment (Enemark et al., 2005). However, Enemark (2004) posits that the possibility of the land administration functions to achieve sustainable development lies in the impacts that land policy framework, the land information infrastructure in place, and the institutional arrangement within the contextual country will have on these land administration functions (Enemark et al., 2005). Hence, land administration is conceptualized within the broader scope of the land management paradigm to reflect these relationships (figure 1).

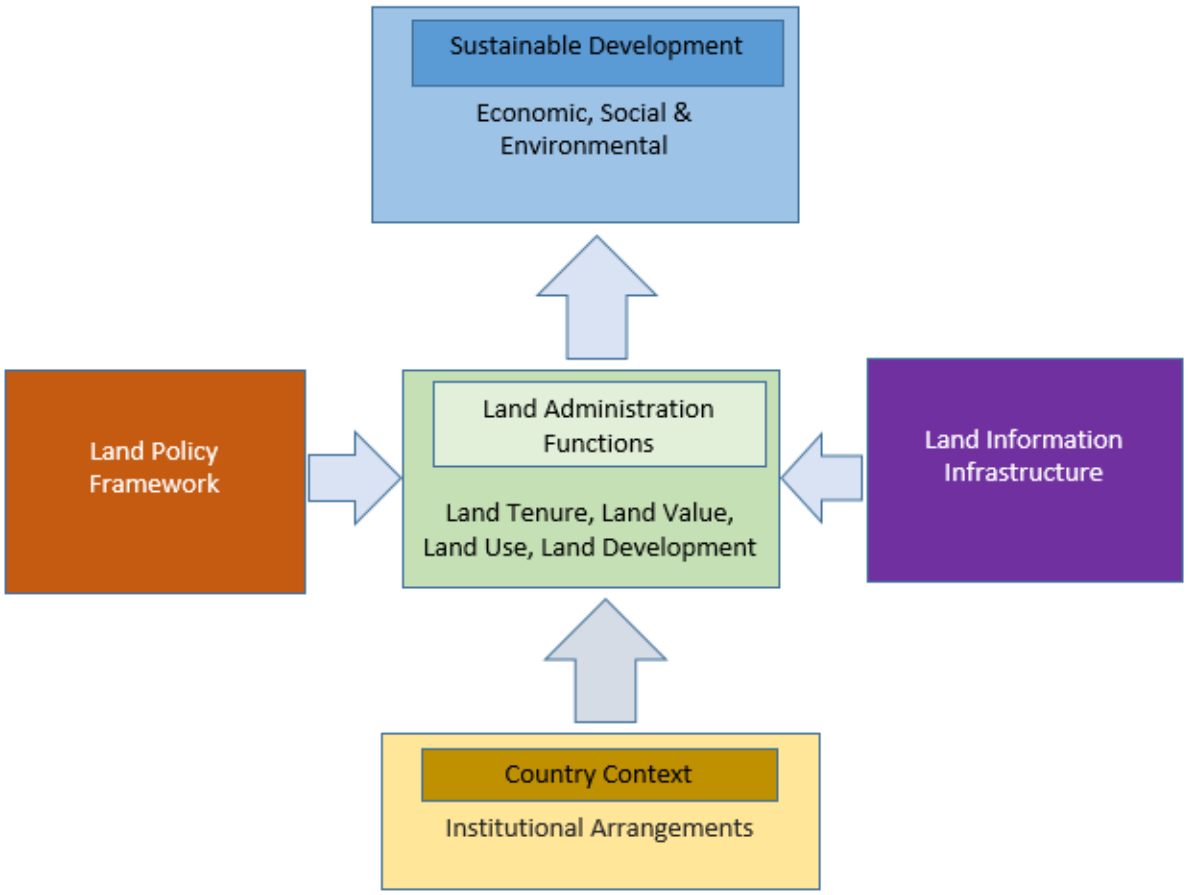


Figure 1. Framing land administration functions within the broader land management paradigm

Source: (Enemark et al., 2005)

Within this conceptualization, the institutional arrangements within the country reflect the local cultural, and judicial settings for regulating land sector activities. These institutions, and their arrangements are dynamic and change with time to better support new land policies, and good land

governance. Land policies reflect the commitments, guidelines, visions, and objectives of the State towards achieving, and or promoting environmental sustainability, economic development, social justice and equity, and political stability from the perspective of the built and natural environment. Land policies are usually concerned with: 'security of tenure; land markets transactions and access to credit; real property taxation; sustainable management and control of land use, natural resources and the environment; the provision of land for the poor, ethnic minorities and women; and measures to prevent land speculation and to manage land disputes, sustainable agriculture, settlement, and economic development (Enemark et al., 2005; Williamson et al., 2010). Land policies reflect the country specific cultures, social systems, and aspirations, and are thus different amongst countries although there could be similarities. On the other hand, land information infrastructure include cadastral, and topographic dataset. The cadaster is a record identifying a land parcel with the associated attribute data like interest. A cadastral system, or infrastructure defines the 'interaction between the identification of land parcels, the registration of land rights, the valuation and taxation of land and property, and the present and possible future use of land' (Enemark et al., 2005). Where these influencing components; country context institutional arrangements, land policy framework, and information infrastructure are in good structures to enhance land administration functions, it positively impacts on sustainable development.

Despite these, the delivery of land administration functions within this broader scope of the land management paradigm cannot lead to societal acceptance, and possible benefits where the land administration structures, professionals, and the public are not well integrated in the whole administration services delivery, and processes. Therefore, whether there are manual processes and paper based land administration system, or one that is underlined by computerized systems and processes, there is the need for public involvement, and participation. However, for a modern land administration system in many developed countries, and the evolving systems in many developing countries, LAS needs to be developed informationally, and technologically to support sustainable development (Dawidowicz & Źróbek, 2017). The use of information and communication technology tools in support of modern land administration systems for sustainable development have been well assessed in literature (Enemark et al., 2005; Williamson et al., 2010; Dawidowicz & Źróbek, 2017; Fateye et al., 2020; Okembo et al., 2022; Bennett et al., 2022). ICT is used in this study as a broader term which encapsulates 'all forms of computing, information technology, internet, and telecommunication' (Mclaren & Stanley, 2017). That is, the delivery of land services for the citizens, and the involvement or participation of these citizens in the processes shall be facilitated via digital, or computerized approaches that will allow a contactless connection, and or interaction between land services delivery professionals, and the public land owners and other stakeholders. Fateye et al., (2020) added that the basic goals or objectives of any effective and efficient LAS can be achieved with the usage of 'reliable geo-information, efficient cadaster survey and effective ICT'. Enemark et al., (2005) notes that the 'interface between land administration infrastructure and professions, and the public will increasingly be serviced by information and communication technologies designed to implement e-government and e-citizenship'. The concept of e-government and e-citizenship is simply the provision of public administration services through digital/ online means for citizens, and thus, allowing citizens to

access these services via online without necessarily being present in person at the State offices. This allows for faster services delivery while allowing for transparency among other benefits.

Modern land administration systems have thus evolved into the concept of e-government and e-citizens, allowing for digital interface between the public, and land institutions and professionals. This complementarity to land administration functions is what transitions the traditional manual and paper-based land administration systems into modern land administration systems (see figure 2), which are effective and efficient towards sustainable development. UN-FIG, (1999) thus proposes that a modern LAS must have the land administration infrastructures: 'organizations, standards, processes, information and dissemination systems, the and technologies required to support the allocation, transfer, dealing and use of land' and that ICT plays crucial role in this infrastructure to provide effective information accessibility to citizens (Enemark et al., 2005).

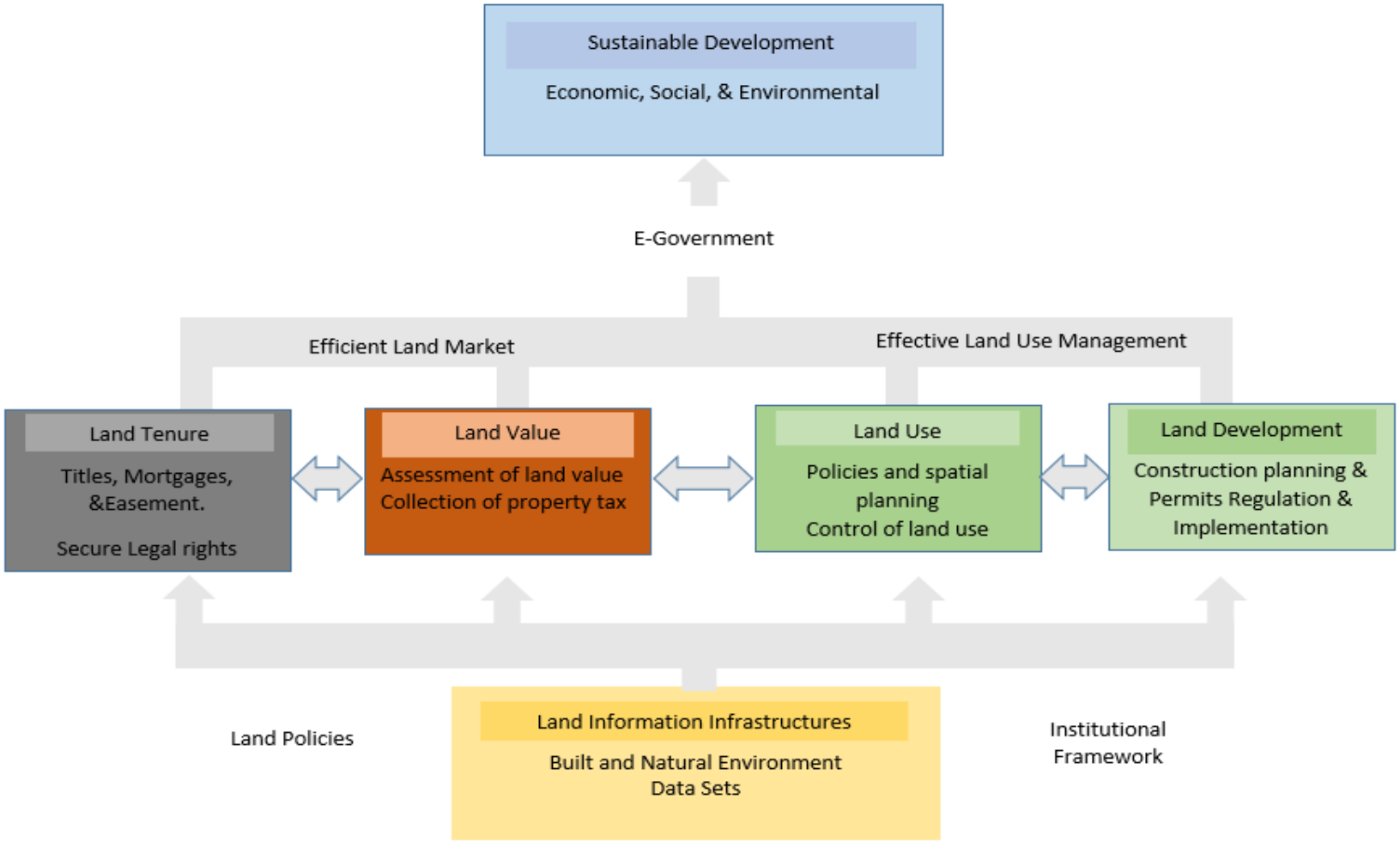


Figure 2. Global perspective of modern land administration systems

Source: Adapted from (Enemark et al., 2005)

2.1 Land Administration and ICT/ Digitalization

The land administration functions; land tenure, land value, land use, and land development are not mutually exclusive. That is, for the objective of achieving sustainable development, all four functions are interdependent. Bennett et al., (2005) however note that these functions were divided up in many countries in historical times. Nonetheless, the advent of ICT tools offered the opportunity for integration. ICT tools have since influenced land administration, land registration, and cadastral design and development (Bennett et al., 2022). Since the 90s, the most important changes in LAS were technology driven, principally, from paper records to computerized systems (Williamson & Wallace, 2007). The evolution of ICT in land administration is well illustrated in (Mclaren & Stanley, 2017). See figure 3 below. ICT in land administration has over the years increasingly improved land administration operations, and enhanced information services, making data easily accessible to support land markets, and rural, and urban economic development (Mclaren & Stanley, 2017).

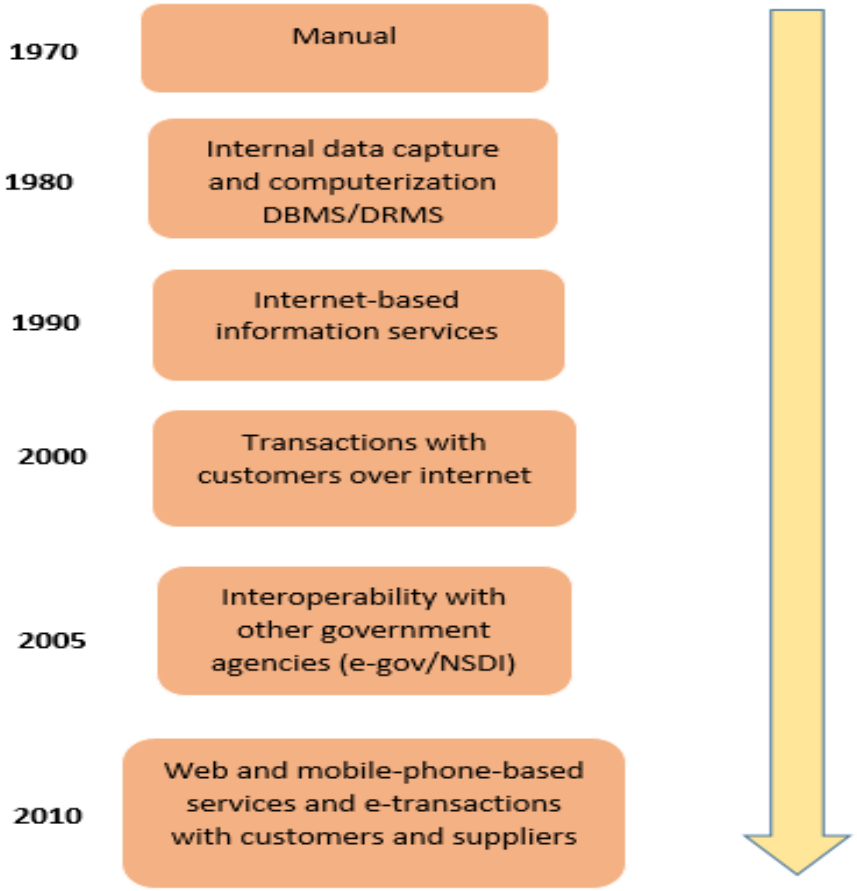


Figure 3. Evolution of ICT in land administration

Source: (Mclaren & Stanley, 2017)

Generally across the world, computerization, or ICT in land administration first occurred around the 1970s where the transition from manual started and focused mainly on financial systems. The interest continued to grow in the early 1980s (Land Equity International, 2020). Around mid-1990s and with the emergence of internet, and digital signatures among others, the transition from paper-based land administration process to digital processes started with earlier systems as the Land online system of New Zealand (Land Equity International, 2020). Many digital technologies have since emerged in different countries especially from early 2000s to date. Biscaye et al., (2017) identify some land technologies supporting land administration processes and consequently land tenure security. These technologies according to the writers are grouped into three types; **Type I (Enabling Technologies)** – These provide support for land tenure enabling environments. The technologies/ databases under this type create openness and help landholders have access to information and the regulatory frameworks on land ownership structures, institutions, and governance that guide them on protection of their lands (Fateye et al., 2021). **Type II (Data Collection Technologies)** – Land tenure data collection and aggregation. These technologies collect, aggregate and organize data on land tenure into databases, and maps through Surveys, GPS tools, and aerial imagery among others to support land tenure security. **Type III (Titling Technologies)** – Formal land titling. These support landowners in preparing land titles as well as other land transactions, and dealings that involve different landowners, as well as with corporate bodies, and government institutions. Table 3 below shows the summary of 38 land technologies around the world, where they are being used, the platforms of their applications, and the type they belong as identified in (Biscaye et al., 2017)

Technology	Target or Implementation Geographies	Platform	Land Tenure Activities
Aumentum Cadastre	Americas, Asia Pacific, Middle East, North Africa, SSA	Computer – desktop	Types II, III
Aumentum OpenTitle	Afghanistan, Liberia, Ghana, Sierra Leone	Computer – desktop; Computer - internet	Types II, III
Aumentum Registry	Americas, Asia Pacific, Middle East, North Africa, SSA	Computer – desktop/ application	Types III
Blockchain (Bitfury)	Piloted in Honduras, Sweden, Republic of Georgia	Internet accessible database	Types III
Cadasta Platform	Africa; Europe; LA; SA; SEA; United State	Computer – desktop; Computer – internet	Types II
Focus on Land in Africa (FOLA)	Burkina Faso, Cameroon, Ethiopia, Ghana, Kenya, Liberia, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, South Africa, Tanzania, Uganda, Zambia, Zimbabwe	Computer – desktop; mobile phone- smart	Types I

Gender and Land Rights Database	Global: for list of countries see http://www.fao.org/gender-landrights-database/country-profiles/countries-list/en/	Computer – desktop; mobile phone- smart	Types I
Geodata Cadastral Database	Evidence of projects in Australia, Philippines, Vietnam, and U.S	Computer – desktop	Types II
Global Forest Watch: Land Rights	Evidence of projects in Australia, Brazil, Canada, Costa Rica, Mexico, New Zealand, Panama	Computer – desktop	Types II
Innola Solutions	Not specified	Computer – desktop	Types II, III
Its4land	Ethiopia, Kenya, Rwanda (still in pilot phase)	Computer – internet	Types II
Land Matrix	Low and Middle-Income Countries (World Bank classification)	Computer – desktop	Types II
Land Portal	Global	Computer – desktop; mobile phone – smart	Types I, II
Land Registration as a Solution	Australia	Computer – desktop	Types II, III
Land Resource Manager	Global	Computer – desktop	Types II
Land Rights Platform	Cambodia (specific)	Computer – desktop; mobile phone – smart	Types I
Land Use Planning for Tenure Security	Not specified	Computer - desktop/application; mobile – smart	Types I
Landfolio Software	Global	Computer – desktop	Types III
Landmapp	Ghana; plans to expand in West Africa and SEA	Mobile phone – smart	Types II, III
LandMark	Global	Computer – desktop	Types II
Landwise	Asia, Eastern Europe, Latin America, Middle East, North Africa, SSA Mapping	Computer - desktop; mobile phone – smart	Types I
Mapping for Rights	Peru; SSA	Internet accessible database; mobile app – smart phone	Types I, II
Mobile Application to Secure Tenure (MAST)	Piloted in Burkina Faso and Tanzania	Computer - desktop; mobile phone - smart	Types II, III
mLocGov	Mali, Nigeria	Computer – desktop/ application;	Types III

		computer – internet	
Mobile DHIS2 Tool	Eastern Zambia	Mobile phone – feature	Types II, III
Mobineo	Kenya	Computer – desktop	Types II
One Map Initiative	Indonesia	Computer – internet	Types II
Open Development Initiative	Mekong region: Cambodia, Laos, Myanmar, Thailand, Vietnam Initiative	Computer - desktop; mobile phone – smart	Types I
RAISG	Amazonia - Bolivia, Brazil, Colombia, Ecuador, Peru and Venezuela	Computer – desktop	Types II
Red Tierras	Bolivia; Colombia; Guatemala	Computer – desktop	Types II, III
Sarawak Geoportal	Sarawak, Malaysia	Computer – desktop	Types II
Sistema de información sobre comunidades nativas de la amazonía peruana (SICNA)	Peruvian Amazon	Computer – desktop	Types II
Social Tenure Domain Module (STDM)	Africa; Caribbean; Colombia; Philippines	Computer - desktop/application	Types II
SOLA Community Server	Not specified	Computer – desktop	Types III
SOLA Open Tenure	Evidence of projects in Cambodia, Guatemala, Nigeria, Uganda	Computer – desktop	Types II
SOLA Registry	Evidence of projects in Ghana, Nepal, Samoa, Lesotho, Tonga, Nigeria	Computer – desktop	Types III

Table 3. Land Technologies, Platforms of Application and Place of Use

Source: (Biscaye et al., 2017)

These have all enhanced the effectiveness and efficiency of land administration systems towards sustainable development across different regions particularly in developed countries of the world. Such studies as this current one are therefore necessary within the African region for the purpose of taking advantage of the new technologies in the land sector and to improve land digitalization within the region towards sustainable developments.

2.3 Land Administration Systems in Ghana

Land administration in Ghana has evolved through complex, and ambiguous processes from pre-colonial, through colonial, to the post-colonial times (Forkuor et al., 2013). These periods have

seen lot of changes not only in land administration processes, but also in land policies affecting the administration systems. The sub-sections below highlight the administration systems in different phases of the Ghanaian land sector.

2.3.1 Land Administration in Pre-Colonial Times (Before 1874)

Prior to the start of colonial rule in 1874, land administration was solely the responsibility of traditional community heads who were recognized as chiefs, and acted both as administrative and political heads in their villages, clans, and tribes (Forkuor et al., 2013). These traditional heads held land in trust for the larger group they represented, and managed these lands in accordance with customary laws Forkuor et al., (2013) which were largely unwritten. These laws were not uniform amongst all the people, but differed from community to community, or from one group to the other, and sometimes, even within the same community (Obeng-odoom, 2016). During this era, Obeng-odoom, (2016) notes that there was little, or no rent demanded to access land. This was not because there was abundant of empty lands, or lack of demand for land, but mainly because land tenure system then was different and didn't consider land as a commodity. The traditional heads in consultations with their elders allocated lands of similar sizes to households or members of the land owning groups as, and when there was the need. Individuals that did not belong to the land owning group could also in some cases be granted pieces of land for their subsistence farming purpose but subject to certain social condition like being socially, and politically accepted by the community based on good conduct (Selase & Jiang, 2015). However, upon the demise of such an individual, the land reverts back to the community in most cases. Conversely, with the households, or members that belonged to the land owning group (indigenes), their lands could go to a relative who equally belonged to the larger land owning group by way of inheritance. It is important to mention that there was no "open access" to land, and rules existed on who owned what land and which land was in reserve mainly for the future generation without any intent of speculation (Obeng-odoom, 2016). The demand for land was also purely for subsistence farming purposes Forkuor et al., (2013) and so Obeng-odoom, (2016) puts it that 'each man farmed according to his strength'. The land transactions in this era were void of any documentation (Forkuor et al., 2013). Land administration during this period was generally for the purpose of social efficiency and not monetarily motivated. It therefore 'eschewed monopolization of the commons by a few' Obeng-odoom, (2016) due to the absence of sell and buy land market economies at the time. It was therefore described an egalitarian system (Selase & Jiang, 2015; Obeng-odoom, 2016)

2.3.2 Land Administration in Colonial Times (1874 – 1957)

The colonial rule in Ghana brought a major change in the country's land administration system. Contrary to the community ownership of land, and the absence of monetary fee for accessing pieces of land in pre-colonial time, the colonial rule commoditized land, resulting in the sale of land. Obeng-odoom, (2016) identifies that colonialism, and trade led to the monetization of the economy and 'buoyed the development of markets and property in land'. The British by way of introducing Western administration into the then colony introduced the 'Indirect Rule' strategy. This was mainly introduced by Lord Lugard (Obeng-odoom, 2013). Indirect rule was adopted by

the British to rule the colonies through their local chiefs since they were unsure from the beginning the sort of opposition the local people would mount if they decided to impose their rule directly on them (Obeng-odoom, 2013). However, in the case of land, Obeng-odoom, (2013) notes that the British attempted a direct rule which was later abandoned due to fierce resistance from the local people. These rule systems were very key to changing the land administration in the colonies Selase & Jiang, (2015) and further boosted a capitalist market in land to the extent that by 1897, it was well established that land could be sold without much conditions (Obeng-odoom, 2016). The British through their indirect rule implemented different laws bordering on land known as *Native Jurisdiction Ordinances* between the periods 1878 to 1910 (Selase & Jiang, 2015). These were all aimed at taking control of land administration in the colony and a feature of these laws was the taking away the power of local chiefs in presiding over cases in the colony, especially, land related cases. Selase & Jiang, (2015) note that these laws gradually repealed and replaced the traditional customary system of land administration and ultimately, weakened the authority of the local chiefs. These laws only left limited land administration functions for the local chiefs which were also only delegated to the paramount, and divisional chiefs, and ripped the village chiefs of their powers in land administration (Selase & Jiang, 2015). The British thus 'endorsed a chieftain account of customary land law' which Obeng-odoom, (2016) described as having been problematic due to the fact that the customary law of the Chiefs who were being used by the British was not necessarily the same as that of the local people. Some of Chiefs used by the British, in some cases deliberately distorted the history, more especially, those relating to land boundaries and since this favored the British, they, the British agreed to re-writing of the history to favor their Chiefs (Obeng-odoom, 2016). This recording of native customary laws by the British led to a complete dilution of the previously flexible and dynamic customary laws into new forms favorable to the British (Obeng-odoom, 2016).

By way of amassing lands in the colonies for themselves, the British in 1927 declared the Northern Ghana a protectorate, and invoked a new law: Land and Native Rights Ordinance of 1927 by which all lands in the area were declared public, and vested in the colonial governor (Selase & Jiang, 2015). Unlike in the Southern parts where the Chieftaincy institutions already existed before the British arrived, it was not so in the Northern part although different form of traditional leadership existed in the form of earth priests[1] also known as tendaana. The British therefore after declaring the area a protectorate instituted their own chiefs by warrant, and these chiefs were mostly the rich merchants, and the strong influential in the communities (Obeng-odoom, 2016). There were other land related laws which the British enacted like; the Lands Bill of 1897, and the Public Lands Ordinance (CAP 134). By the Land Bill of 1897, lands in the colonies, the then Gold Coast were to be controlled by the British. It mandated that all vacant lands in the region be confiscated and administered as Crown lands (Obeng-odoom, 2013). And the Public Lands Ordinance (CAP 134) also sought to vest and regulate the acquisition of lands in the British Crown (Forkuor et al., 2013). However, prior to the Land Bill of 1897, the Land Registry Ordinance was passed in 1895 which

[1] Earth priests, also known as Tendaana (plural) or Tendaamba (singular) 'are the descendants of the pioneer settlers and they are the ultimate authorities re- garding land in their respective villages and towns in Ghana' (Abubakari et al., 2018)

sought that writing down, or documentation of land management processes was crucial for clarity (Obeng-odoom, 2016). This Ordinance stayed in force until post-independence in 1962 when it was repealed and replaced with the Land Registry Act by the first post-independence government of Dr. Kwame Nkrumah, the Convention People's Party (CPP) (Obeng-odoom, 2016)

Despite the seemingly good relationship between the British colonial rulers, and Chiefs through whom they indirectly ruled the colonies, some of the laws passed by the British on land did not sit well, not only with the local people but also many of the Chiefs as well. A typical example of such a law was the Land Bill of 1897 by which vacant lands could be confiscated by the British. According to Obeng-odoom, (2013) this Bill in principle only wanted to have the opportunity to lease those lands to the richer class. This Bill was highly resented by the Chiefs, native educated elites, native merchant class, and the native bureaucrats which led to the formation Aborigines Rights Protection Society (ARPS) in protest of the Bill (Obeng-odoom, 2013; Obeng-odoom, 2016). The group petitioned the British Queen in resistance to the Bill claiming that there was no such thing as vacant land in the Gold Coast, and that lands lying idle which the British considered waste lands were actually being allowed to fallow for farming (Obeng-odoom, 2013). This revolution led to the British abandoning all attempts of direct rule and administration of land. Subsequently, in 1900, by way of trying to formalize, and westernize land tenure in the colonies, the British passed the Concessions Ordinance (No. 14) which stipulated that the Supreme Court must be given all relevant information on every concession so as to be published in the Gazette and that without the permission of the Court, any such concession was incomplete (Obeng-odoom, 2016).

2.3.3 Land Administration in Post-Colonial Times (1957-to date)

After independence in the Gold Coast, the State, led by the Convention People's Party of Dr. Kwame Nkrumah, that had won the first general election, did not ignore the authority of the Chiefs but somehow upheld chiefs' role in local development and land administration from the 1970s and so, no new radical land reforms were made despite the selfishness of most of those Chiefs in the management of land (Obeng-odoom, 2013; Amanor, 2022). However, the CPP government in 1958 sought to control the revenues of Chiefs but mainly those Chiefs that were seen sympathizers of the then opposition party, the National Liberation Movement (Amanor, 2022). Thus, in 1958, the Ashanti Stool Lands Act of 1958, and the Akim Abuakwa (Stool Revenue) Act 28 of 1958 were introduced (National Land Policy, 1999; Obeng-odoom, 2013; Obeng-odoom, 2016; Amanor, 2022). These Acts only reversed the collection of stool revenues by the Chiefs to the State. The main objective was to prevent those Chiefs from being able to fund the opposition National Liberation Movement (NLM). The two Acts according to Obeng-odoom, (2016) also vested the management of all such lands into the State through the power of eminent domain. Although these Acts started with certain specific Chiefs, Amanor, (2022) notes that the Stool Lands Act in 1960 extended it to all other customary stool lands in the region. However, Obeng-odoom (2013; 2016) again note that the Stool Lands Acts only vested the management of all those lands in the government while the benefits accrued to the Chiefs. Other land related laws, or reforms implemented by the CPP government included the Timber Lands Protection Act of 1959 which prevented farmers, in the western region where cocoa farming was beginning anew, from

clearing forestlands already acquired until licensed timber corporations had felled all the timber in those forestlands (Amanor, 2022). This Act gave Chiefs the opportunity to royalties for the timber. In 1962 however, the Timber Concession Act was passed again by the CPP government to vest the customary rights, and the management of these forestlands of timber in the Government (Amanor, 2022). The other governments that came after the CPP according to Obeng-odoom, (2016) did not effect any major changes but left the power of land administration and management with the Chiefs until the 1980s and 1990s when Jerry John Rawlings came into power.

The period around 1980s and 1990s according to Obeng-odoom, (2016) was when major land reforms were enacted. Some of these included; the Land Appropriation Ordinance of 1901, the Kumasi Lands Ordinance, 1943 (Cap 145), the Land Development Act of 1960 (Cap 143), and the Land Registration Act 1962 (Act 122) (National Land Policy, 1999; Selase & Jiang, 2015). However, the National Land Policy notes that these Acts had been ad hoc in nature, and did not provide an overall direction for policy development. They could therefore not deliver an effective and efficient land management system in the country (National Land Policy, 1999). Selase & Jiang,(2015) for instance note that a deficient of the Land Registration Act 1962 (Act 122) was that it failed to request the attachment of accurate plans to the registrable instruments. In the effort to address the challenges of the different Ad hoc Acts, an attempt towards a comprehensive land law was made in 1986 to re-structure the system for land title registration in Ghana. This led to the Land Title Registration Law, 1986 PNDCL 152 which has been in force to date (Selase & Jiang, 2015).

Notwithstanding the PNDCL 152, there were still found some inadequacies in the existing laws and thus the need for a more comprehensive land policy for the country. Therefore, in 1994, a revised and finalized report on such a policy document was submitted to the Government of Ghana for consideration (National Land Policy, 1999). The Lands and Forestry ministry then, commissioned experts and committees to look into the report and make recommendations for a policy framework based on 'comprehensive principles that offer direction for efficient management and use of land' (National Land Policy, 1999). The review of the report by the experts and committees, and all other relevant issues and stakeholders around it led to a National Workshop in 1997 on April 27th. The result of the national workshop is the Ghana National Land Policy of 1999 (NLP) which was approved by the Government for implementation on 21st January 1999 (National Land Policy, 1999; Selase & Jiang, 2015). This has been in use to date 2024 (at the time of writing this thesis). It is also important to mention that the 1992 Constitution of Ghana equally makes provisions that bother on the administration of land in the country. Highlights of these provisions can be found in articles; 257, 258, 266,267. Article 257 relates public lands and other public property; 258 bothers on the establishment of the Lands Commission as the institution charged with the administration of State lands in the country; 266 is on the ownership of land by non-citizens; and 267 talks about Stool, and Skin Lands and Property (Government of Ghana, 1993).

Fast forward into the 2000s after the NLP, a major move in land administration occurred in the form of the LAP which started in 2003. This project brought many developments in the land administration system of Ghana. Among these developments were; the start of digitization as

already noted in chapter one, the establishment of customary land secretariats in support of customary land administration, and also, the passing of the Lands Commission Act of 2008, Act 767 (Forkuor et al., 2013). Prior to the passage of this Act, there existed six different governmental institutions responsible for different, and specific aspects of land administration in the country. These institutions were; Lands Department (which was changed under the 1969 constitutional review into the Lands Commission under the Lands Commission Act of 1971 (Act 362)), Survey Department, the then Town and Country Planning Department[2] now Land Use and Spatial Planning Authority (LUSPA), Land Title Registry, Lands Valuation Board, and the Office of the Administrator of Stool Lands (Forkuor et al., 2013). These institutions were however only responsible for the statutroy aspect of land administration while the customary aspect still remained with the traditional authorities who continued to allocate lands to individuals, and even to the government in some cases. The six government land institutions which were established by different Acts worked autonomously with little to no coordination amongst them which allowed for shortcomings as land tenure insecurities, haphazard spatial development, overlap in functions, land disputes and litigation, encroachment of government lands, institutional, financial and logistical challenges among others (Forkuor et al., 2013). It was as a result of these challenges that the LAP sought to pass the Lands Commission Act of 2008, Act 767. The Act sought to 'establish the Lands Commission to integrate, subject to the Constitution, the operations of public service land institutions under the Commission in order to secure effective and efficient land administration and to provide for related matters' (Lands Commission Act, 2008). It was also to foster coordination for land administration. Subsequent to this, four of the six institutions were integrated into the new Lands Commission. These four were; the Survey Department, Lands Valuation Board, the Land Title Registry. and the old Lands Commission. This merger has existed as such to date (2024) as the Lands Commission with four divisions which have clearly defined roles and mandates (see figure 4 for the general structure of the lands sector organogram). The divisions are; the Land Valuation Division (LVD), Survey and Mapping Division (SMD), the Land Title Registration Division (LTR), and the Public and Vested Land Management Division (PVLMD). A more recent development in the land administration system is the passage by parliament of the Lands Act 2020, Act 1036. This Act revises, harmonizes, and consolidates the previous laws, and enactments on land into a single law to ensure a sustainable land administration and management, effective and efficient land tenure, and to provide for all such related issues. This manifests all reforms in the Ghanaian land sector that began with the implementation of the National Land Policy (Land Act, 2020. Act 1036; JLD & MB Legal Consultancy, 2021).

[2] The Town and Country Planning Department (TCPD) is now changed to the Land Use and Spatial Planning Authority. Therefore, the two names are used interchangeably in this study to refer to the same institution

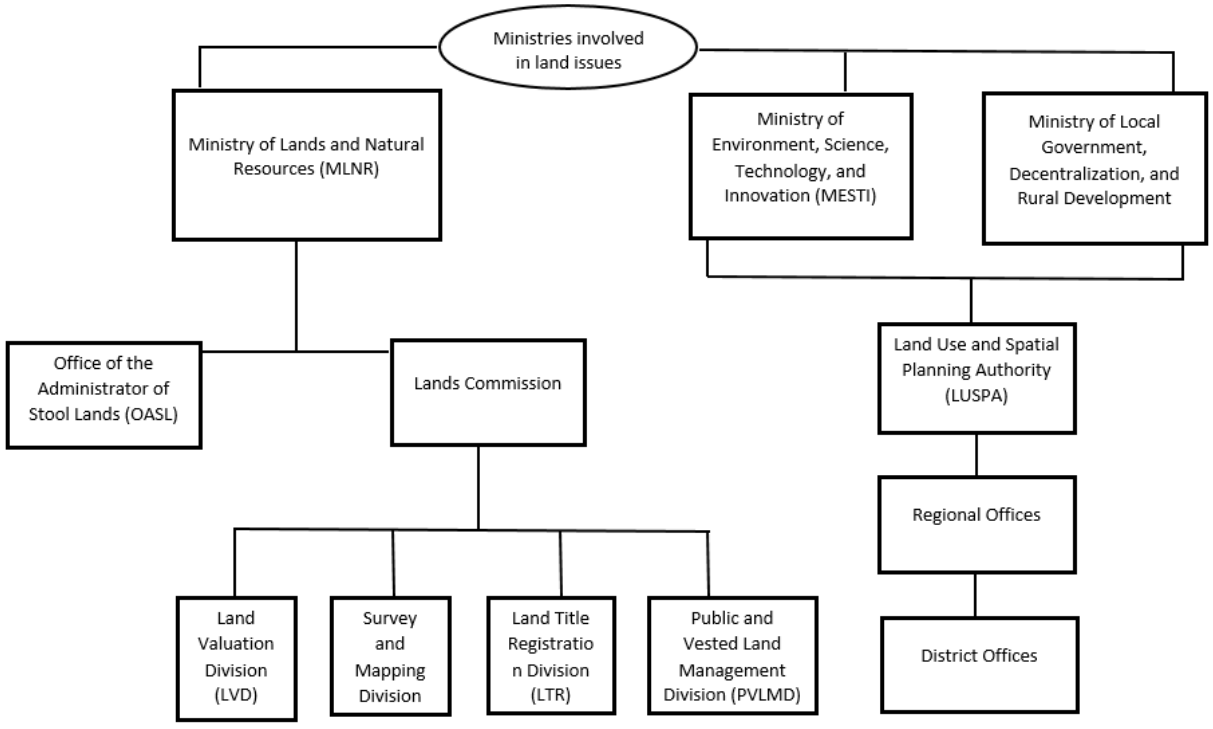


Figure 4. Organogram of public sector ministries and institutions in land administration

Source: Adapted from (Oberdorf, 2017)

2.4 Blockchain Technology, and Land Administration

2.4.1 Blockchain Technology

Blockchain technology's application started in the financial sector with the likes of the decentralized digital money (Bitcoin) and other cryptocurrencies (Akram et al., 2020; Habib et al., 2022) 'Bitcoin is a peer to peer electronic payment system in which transactions are performed without the need for a central clearing agency to authorize transactions' (Göbel et al., 2016). Broni, (2019) notes that Blockchain technology in principle combines encryption and distributed computing. He further states that these two existed even before 2008 when Satoshi Nakamoto employed the two together to build Blockchain technology. Hence, the idea of Blockchain technology was first introduced in 2008 by Satoshi Nakamoto in the paper: Bitcoin: A Peer-to-Peer Electronic Cash System (Nakamoto, 2008). However, over the years, the technology has gained attention and interest across all sectors. Blockchain is actually predicted to not only overhaul the digital economy but to transform many global industries (Perera et al., 2020). In the white paper from Satoshi Nakamoto, he identified that transacting money online was exclusively based on the financial institutions/ banks acting as trusted third parties. These banks validated every online transaction by crosschecking to be sure that the purported transaction isn't made twice

with same money (double spending). This system of the banks playing the third party role has the inherent challenge of trust, and that a completely non-reversible transactions were nearly impossible as the banking institutions could not avoid mediating roles. Therefore, with this reversal possibility, the need for trust only increases (Nakamoto, 2008). The situation however increases transaction cost, makes transacting partners suspicious while still allowing for some level of fraud possibilities (Nakamoto, 2008). It also leaves the fate of the entire monetary system to the bank as the third party which only increases the risks (Nakamoto, 2008; Oberdorf, 2017). Thus, a new way of a possible direct transaction without the third party was necessary. To this end, Nakamoto proposes that there should be a system where transacting parties can trust a computational proof of the chronological order of transactions to be sure that there has not been a double spending without necessarily involving a trusted third party like the bank (Nakamoto, 2008). According to Nakamoto, (2008) this solution/ system uses 'a peer-to-peer, distributed timestamp server to generate computational proof of the chronological order of transactions' in a completely transparent manner that becomes irreversible after validation (Oberdorf, 2017). This system is Blockchain.

Accordingly, 'Blockchain is a system of value transaction and verification' in which users rely on a computational solution to a cryptographic algorithm to validate transactions by way of 'checking whether transactions took place only once and rightfully within the rules of the specific system' (Göbel et al., 2016; Oberdorf, 2017). It is a decentralized database, or decentralized ledger technology (DLT) that consists of interconnected blocks of data which are protected by cryptographic hash values against tampering, and works on a peer-to-peer consensus building mechanism amongst its networked participants (connected computers/ nodes) without any central controlling authority (Ali & Tahir, 2020; Sanka et al., 2021). In a Blockchain system, a transaction is requested and is distributed to all the nodes. The requested transaction is now mined to show Proof-of-Work (PoW). Mining is a process by which all the interconnected nodes, or some of them, referred to us miners compete to solve a complex mathematical and cryptographic algorithm/ puzzle to derive a solution (hash value) necessary to proof that the transaction occurred only once and rightfully within rules of the system (confirmation of the transaction). This confirmation is the PoW and allows the miner that solved the algorithm to create the new block which is timestamped. However, this new block is further broadcasted to be verified and validated by the majority of the other nodes (consensus mechanism). It is then added as a new block to the main Blockchain if found to be valid.

The connection of the new block to the already existing blocks occurs by way of a linkage of the hash value of the previous block to the hash value of the current or new block. This creates a chain of link between the blocks hence the name Blockchain. The data in the Blockchain can now no longer be changed or tampered with by any single node except with the informed consent of all, or the majority (51%) plus of the interconnected nodes. This is because any such attempt alters the hash value which will then make it different from the already stored one that is available as the distributed copies to all the nodes. This provides immutability, security, and data integrity. Blockchain applications thus consist of several techniques including; cryptographc hashing, timestamp, mathematical algorithms, peer-to-peer networks, and consensus algorithms among others (Akram et al., 2020).

In chapter four, I discuss the structure of Blockchain, the types of Blockchain architectures, the working process of a Blockchain system, as well as the major benefits associated with Blockchain systems which includes smart contract possibilities, transparency, and trust among others. Currently, three generations of Blockchain exist; Blockchain 1.0 (Bitcoin), Blockchain 2.0 (Smart contracts), and Blockchain 3.0 (DApp i.e Distributed Application). See Akram et al., (2020) for details.

2.4.2 Blockchain Technology for Land Administration Transparency.

Blockchain as has been identified is a system for value exchange, or transfer with in-built verification and validation processes without the need for a third party acting as a trust body. Blockchain's application in land administration manifests in three different folds: as a database where it is for storage, and processing of data; for transaction by way of using it to process the transaction of data, and value; and also for payment by way of using the digital payment system through cryptocurrency (Oberdorf, 2017). Additionally, it allows for stakeholder integration, as well as services delivery and processes integration. Anand et al., (2015) identify Blockchain's usefulness for title and deed registration, timestamped land transactions, multi-party transparent interaction, tamper-proof land data recording, disaster recovery, and restitution and compensation in post-conflict zones. Given that a Blockchain system operates in a decentralized form without intermediary trusted third parties, it allows for openness and transparency in its application either as a database, transaction tool, or payment tool. Several studies on Blockchain for land administration have therefore championed its usefulness for enhancing land administration transparency (Ameyaw & de Vries, 2020; Niloy et al., 2021;Sahoo et al., 2022)

Like all database systems, Blockchain as a database allows for the entry of data and storing of data in an organized manner. The difference in Blockchain database (from relational databases, and other available databases (such as graph databases) lies in the distributed nature of the storage and retrieval of data approach through the blockchain system. That is, it is a distributed database which maintains timestamped records or data in an immutable format and which are linked to each other by cryptographic hash values (Anand et al., 2015). Blockchain database has no single control point but keeps copies of all data or records available to all the connected parties to the system. In this way, any purported change, deletion, or mutation reflects to all the interconnected parties due to changes that will occur in the cryptographic hash values of the interconnected data. The Blockchain database is thus described as a 'collaboratively managed database of shared, synchronized, and replicated records that typically does not rely on central governance' (Daniel & Speranza, 2020). By this property, once data are entered into the Blockchain system, it is considered secure from tamper, and possible loss since copies are available to all the parties. It also allows for easy accessibility to data without any intermediary. Hence, data on land title, deed/ lease, maps, plans, among others can be safely digitized, and kept in a Blockchain database for digital security. Lemieux, (2017) identifies three types of record solution through the Blockchain technology application. First is the mirror type solution which can be used either in a public, or a private Blockchain. In this approach, the Blockchain acts as a repository of "digital fingerprints", or hashes of the data in a different original system. That is, the original data in a paper, or digital form, will now exist in a digital form and be hashed. This gives the digital fingerprints of the data,

and the hashes are anchored to the Blockchain to help validate the integrity of the data as is the case of the Brazilian land registration pilot project (Lemieux, 2017a). The second solution is the digital record type where data are not only mirrored on the Blockchain but are actually created on chain in smart contracts formats (Lemieux, 2017a). A smart contract 'encodes procedures that execute among a multi-stakeholder network as part of a work process flow' Lemieux, (2017) when the specified rules are met. The Swedish Blockchain-based land transfer registration system uses this solution type. See Lemieux, (2017) for details. The third solution type is the tokenized type. In this type, in addition to keeping the records on chain, assets like land and other property are also represented and captured on chain (as tokens) via linking them to an underlying cryptocurrency (Lemieux, 2017; Agbesi & Tahiru, 2020). This process of creating a token to represent an asset is termed as minting (Agbesi & Tahiru, 2020). An example of this is Ubitquity's Brazilian pilot land titles registration recordkeeping solution (Lemieux, 2017a). In consequence therefore, Blockchain technology makes possible digitization of land rights data, define a transaction approach (possible automation) through smart contracts, as well as represent land and landed property through tokens which can then be linked to cryptocurrencies to allow for possible exchanges (Konashevych, 2021)

Once land data have been entered into a Blockchain database, any subsequent transactions on that land - by way of selling, buying, leasing, registration, or payment becomes possible, as the Blockchain system mainly allows for the exchange, or transaction of value in peer-to-peer (P2P) approach. As already mentioned in the previous paragraph, in the working process of the Blockchain system, the distributed P2P protocol allows for parties to transact values in a way that is subjected to oversight verification and validation leading to a consensus building on the authenticity, and genuineness of every transaction. Daniel & Speranza, (2020) posit that the P2P protocol of the Blockchain system is leveraged to track land transactions over the internet as it allows for transparency, traceability, and built-in-trust useful for managing land rights. Land administration involves several stakeholders, such as surveyors, valuers, and land registrars. Additional stakeholders include: land sellers (individuals, or institutions), financial institutions/ banks, planning institutions and others. The need for integration, and transparency amongst all these stakeholders in land transactions can therefore not be underestimated. At the moment however, most traditional land administration systems do not have an integrated database that allows for such a distributed availability of land data, or technology for land transaction/ or processing in such a distributed approach without intermediaries (Niloy et al., 2021). Land transactions are therefore (potentially and actually) fraught with a low level of transparency, unnecessary delays in land transactions and processing due to disconnected working relationships. This situation is particularly pronounced in the many developing countries where both human capacities, and technologies are somewhat limited (Ameyaw & de Vries, 2021). The situation equally creates room for all sorts of possible tamper and other malicious activities, and data loss. This situation makes the P2P integrated protocol of the Blockchain system ideal in land transactions for integrating stakeholders, while at the same time integrating land services delivery and or transaction processes. It also enhances inclusivity by allowing for (based on specified rules governing the system) an all-stakeholder, or majority stakeholders' verification and validation of every action relating to land transactions.

During a transaction on a Blockchain system, participants (nodes) on the system have two keys each: one public key, and also one private key which are stored in their wallets (Daniel & Speranza, 2020). The private key is used to sign the transaction for distribution. The public keys of the network participants are distributed to each participants. This helps participants to validate the authenticity of the proposed transactions (Krishnapriya & Sarath, 2020). That is, in a land sale for instance, the seller uses their private key to sign into the Blockchain system, and uses the private key to sign a unique digital signature to initiate or create a transaction on the Blockchain network (Anand et al., 2015; Daniel & Speranza, 2020). This created transaction is distributed to all the participants using the public key of the creator. This helps the other nodes to know from which node the transaction is coming. That is, the associated public key helps to authenticate the validity of the transaction (Krishnapriya & Sarath, 2020) It is important to mention that for security purposes, there is also the possibility to make the public key anonymous whereby it will not lead one to the creator of the transaction (Nakamoto, 2008). In consequence therefore, in a land administration system, once a stakeholder (land owner) has connected to the Blockchain system through their wallets (account) with the private keys, the land property can be created and represented as a token (non-fungible) on the system. They are created as non-fungible tokens due to the unique characteristics of each land (fungible, and non-fungible token are explained in chapter 8). In so doing, a transaction will be created and broadcasted to the other nodes. There will then be the verification and validation of the transaction based on proof of work. A consensus will then be built to accept and add the completed transaction as a new block to the Blockchain system leading to transparency in the entire transaction system.

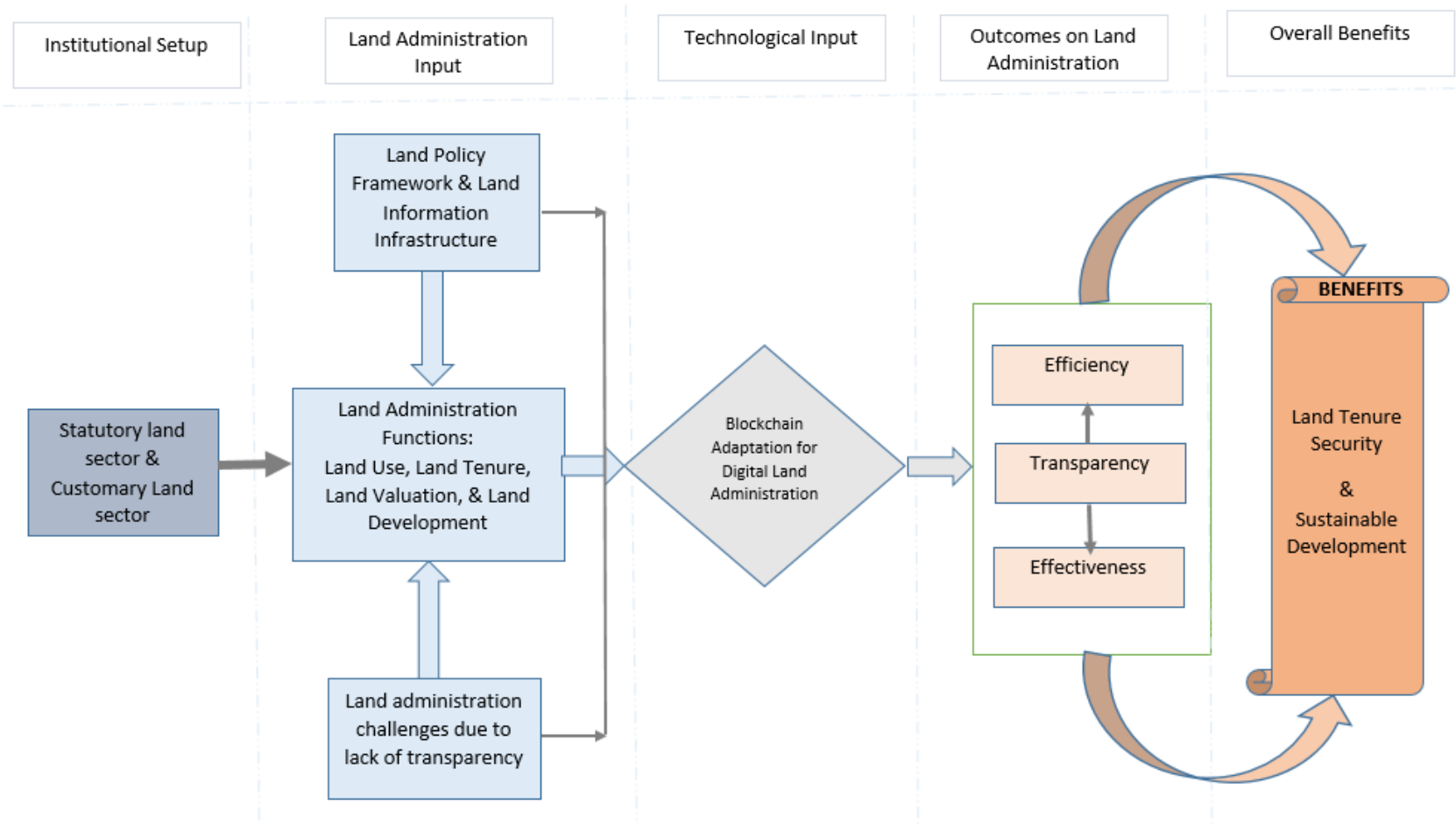


Figure 5. Conceptual framework of land administration & Blockchain adaptation for transparency outcomes

Source: Author's Construct

Transparency in a Blockchain-based land administration as identified above stands to enhance efficiency, and effectiveness in land administration (Djursén & Björk, 2022; Khan et al., 2022; Ansah et al., 2023). The elimination of intermediating parties for the verification and validation of the necessary aspects of land administration transactions services helps to reduce unnecessary bureaucracies, and redundant tasks amongst the various institutional stakeholders. This improves efficiency in land administration services delivery, while the supervisory oversight within the working system enhances effectiveness and at the same time eliminates fraud and corrupt deals on the part of land services professionals (Veeramani & Jaganathan, 2020). In the paper, 'An Improved Blockchain Technique for Secure Land Registration Data Records', Humdullah et al., (2021) concluded that Blockchain technology can improve efficiency of the land registration process, and also land administration work performance up to 30% by reason of possible prevention of fraud deals, and enhanced transparency from P2P protocol, and the consensus building mechanism. The overall implications of the Blockchain-supported improved land administration system/ or services delivery translates into land tenure security, and into an overarching sustainable development by way of contributing to achieving the no poverty, and zero hunger among the other digitalization goals of the United Nations SDGs already highlighted in chapter one. As land administration functions of land use planning, land registration, land valuation, and land development become more transparent, easily accessible to citizens, reliable, and trusted, it enhances overall land tenure security for citizens, knowing that land transactions are based on genuine deals and documents which have been verified, and validated by all the relevant stakeholders.

Chapter 3.

Research Methodology

3.0 Introduction

This chapter present the research methodology adopted for undertaking this study. It highlights the rationale behind the research paradigm, philosophical basis, and the study strategy. The section first delves into the discourses surrounding the three research paradigms; qualitative, quantitative, and mixed paradigms and why all paradigms are appropriate for different research works although not mutually exclusive (Gavu, 2020). It discusses the criteria, and justification for the three case studies used, and goes on to describe the data collection and analysis phase which included: pre-fieldwork preparation, fieldwork activities, and post-fieldwork activities. Ethical considerations regarding the research are finally presented.

3.1 Research Decision

Every research work involves decisions on how the research will be carried out. These decisions are invariably influenced by elements as the philosophical basis, the research design, and the research methodology to adopt. That is, the whole research involves the intersection of philosophy, research design, and the research method (Creswell, 2014). These decision guide the researcher through a logical research study to a credible results. A careful consideration of the appropriateness of these three can therefore not be overemphasized in every research study.

3.2 Philosophical Basis

Research philosophy refers to the set of beliefs, and assumptions which underline the development of knowledge and these assumptions are made either consciously, or unconsciously at every stage of the research work (Saunders et al., 2016). It is therefore essential that the philosophical basis, and the research design/ paradigm of inquiry be reviewed right from the early stages of the study, and the main philosophical assumption embraced for the study be made explicit as well (Mccallin, 2003; Creswell, 2014). Research philosophical assumptions are usually based on disciplinary backgrounds, research experiences, as well as the research inclination of the researchers involved in the research study, and the beliefs of researchers. These factors influence the researchers' choice of research paradigm (Creswell, 2014). Hence, a well thought-out and consistent set of assumptions and beliefs guide to a credible research philosophy, and underpins the research methodology, strategy and data collection, and analysis (Merriam & Tisdell, 2020; Saunders et al., 2016). Philosophical assumptions shape how the researcher understands the research question, the methods adopted, and how results are interpreted. Thus, in planning the study, Creswell, (2014) advocates that researchers need to think through the philosophical assumption or philosophical worldview assumptions they bring into the study, the research design that relates to this assumption, and the research methods that transform the approach into practice. Hence, the interrelation of the philosophical assumptions, research design, and the research methods guides the research study from conceptualization, through data collection and processing to conclusion.

It is crucial that researchers understand the philosophical assumptions of different research works to help make informed decisions on the available choices in designing and implementing the research study (Merriam & Tisdell, 2015). Different philosophical assumptions exist and Creswell, (2014) identifies four common philosophical assumptions/ worldviews to include; postpositivism, constructivism, transformative, and pragmatism.

Postpositivism: This view looks at identifying the causes for certain outcomes. It holds that knowledge is relative and not absolute (Merriam & Tisdell, 2015). Postpositivism is more of quantitative and a reductionist approach in which ideas are broken down into smaller constituents and tested results.

Constructivism: Constructivism relates more to how researchers seek to subjectively understand the world or the phenomenon of study based on the research participants' views and experiences of the subject matter. Constructivism or social constructivism relates more to qualitative research designs which are mostly context specific, inclusive, involved and allows for emergence of other research questions as the study progresses (Martens, 2014). In this, the researchers rely on interactions and or discussions with research participants to make meanings from what participants do, or say about the object of research (Creswell, 2014).

Transformative: This philosophical assumption borders on the need for incorporating politics and political change motives to help change the situation of marginalized groups in society (Creswell, 2014). In most cases, a research of this philosophical assumption sees the marginalized group as part of the change process and thus sometimes form part of the research questions designing, collection and analysis of the data so as to give voices, and to not further marginalize them (Creswell, 2014; Martens, 2014)

Pragmatism: As opposed to the Postpositivism which seeks to find causes, pragmatism is concerned with better understanding the problem and applying all possible solution approaches to addressing it. It is thus usually associated with mixed methods research, employing different approaches to finding solution, or answering the research questions (Creswell, 2014). Thus, pragmatic researchers identify a problem as the basis of their study, and aim to find practical solutions that can inform future practices (Saunders et al., 2016).

In view of these, this study is premised on the pragmatist's philosophical worldview. Pragmatists seek to find practical solutions not only to the identified problem, but also to inform future practice (Saunders et al., 2015). This is the exact position of this research. I identified that after about two decades of land digitalization initiative, the land sector is still predominantly manual, and faced with the numerous associated challenges of manual systems and processes; corruption, and double sales among others resulting from a generally low level of transpaency. Thus, this study aimed at finding the way forward to addressing how we can sustainably digitalize the land sector in a way that salvages the transparency problem. Given that Ghana has both statutory, and customary land systems coexisting, it is only ideal to assess the problem from both perspectives and hence the need for cases from both systems to be studied. Accordingly, I adopted the case study design, employing various data collection approaches appropriate to elicit the right data for addressing the situation in each sector as is emphasized by pragmatists that multiple paradigms are necessary for

addressing a problem (Creswell, 2014; Merriam & Tisdell, 2015; Creswell & Poth, 2016). The mixed method was considered most suitable as it better aligns with the pragmatic approach. Based on differences in the prevailing digitalization practices in the different cases, indepth inquiry was necessary to elicit details on the digitalization activities and to understand the true meanings of things, which forms the basis to identifying ways forward to addressing the challenge. I adopted varous theories to help frame the right questions on the problem and to get the right and detailed data, for better interpretation, and advancement of knowledge. This makes the pragmatic philosophical worldview more appropriate in that pragmatists believe that practical meanings of knowledge in identified contexts, and, approapriate theories are the requisites for possible successful actions to address the problems (Saunders et al., 2016).

Each of the philosophies/ worldviews however makes their own assumptions based on a set of beliefs about realities encountered in the research (ontology), about human knowledge (epistemology), about the research process (methodology), the language of the research (rhetoric), and about the extent and ways that the researcher's own values influence the research process (axiology), (Creswell, 2014; Martens, 2014; Creswell & Poth, 2016; Saunders et al., 2016). **Ontology:** This relates to the researcher's belief of the nature of reality. That is, how a researcher sees a phenomenon, or an object and how they study this phenomenon as their objects of research (Saunders et al., 2015). This therefore determines what the researcher chooses to research into. **Epistemology:** How we know what we know (Creswell, 2014). Epistemology defines the 'nature of knowledge, its possibility, scope, and general basis' (Crotty, 1998), that is, the acceptability of the type of knowledge we have of the object of study, its adequacy, validity, and legitimacy as well as how we communicate this to others (Saunders et al., 2015). Thus the more knowledge a researcher has about a phenomenon, the more likely it is to influence the researcher's decision of what they will study, or research into. Hence, researchers with statistical background are likely to undertake more quantitative forms of research as against those with social background that might be interested in details of situations and hence go in for qualitative researches. **Axiology:** This concerns how researchers' own values and ethics influence the research process, and outcomes, and how the researcher deals with these values and ethics, and that of the research participants. This influence of our own values and ethics on the entire research and how we manage it is crucial for the credibility of the research results (Saunders et al., 2015). **Methodology:** This defines the processes of research data collection through various inquiry forms, data analysis, and data interpretation to answer the research question, or address the research problem. Depending on the type of data to be collected, and whether these are determined in advance, or emerge as the collection process proceeds, a methodology choice can be made (Creswell, 2014). However, 'the logic of method does not dictate as to what specific data collection techniques and analytical methods a researcher must use' Gavu, (2020) but must be guided based on the merits and appropriateness of the different data collection tools, and analysis possibilities to the specific research question. As with philosophical basis, the choice of methodology relates to, and goes with the appropriate research design. Accordingly, my background as a qualitative researcher influenced the choice of research topic. However, with the nature the realities on the ground, I realized the need for a complementary strategy and hence the mixed research design. And being a

time bound research with the objective to delve into the details of the issue, the pragmatic philosophical basis was best suited to study the problem.

3.3 Research Design

Research design defines the overall structure/ plan a researcher takes to carry out the research work which spans from identifying the problem through to answering of the research questions and writing out the research report, or paper (Yin, 2016 ; Saunders et al., 2016; Creswell & Poth, 2016). Research designs are sometimes also referred to as strategies of inquiry (Creswell, 2014). Generally, three research designs are available to researchers; qualitative, quantitative, and mixed research designs. The choice of any particular design for a research study is influenced by the research question that the researcher seeks to answer (Saunders et al., 2016). Deciding on a specific designs therefore forms the first methodological choice in any research work (Saunders et al., 2016). Thinking through carefully to decide on the appropriate research design provides sound grounds for carrying out the research study as the design provides logical blueprints for the entire research work (Yin, 2016). This allows for a reasonable justification for the research basis of either a qualitative, quantitative, or a mixed research.

3.3.1 Qualitative Research Design

Qualitative researches are explorative in nature, trying to understand the meanings people attribute to certain social phenomenon, or problems within specific contexts. Qualitative research designs have roots in anthropology, sociology, humanities, and evaluation studies Creswell, (2014) and subscribe to the belief that reality is a social construct and that individuals have subjective meanings of their experiences, or towards certain phenomena, or objects. Qualitative research design is associated with the paradigms; social constructivism, transformative, and pragmatic. For instance, it may be used to explore the social construction of reality, or to identify causal relationships in a phenomena by the social constructivist researcher, the transformative researcher may rely on it to capture the lived experiences of less privileged group in society, and the pragmatic may employ it to complement other designs where they find it appropriate (Martens, 2014). In qualitative design, the interaction with research participants to discuss their lived experiences allows the researcher to gain rich and detailed data about the phenomenon under research. Often associated with the social constructivism or interpretative paradigm, Saunders et al., (2016) argue that different people at different times, and in diverse circumstances make different meanings and as such, they create, and experience different social realities. The belief is that people construct knowledge in a progressive manner as they get involved in, and make meanings of certain experiences, activities, or phenomenon (Merriam & Tisdell, 2015). Therefore an attempt to study such a complexity based on definitive and strict laws like generalizability, or as though the knowledge is existing and only needs to be discovered may cause loss of the rich insights into the phenomena under study (Saunders et al., 2016; Merriam & Tisdell, 2020). Inquiries in qualitative research mostly aim to answer the questions of ‘why, and how, which allows for unearthing new insights and interpretations. Answering these question mostly relates more to detailed description, and or explanation of processes, or phenomenon which makes qualitative studies use words, images, video clips and such other materials as the data, and analyze these through various forms

including; coding, and theme generation as against numerical data analyzed by statistical techniques (Saunders et al., 2016).

Different forms of qualitative designs are identified; case study, ethnography, grounded theory, narrative, and phenomenology (Creswell, 2014; Yin, 2016; Merriam & Tisdell, 2020) .Qualitative designs rely on several approaches for data collection. Observation, interviews, focus group discussions, and open-ended questionnaire guide among other complementary data collection tools. Since data gathered are usually in words, i.e. textual descriptive, or oral explanatory, analysis of qualitative research data are guided by the development of codes, and themes to help establish relationships, and new insights or discoveries. These research types thus often lead to the development of theories rather than testing a theory, or a hypothesis like quantitative studies do. Qualitative researches usually focus on specific contexts with usually lesser research participants capable of giving the detailed lived experiences of the phenomenon under study. This makes the applicability of the study results usually specific to the study area but forming basis for actions in similar contexts, as against possible generalization to other contexts, or the broader population. It is thus criticized as being non-representative although that is not the main ultimate of qualitiative researchers.

3.3.2 Quantitative Research Design

Quantitative research designs with origin in psychology relates to the examination of the relationships between variables measured numerically, and analyzed through statistical techniques (Creswell, 2014). This design uses data to test theories by the deductive approach (Saunders et al., 2016). That is by way of confirmation, or validation, and to develop generalization in support of theories (Williams, 2007; Creswell, 2014). The postpositivist / positivist assumption supports quantitative design and argues that there is just one reality that can be measured (Merriam & Tisdell, 2015). It is also used with the realist, and pragmatic paradigms in a mixed research design (Saunders et al., 2016). Quantitative researchers are independent from the research participants, and the research outcomes are based on objective measurements and analysis of research data. Data collected are quantifiable to answer questions as; '*what percentage?*, or *how many?'*. Quantitative results help to identify trends in a data sets, and aim to have a representative sample size to allow for generalization of results to the larger population. The main types of quantitative research designs are experimental designs, and surveys (Creswell, 2014). Data collection is usually through structured survey questionnaires.

3.3.3 Mixed Research Design

Mixed research design blends the attributes of both quantitative, and qualitative research to achieve the advantages of both designs while overcoming each's weaknesses with the strengths of each other. It thus rejects dogmatism (Johnson & Onwuegbuzie, 2004). Martens, (2014) defines it as *'research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry'*. The mixed design is an extension of the qualitative, and quantitative designs rather than a replacement Williams, (2007) and as such allows for synergic results beyond each

single design's ambits. This provides grounds for mixed design researchers to be able to test, and to build theories in a single study (Williams, 2007). The design is thus based on the pragmatic, and realist philosophical perspectives (Johnson & Onwuegbuzie, 2004; Creswell, 2014).

Mixed design researchers have the option of either using both qualitative, and quantitative data collection, and analysis techniques at the same time (parallel) or one after the other (sequential) Saunders et al., (2009). In the sequential however, there is the explanatory sequential mixed design (where quantitative data are first collected and analyzed, after which qualitative data are collected to help explain the quantitative results into details) and the exploratory sequential (where qualitative design is first used to collect and analyze data, which is afterwards built into a quantitative design phase) (Creswell, 2014). This available options sometimes enables the study to achieve results that were even unanticipated but which emerges to ehance the study outcomes. Creswell, (2014) further notes a third strategy available to the mixed researcher which he labels as the transformative mixed research. In this, the researcher draws on a theoretical perspective as the basis of their research and within this perspective, either the parallel, or the sequential mixed designs can be utilized (Gavu, 2020). The overarching importance of the mixed design over using either the quantitative, or the qualitative designs solely is that it allows for flexibility in the research approach, and also permits researchers to either make predictions, explorations, description, or to understand the study phenomenon.

3.3.4 Choice of Research Design

Choosing a research design has different considerations based on; the research problem at hand, the objective one wants to achieve, and the research questions to answer. Choice of a design is not based on the advantages of one over the other but rather on their appropriateness for the particular study (Gavu, 2020). Johnson & Onwuegbuzie, (2004) note that a tenet in the mixed design is that the researcher must be open-minded, and creative on the design that will effectively answer the research questions and not be limited by the confines of either the quantitative, or qualitative designs. That is, in a mixed design, the researcher is at liberty to bring in new dimensions and ideas in the research process to help achieve the research objectives. Mixed research can be designed in diverse ways according to Johnson & Onwuegbuzie, (2004). Some of these include; by paradigm (that is whether the quantitative, and qualitative paradigms will both have equal status in the study, or one will have a dominant status against the other), by time ordering of the quantitative, and qualitative phases of the research i,e whether they'll be carried out at the same time (parallel), or one after the other (sequential)), by the degree of mixture (from a single design to a full mixed design), by the phase of the study where the mixing will occur (i.e in the objective, methods of data collection, research methods, data analysis, or at the data interpretation phase). By these openness and flexibility, a new design could emerge during the mixed design study depending on the study conditions, and information gathered which allows for novelty.

Given the advantages and limitations of each single design, capitalizing on mixed designs reduces the problems with single methods and incorporates the strengths of both methods (Johnson & Onwuegbuzie, 2004). Based on these and given the nature of the research objective to assess the feasibility of Blockchain technology adoption for a transparent land administration system in

Ghana, I adopted a parallel mixed research design. The objectives 1-3 are explorative in nature which were addressed by the qualitative research design. Objective 4 which sought to assess the digital readiness of the land sector by way of developing a digital land maturity assessment framework, and further measuring the digital maturity level was addressed through both the qualitative, and quantitative designs.

3.4. Research Matrix

To guide and streamline the research processes towards addressing the objectives, a research matrix was designed for the study. This defines the study objective and the approach to achieving these by way of the specific research questions/ sub-objectives to achieve under each main objective, required data, data sources, data acquisition tools, time for data acquisition, and the method to analyze the data received. Table 4 below presents the research matrix.

No	Research objective	Specific research objectives/ questions	Required data	Data sources	Data collection tools	Time/ phase for data collection	Data analysis method
1	To conceptualize BT and land administration transparency.	To identify the essential elements and relations between Blockchain technology and the transparency of land administration in existing literature.	Literature on the concept of Blockchain, and on the concept of land administration transparency	Secondary	Literature search	Pre-fieldwork	Literature review, and framework analysis
		To assess the potential of Blockchain technology to improve the transparency of land administration functions—based on the Ghanaian land administration context.	Relevant data on land administration functions and processes in the Ghanaian context, and also on how Blockchain can enhance transparency in these functions	Secondary/ Primary contacts	Literature review, and phone contacts to some experts/ professionals in the field	Pre-fieldwork	Literature review, and framework analysis
2	To assess land acquisition, and registration processes, and the potentials of BT towards these	To assess and identify the main challenges of the current land acquisition processes in Ghana.	Relevant data on land acquisition, and registration issues in Ghana	Secondary/ Primary contacts	Literature review, and phone contacts to some experts/ professionals in the field	Pre-fieldwork	Literature review
		To explore opportunities, and ways to address the land acquisition, and registration challenges.	Relevant literature	Secondary	Literature search	Pre-fieldwork	Literature review, and SWOT Analysis
		To conceptualize a smart land acquisition, and registration process that can help address identified challenges in land acquisition processes in Ghana.	Relevant literature, and primary data on land acquisition process, and on Blockchain usage, and how Blockchain can be	Secondary, and primary	Literature review, and phone contacts to some experts/ professionals in the field	Pre-fieldwork	Literature review

			inculcated into the acquisition, and registration process				
3	To develop a contextual guide of reference based on lessons from a previously adopted digital system (GELIS) that can be used during consideration of digital tools like BT for the land sector	What could be the underlying reasons why Lands Commission did not fully achieve the expected outcomes on land services delivery with the adoption of GELIS?	Relevant data on GELIS adoption issues	Secondary, and primary	Literature review, and informal interviews with field professionals	Pilot fieldwork	Literature review, and Content analysis
		What experiences exist in the GELIS project and how can these shape future adoption of a technology like Blockchain?	Relevant data on GELIS adoption issues	Secondary, and primary	Literature review, and informal interviews with field professionals	Pilot fieldwork	Literature review, and Content analysis
		How can we develop a guide for the Commission, and similar land administration systems in other developing countries to make use of a technology adoption procedure in a future adoption of Blockchain technology?	Relevant data on technology acquisition and especially relating to Blockchain	Secondary, and primary	Literature review, and informal interviews with field professionals	Pilot fieldwork	Literature review, and Content analysis
4	To assess the digital readiness of Ghana's land administration system towards a possible BT uptake for a transparent land administration services	To what extent is Ghana's land administration system digitally ready towards a possible Blockchain technology uptake for a transparent system?	Relevant data on the digital maturity status of land administration systems in Ghana	Secondary, and primary	Literature review, interviews, questionnaire, and observation	Fieldwork, and post fieldwork	Literature review, framework/ thematic analysis, and content analysis

Table 4. Research Matrix

3.5 Methodology

Research methodology is the general approach, and or process a researcher takes in conducting the entire research project (Williams, 2007; Mohajan, 2018). It directs the whole research and Leedy & Ormrod, (2014) note that research methodology performs two main functions; 1. '*To dictate and control the acquisition of data*', and 2. '*To analyze the acquired data in order to extract meanings from them*'. These functions give basis for differentiating methodology, and methods. According to Saunders et al., (2009), methodology refers to '*the theory of how research should be undertaken*' while methods refer to the '*techniques and procedures used to obtain and analyze data*'. This makes methods more associated with the data acquisition function of methodology while methodology forms the broader term, or the umbrella framework for all the activities a researcher undertakes from the start of a research project to its conclusion within which methods are embedded.

As is in line with research design, there are three research methods associated with the three research designs already identified. These methods are; quantitative, qualitative, and mixed research methods. Each method consequently has their associated research strategy; i.e. the plan that a researcher uses to answer the research questions, or address the objective. Saunders et al., (2016) identify the various research method and their associated strategies. Experiment, and Survey are associated with quantitative, case study, and archival and documentary research are associated with mixed method, while ethnography, action research, grounded theory, and narrative inquiry are associated with qualitative research. However, Yin, (2003) posits that the choice of any of these strategies for a research study is contingent on three major conditions; 1. 'The type of research question posed', 2. 'The extent of control an investigator has over actual behavioral events', and 3. 'The degree of focus on contemporary as opposed to historical events'. These strategies are however not mutually exclusive and can be used together in certain instances. Accordingly, and as identified under subsection 3.3.3, a mixed research design was adopted for this study, and follows consequently that the mixed research method, and its associated case study strategy are chosen for the study. Mixed method research '*combines the use of quantitative and qualitative data collection techniques and analytical procedures*'. Several reasons inform the choice of a mixed method design for a research study. Saunders et al., (2016) highlights some reasons, and the advantages argued out for the choice of mixed methods. These include amongst others;

- Initiation; at the beginning of a research, mixed method can be used to help formulate the study questions which can then inform the drafting of interview questions, and questionnaires, as well as selecting research participants, and sample size amongst others
- Facilitation; where new and possibly unexpected discoveries are made in the process of the research which will require the use of other methods to facilitate better understandings, or interpretations
- Complementarity; where both methods allow meanings and findings to be elaborated, enhanced, clarified, confirmed, and validated.

- Diversity; it allows for several different views to inform, and be reflected in the research study
- Problem solving; where the initial method proves inadequate at addressing the problem, adding an alternative can be very useful
- Focus; the different methods could be used to focus on specific items within the study which otherwise could not be suitable with a single method
- Triangulation; it may be used in such a way that data from one method maybe used to find out if they corroborate the findings from another method

In this study, mixed method was adopted to help us be able to address the research objectives as we identified that any single method alone was not enough to help achieve the objectives. The research by its explorative nature used the qualitative method to establish the elements and relationship between Blockchain and land administration transparency, identified the possible use scenario of Blockchain in the Ghanaian land sector, identified the challenges and opportunities inherent in the Ghanaian land sector for possible Blockchain uptake, and identified context technological, organizational, external, and socio-cultural elements of consideration to guide Blockchain technology uptake. And in assessing the digital readiness of the Ghanaian land sector for Blockchain, the quantitative method was also used together with the qualitative method to know the digital maturity level of the land sector and the way forward for advancement. Employing the mixed method in this way allowed for problem solving by way of allowing us to address all the research objectives. It also allowed for complementarity as the quantitative results on the digital maturity of Ghana's land sector were enhanced and elaborated with the qualitative interview responses which respondents' gave for their choices of the numerical value responses to the quantitative questionnaire. Additionally, triangulation was made possible by way of comparing to see if the qualitative results corroborated the responses to quantitative questionnaire, which eventually allowed for validation. Therefore, it is mainly the problem solving, triangulation, complementarity, and to a lesser extent, the facilitation reasons that underline why the mixed method was adopted in this study.

3.6 Research Strategy - Case Study

Case study research allows for the study, or exploration of an individual, a group, or a phenomenon over a period of time (Leedy & Ormrod, 2014; Mohajan, 2018). It involves empirical inquiry into a phenomenon within its real life context based on multiple evidence sources (Williams, 2007; Saunders et al., 2009; Mohajan, 2018). Picking such a specific object, or phenomenon of study permits the researcher to do an in-depth probing to uncover deep details about the study phenomenon. It focuses on specific instances, delves into them to reach better understanding of complex phenomenon (Martens, 2014). In a case study strategy, the researcher has the option of choice. Saunders et al., (2009) note four case study possibilities based on two discrete dimensions. These are: single case, or multiple case, and holistic case, or embedded case. In the first dimension, a researcher may choose a single case study (possibly due to its unique features to allow for and promote better understanding of the phenomenon of study or to inform practice in similar contexts) or a multiple case studies which might have certain key similarities, or differences to allow for comparison, building of theory, or for generalization (Saunders et al., 2009; Leedy & Ormrod,

2014). The second dimension relates to the unit of analysis. In this, when the researcher chooses an organization as a whole to focus on in the study, then it is a holistic case study. Conversely, where, although the researcher is considering the organization as a whole for the research but examines sub-units or departments of this organization, then it is an embedded case study as the sub-units of interest are embedded in the broader organization as a whole (Saunders et al., 2009). I chose the embedded - multiple case studies strategy. This is because, although the selected institutions were taken as a whole, not all the units formed part of the research participants. For instance, Accounts department were not included in the study. Merriam & Tisdell, (2016) identify what they term as the qualitative mixed method case study in which case 'one form of data in a mixed methods study is more primary than another'. Here, the original design of the study is a qualitative case study in which primary data was based mainly on qualitative data collection tools as interviews, and observation among others. However, during the study, it appeared that the need to use quantitative data collection approach, such as using a survey with a broader group of participants, would help to generate further important data and as such, this was consequently employed to complement what was primarily designed as a qualitative case study. Thus, the quantitative design is nested in the primary qualitative design (Clark et al., 2013). This way of mixing the two designs is what Clark et al., (2013) term as an 'embedded study' and define as having an unequal priority in terms of the relative importance of the quantitative and qualitative components for addressing the study's research questions. Regardless of whichever case study strategy a researcher chooses, they primarily will need to spend time on site, or via other communication mediums interacting with the people involved in the phenomenon being studied (Williams, 2007). Despite allowing for detailed data acquisition, case studies are also criticized as time consuming and costly, and also where single case study is used, generalizability of results is often difficult (Leedy & Ormrod, 2014; Mohajan, 2018). However, multiple case studies are used where the need for generalization is necessary and as such, multiple case study is argued as preferable to the single case study alternative (Saunders et al., 2009)

3.6.1. Justification of Case Study

There are different reasons that inform the choice of a case study research strategy. In this study, three main reasons motivated this choice of a case study strategy.

First, the concept of land administration and technology is fraught with diverse complexities of both historical and contemporary events on the one hand. On the other hand, land administration systems are different in many ways based on their geographical contexts and as such requires contextual focus, especially, in the consideration of a contemporary technology as Blockchain in support of land administration services. These complexity, contextual, and contemporary characteristics of the concepts of the study require in-depth understanding of the inherent issues in them. A research strategy which offers the opportunity to address these through in-depth exploration is therefore considered more appropriate for the study. Yin, (2016) identifies that a case study is more useful when, *the how, or why* question is being asked about 'a contemporary set of events'. In this case, Blockchain technology's consideration in land administration present a contemporary event. (Saunders et al., 2009) also point that case study allows for 'empirical investigation of contemporary phenomenon within their real life contexts. Yin, (2016) further

defines case study as '*an empirical method that investigates a contemporary phenomenon (the "case") in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident'*. The complexities of land administration relates to the different systems of both customary land administration, and statutory land administration operating side-by-side with each other. Navigating the processes of these systems present complex and intertwining issues of tenure right overlaps, contradictions, commonalities, and oppositions which can only be understood through detailed data. Flyvbjerg, (2006) is of the view that such complex issues are best understood through in-depth case study. These opportunity of the case study to permit delving deep into the issues of land administration and a possible uptake of a contemporary technology as Blockchain made it more viable a strategy choice as opposed to the others that limit the possibility of such in-depth investigation.

Secondly, the case study strategy was adopted for this research due to the nature of the questions posed. According to Yin, (2003 p.6) the *'how' and 'why'* research questions are more explanatory and the case study research strategy is preferred as these questions deal with operational links that might need to be traced overtime. In this research, the main question is *'how can Ghana sustainably adopt BT in support of land services for a transparent land administration system?'* Consequent to this are four sub-research questions: How does BT relates to land administration transparency? How can BT potentially enhance the land acquisition and registration processes in Ghana? How can we develop a contextual reference guide for use by the land sector in the possible consideration of BT uptake? How can we assess the digital readiness of Ghana's land administration system towards a possible BT uptake for a transparent system? These questions help to delve into the intricacies of BT consideration for land administration as they help to trace the relationships in the concepts of study, as well as the actors, artefacts, roles, and power structures among other elements relevant for addressing the questions.

The third reason why the case study was adopted is the flexibility of applying several evidences based on the use of multiple data acquisition tools as interviews, focus group discussions, and observation among others to answer the study questions posed. Yin, (2016) points that a case study relies on multiple sources of evidence at the end of which all the data must converge in a triangulating fashion. Due to the numerous actors involved in land services delivery and their stakes in such an important land service decision as a technology uptake, I needed to gather data from different stakeholders, and sources through different data acquisition tools which included interviews, observation, telephone calls, and video elicitation among others.

It is important to mention that case study strategy like the other strategies is not without criticisms and or controversies. The first and major criticism of this strategy is the possible generalizability of its results. Postpositivist proponents hold the argument that single case studies especially provide very little basis for generalization and possible development of scientific knowledge (Yin, 2003; Flyvbjerg, 2006; Akaateba, 2018). This criticism has however received different counter arguments (Akaateba, 2018). Flyvbjerg, (2006) for instance argues that case study can be generalizable based on the research objective, and where a strategic choice of the case to be studied is selected. For instance, where the objective is to achieve a great deal of information on a phenomenon, a strategic choice of a critical case will be better suited for generalization of the

results compared to representative case or a random sample strategy which cannot yield such a great deal of information (Flyvbjerg, 2006; Duminy et al., 2014). Here, a critical case will be one that is 'most likely', or 'least likely'. That is 'cases likely to either clearly confirm or irrefutably falsify propositions and hypotheses' (Flyvbjerg, 2006). A second counter argument to the generalization criticism of case study strategy is its capacity through the depth of details which helps to evoke empathetic or comparative response from their readers' experiences (Duminy et al., 2014). That is, readers themselves must decipher whether the results reported in the case study research are applicable to other cases (Leedy & Ormrod, 2014; Akaateba, 2018). This is termed as the 'naturalistic generalization' by Stake (1978 p.6) cited in (Duminy et al., 2014). 'Naturalistic generalization' are more concerned with developing expectations and guiding actions than with predictions, and the empirical and logical tests of formal generalization (Duminy et al., 2014). Therefore, this basis of case study generalization is more about making the findings of a case study research the basis for action, not only in the study area but also in similar situations elsewhere (Duminy et al., 2014). Finally, a third counter argument from supporters of case study strategy is whether the generalization from case studies should be considered from the statistical (population) generalization perspective, or from a different perspective. Yin, (2016) argues that case studies are generalizable to theoretical propositions (analytic generalization) and not to populations or universes (statistical generalization). In this type of analytical generalization, the researcher looks to rather generalize certain set of results to some broader theory (Akaateba, 2018). These counter arguments scientifically provide sound basis in support of possible generalization of case study research results. However, based on the fact of strategic case selections, and readers' discretion on the applicability of the findings to other places, I am cautious on the generalizability of this research's results to all the remaining land sector institutions in Ghana. Rather I agree, first with Duminy et al., (2014) that case study generalization is more about making the results of the study a basis for action, not only in the study area but also elsewhere, and secondly, with Yin on the analytical generalization of case studies' results in which case there is an optimized contextual in-depth understanding of the phenomenon of study based on the selected cases. This study sought to address how Ghana can sustainably adopt BT in support of land administration services for land administration transparency based on three selected cases. I therefore posit that the contextual in-depth understanding of land administration and Blockchain technology uptake processes in the studied cases which were strategically selected offers basis to inform actions on same across the country. These bases make the case study strategy the optimal choice amongst the other strategies.

3.6.2 Criteria for Selecting Case Study Areas

In selection of the case study areas for this research work, different considerations were made before concluding on the Accra Lands Commission (ALC), Kumasi Lands Commission (KLC), and the Otumfuor Customary Land Secretariat (OCLS) also known as the Asantehene Land Secretariat (ALS) as the three case studies. The first consideration was based on accessibility to data. Difficulties in accessing data literally means no research study as research data forms the core of a research study (Yin, 2016). Thus, to be sure that I could have access to data, a pilot study was carried out from April to June in 2021 mainly through telephone outreach. During this pilot study phase, I contacted the three study institutions to assess the data accessibility possibility.

Officials of the three case study institutions showed willingness to share their knowledge, experiences, as well as facilitate possible accessibility to any other information that might be necessary for the research when the time was due. Some of the officers I engaged in the pilot study phase showed much interest in the research topic which borders on land administration and Blockchain uptake feasibility assessment to help know how Ghana's land sector can sustainably adopt the technology to foster land transparency. This is because, according to these officers, it was long overdue for a digital land service delivery in Ghana. Therefore, a study in that direction was considered opportune and a step in the right direction to help contribute to the knowledge base on the way forward for digital land services delivery. They were therefore happy and very willing, and assured me of access to all the relevant data when the time was due for me to commence the study. Creswell & Poth, (2016) advise that investigators select accessible cases in a case study research to be able to get access to the in-depth data this strategy aims at. This pilot study also facilitated some preliminary observations and understanding of the concepts of the study contextually, and this guided the designing of the field interview questions (Asante, 2020).

The second consideration was based on the richness of information. The three study areas are categorized into the statutory, and customary study institution. Accordingly, the ALC, and the KLC represent the statutory institutions while the OCLS represents the customary institution. The ALC has the Enterprise Land Information System (ELIS) which is the land information system in use, and is also piloting the Lands Commission Portal which is meant to be the user interface where the public clients can access services, and also transact, and or interact with the Commission. These digital initiatives make the ALC an ideal study area to be able to obtain as much information as possible on land digitalization processes as they have comparatively gone far with the digitalization initiative compared to the other Lands Commissions branches in other regions. This is also in line with the point made by Flyvbjerg, (2006) that a case is preferred where the aim of the study is to obtain the 'greatest possible amount of information' on a phenomenon of study. The ALC therefore offered this possibility of accessing as much and rich data on the study topic as possible. The KLC study area has also had the Lands Commission Information Management System (LCIMS) for relatively a long period of time. This information system underlines the internal digital system for tracking the movement of land application files. Although this system has limited functionalities in comparison with the ELIS in Accra, the long experience with this digital system in Kumasi offered a very good opportunity for accessing and assessing rich information from different perspective such as, why despite the many years of usage, this system has still not evolved over time to embrace more functionalities; how can the current system be improved; what have been the challenges to advancing the LCIMS; and what new functionalities will be necessary among others. This position therefore equally made the KLC information rich case as labelled in Flyvbjerg, (2006) as 'information oriented selection'. Finally, the OCLS was selected as the customary institution in addition to the two statutory institutions because it equally represented a source of rich and detailed information on the topic. This is because, the OCLS as at the time of the research data collection was in the uptake process of a digital system in support of land services delivery. And given that the initiative was ongoing, it presented good opportunity to learn from their uptake experiences and to delve deep into the whole process of uptake decision making, and implementation among others. Also, the OCLS is one of the only three customary

land secretariats that existed in Ghana prior to the Land Administration Project (LAP) in 2003. The two others were; Akyem Abuakwa Land Secretariat in Kyebi, and the Gbawe Kwatei Family Land Secretariat in Accra (Okyere & Bedu, 2022). Thus, in addition to the uptake of a digital system, the OCLS also had a long term experience of administering customary land and this rich experience in customary land administration was very instrumental for the study thus necessitating the inclusion of the OCLS in the cases selected. These three cases given were purposively selected because they were considered to offer deeper insights into the study.

Third reason for the selected cases, and why it is a mix of cases from the statutory, and customary land institutions is due to the issue of heterogeneity and comparability (Akaateba, 2018). Creswell & Guetterman, (2019) term this as the 'maximal variation sampling' in which different case studies are purposely selected based on certain differences in characteristics, or dimensions. Such cases reflect different perspectives, or contexts of the phenomenon under study (Akaateba, 2018). Thus, the ALC and KLC were chosen to give the statutory land administration perspective, while the OCLS on the other hand gives the customary land administration perspective. Being the two main land administration systems, they both have different land administration tenets, procedures, and laws although there are certain convergences in land laws, and land registration processes (Ameyaw & de Vries, 2021). This differences lead to varying land services outcomes within the statutory, and customary administration systems, hence, the choice to select case studies within these two varying administrative systems. On the other hand, the selected cases are comparable in other dimensions. First, the registration of both customary lands, and statutory lands are done by the Lands Commission. Where a land is purchased from the customary sector and is to be registered at under the laws of the country at the statutory Lands Commission, the Commission requests from the parties purporting to register to produce their source of grant which they can only get from the customary authority that sold the land to them. Where this is provided, the land is registered in the same way as a statutory land will be registered. This similarity also facilitates a cross-level inferences between the selected cases which makes them suitable cases.

Fourth reason for the case studies is premised on the fact that Accra, and Kumasi are both the two most populated cities in the country (Ghana Statistical Service, 2021) although Greater Accra region is the smallest region in the country geographically. They both also form the two largest business hubs in the country. The larger population of these cities gives them a direct bearing on the availability of land for different purposes, and as such, implications for the land administration in these cities. It was therefore considered interesting to choose both cities.

Finally, language and communication barrier informed the choice of the case study institutions. Traditionally, I am an Akan and a native speaker of the local language of Kumasi which is Asante Twi. It is also the most widely spoken local language in Ghana. Thus, picking a study case in Kumasi made communication with the respondents easier for me which accounted for selecting both the KLC, and the OCLS in the Kumasi study area. In Accra, although the local language is Ga, it is not the medium of communication in formal institutions as the Lands Commission. The most common medium of communication at the ALC is either Twi, or English language and since I speak both languages perfectly, it was convenient for my selection.

3.7 Scope of the Case Study Institutions

This sub-section gives the scope of the selected case study institutions. It focuses more on the study institutions' emergence from solely manual land administration processes, and services, to transitional attempts, and or interventions made towards digital systems and services. This is to help appreciate the evolution from manual, to digital, or quasi-digital land processes, and services in Ghana and how these inform the need for advancement into digital land administration in contemporary times. The study institutions are administratively located in Accra, and Kumasi which are shown in the map(s) below;

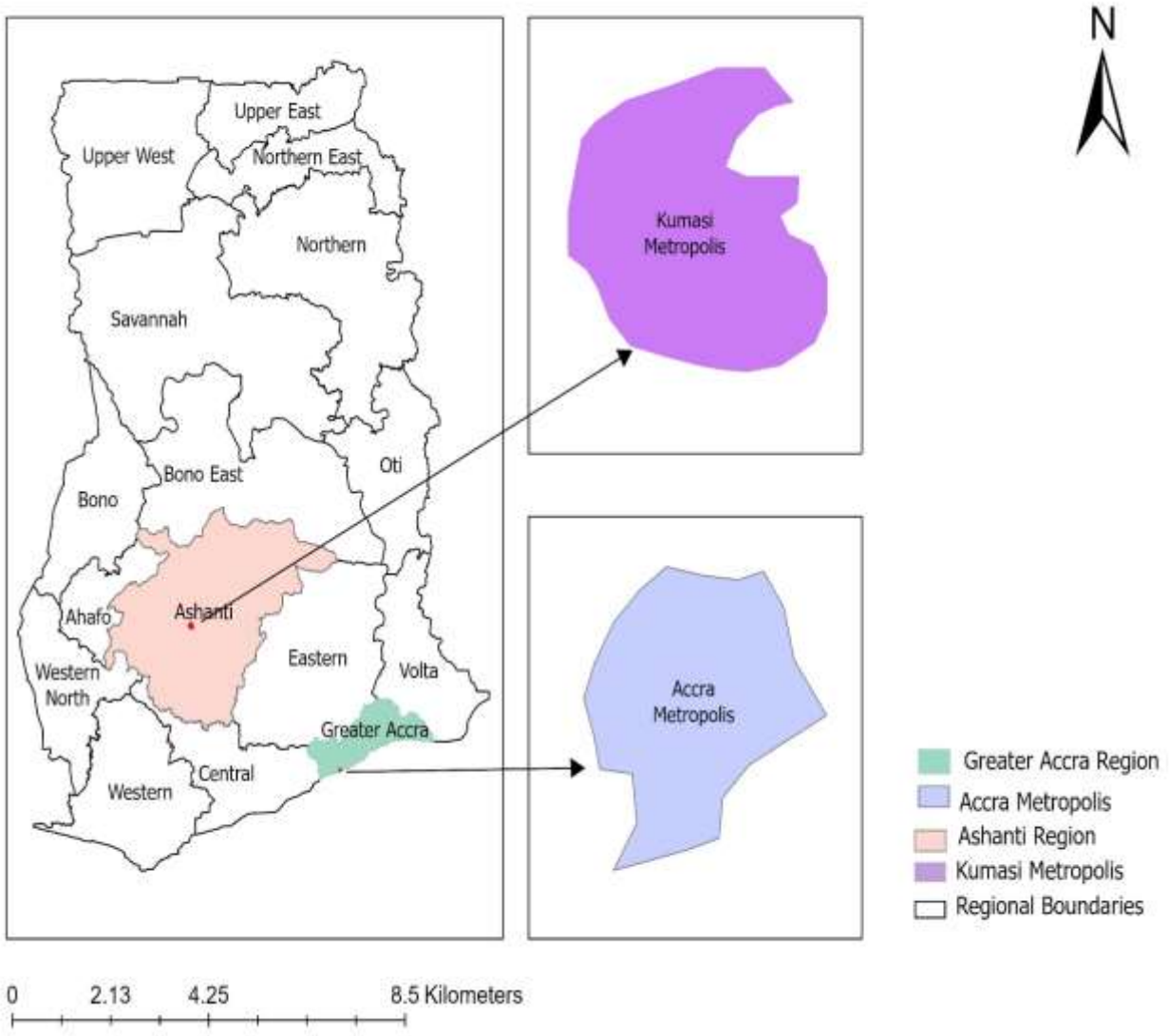


Figure 6. Map of Ghana showing study areas

Source: Author's construct

3.7.1 Accra and Kumasi Study Institutions

Accra, and Kumasi are the two cities for the empirical study. In Accra, the Greater Accra Regional Lands Commission is the case study institution, while in Kumasi, the Kumasi Lands Commission, and the Otumfour Customary Land Secretariat are the two case study institutions. Accra is the capital city of Ghana and the Greater Accra region. The British colonial masters of the then Gold Coast, currently Ghana, found Accra as the capital in 1877 (Thurman, 2010). Within the political, administrative, and governance structure, Greater Accra region currently has 2 metropolitan, 23 municipalities, and 4 district assemblies (MMDAs) as at May, 2024. Accra is within the Accra Metropolitan Assembly (AMA). Although Greater Accra region has the smallest landmass of about 3,245 square kilometers in comparison to other regions in the country, it is the most populated of all with a population of 5,455,692 people (Ghana Statistical Service, 2021). Kumasi on the other hand is the capital city of the Ashanti region, and is one of the first local districts to have been created in 1974, the second order city in Ghana next to Accra (Forkuor et al., 2013). Ashanti region has a landmass of 24,389 square kilometers. It has 1 metropolitan, 19 municipalities, and 23 district assemblies (MMDAs) and a population of 5,440,463 people (Ghana Statistical Service, 2021). Kumasi is within the Kumasi Metropolitan Assembly (KMA). Both cities Accra, and Kumasi are the first and second most populated in the country respectively and these populations are a cosmopolitan mix of people from all parts of the country and beyond.

Land tenure in both Accra and Kumasi are characterized by a dual legal system Boamah & Amoako, (2020) which are the statutory, and customary systems. In Accra, customary lands form about 78% of all lands in the city and are vested in the indigenous Ga communities represented by Chiefs and heads of families, and clans as the traditional leaders (Boamah & Amoako, 2020). There are also State/ Public lands which form 20% with the remaining 2% falling under private/ customary lands (Boamah & Amoako, 2020). Some well-known stools in Accra include; Nungua stool, Asere stool, Osu stool, Jamestown stool, La stool, and Bortiano stool. Also, well-known family with a customary land secretariat in Accra is the Gbawe Kwartei family. Accordingly, two categories of customary lands exist in Accra; the Stool lands, and Fmily lands. Quaye, (2021) found that in Accra, and in terms of socio-political structure, there is a non-centralized traditional structure, and less adherence to traditional authority system and social values and with a diffused land ownership arrangement.

In Kumasi, the categorization of land is also Customary, and State/ Public lands. Public lands form only 1% of all lands in Kumasi. There remaining lands have further categorization; Part one lands or "Kumasi Town Lands" and Part two lands (Boamah & Amoako, 2020). Part one lands form 18% of the land in Kumasi and is vested in the State (Government) to be held and managed in trust for the native people of Kumasi. Part two lands on the other hand represent the Stool lands as defined by Article 267 of Ghana's constitution (Boamah & Amoako, 2020). With the Stool lands which make up 81% of Kumasi's land, Boamah & Amoako, (2020), there is a centralized customary land tenure arrangement structure with the Asantehene (Asante King/ Overlord) being the owner and custodian of all such lands in the Kumasi metropolitan assembly (Forkuor et al., 2013; Quaye, 2021). These Stool lands are managed by the Asantehene's Customary Land Secretariat, also known as the Otumfuor Customary Land Secretariat.

The prevailing land administration systems in both cities are the statutory, and customary systems and a 'similar formal organizational arrangements for land registration govern the land delivery systems in Accra and Kumasi' (Quaye, 2021). However, it is important to mention that the whole of Accra is a title registration zone, while Kumasi comprises both title, and deed registration zones. Land registration is done by the Lands Commissions (see images in the figures 7, & 8 below) in both cities as established by Article 258 of the 1992 Constitution of the Republic of Ghana, and the Lands Commission Act 2008 (Act 767). The delivery of land administration services and processes from a digital perspective in both cities however has some disparities despite their numerous similarities identified. This makes both ideal study cases for a digital land administration assessment.

Figure 7. Photo of the Accra Lands Commission

Source: Field photography, 2022

Figure 8. Photo of the Kumasi Lands Commission

Source: Field photography, 2022

The biggest land intervention in the history of the Ghanaian land administration system is the Land Administration Project (LAP). LAP was a joint project of the Government of Ghana, and the World Bank together with some other partner organizations including; Canadian International Development Agency (CIDA), British Department for International Development (DfID), the then German Technical Assistance Corporation (GTZ) but currently Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Kreditanstalt fuer Wiederaufbau (KfW), and Nordic Development Fund (NDF) (World Bank, 2008). Land administration by the Lands Commission hitherto the LAP was mainly a manual system which Karikari & Stillwell, (2005) described as a clerical support system with computers that were mainly for word processing. This system was fraught with various challenges including; slow data input, and services delivery, unscrupulous manipulation of manual land data as well as tedious retrieval of land information among others. As steps towards transformation from manual land services delivery to a digitalized system, various interventions have taken place. The first most important intervention on transformation from manual to digital system was under the Land Administration Project (Arthur, 2022). This

LAP aimed "*to develop a sustainable and well-functioning land administration system that is fair, efficient, cost effective, decentralized and that enhances land tenure security."* (World Bank, 2008). LAP was in two phases, LAP 1 & LAP 2. Arthur, (2022) identified that the main interventions so far in the digital transformation of the Lands Commission were under LAP (see figure 9 below) where the foundation for digitization and digitalization of the Lands Commission began. However, it is important to mention that the LAP interventions in Accra were not the same as in some other Lands Commissions including Kumasi.

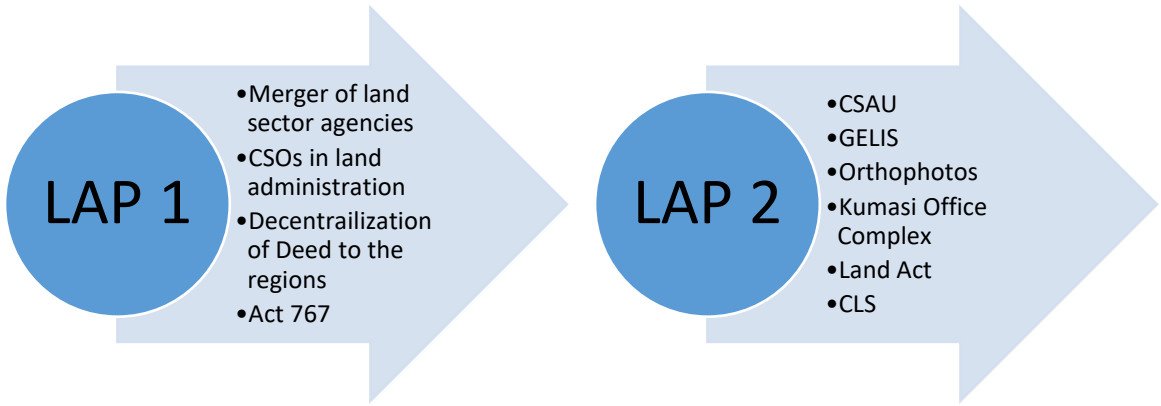


Figure 9. Foundational interventions for digitization & digitalization of the L.C

Source: (Arthur, 2022).

As part of the LAP 2, the Ghana Enterprise Land Information System (GELIS) was established to allow users from the relevant ministries. and agencies to undertake their daily business processes efficiently in a digital environment via the use of a common database and to present a One-Stop-Shop for all land stakeholders including the public (Deane et al., 2017). This was mainly piloted at the Accra Lands Commission and some other regional offices including; Koforidua (Eastern Region), Sekondi-Takoradi (Western Region), Tamale (Northern Region), Bolgatanga (Upper East Region), Savelugu (Northern Region) and Tema (Greater Accra Region). The GELIS project is presented in details in Chapter five of the dissertation. As part of, and preceding the GELIS project was data capture and conversion which involved; scanning, geo-referencing, digitizing & integrating, and archiving (Arthur, 2022). Although GELIS was not piloted in Kumasi and some other regional offices, the data capture and conversion exercise was nationwide across all the regional Lands Commission offices. Worthy of mentioning is that despite the immense efforts in this data capture and conversion exercise, not all land data had been captured and converted as the exercise continuous till date in 2024 at the study institutions. The GELIS project ended with the closure of the LAP as funding was no longer available (Deane et al., 2017). However, the post-GELIS project has seen other digital initiatives as the Enterprise Land Information System (ELIS) (see figure 10) which was an in-house information system built by the Acrra Lands Commission in advancement of the functionalities of the GELIS. ELIS is discussed further in chapter five.

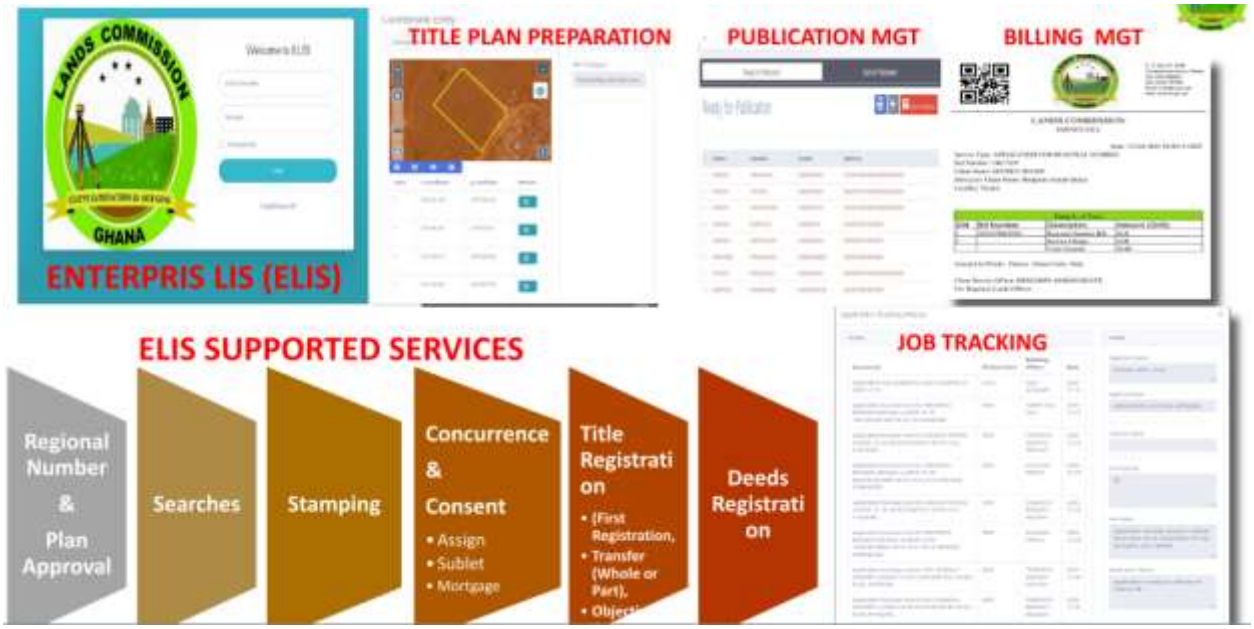


Figure 10. Enterprise Land Information System (ELIS)

Source: (Arthur, 2022)

In addition to ELIS which is currently the digital land information system at the Accra L.C, there has also been the Lands Commission Portal initiative in Accra. Following the creation of six new regions in Ghana in 2018, the Lands Commission opened new offices in these new regions and have set up the ELIS system for these new regional offices. However, the ELIS is still not operational in Kumasi and some other old regional offices. Another digital initiative operational at the Accra Lands Commission is the Lands Commission Portal (see figure 11 below). This is a portal developed to help clients to be able to remotely interact with the Lands Commission for some selected services as; requesting for search, and payment for services among others. These digital initiatives although are planned to be scaled up to the other regions including Kumasi have not yet reached the Kumasi Land Commission.

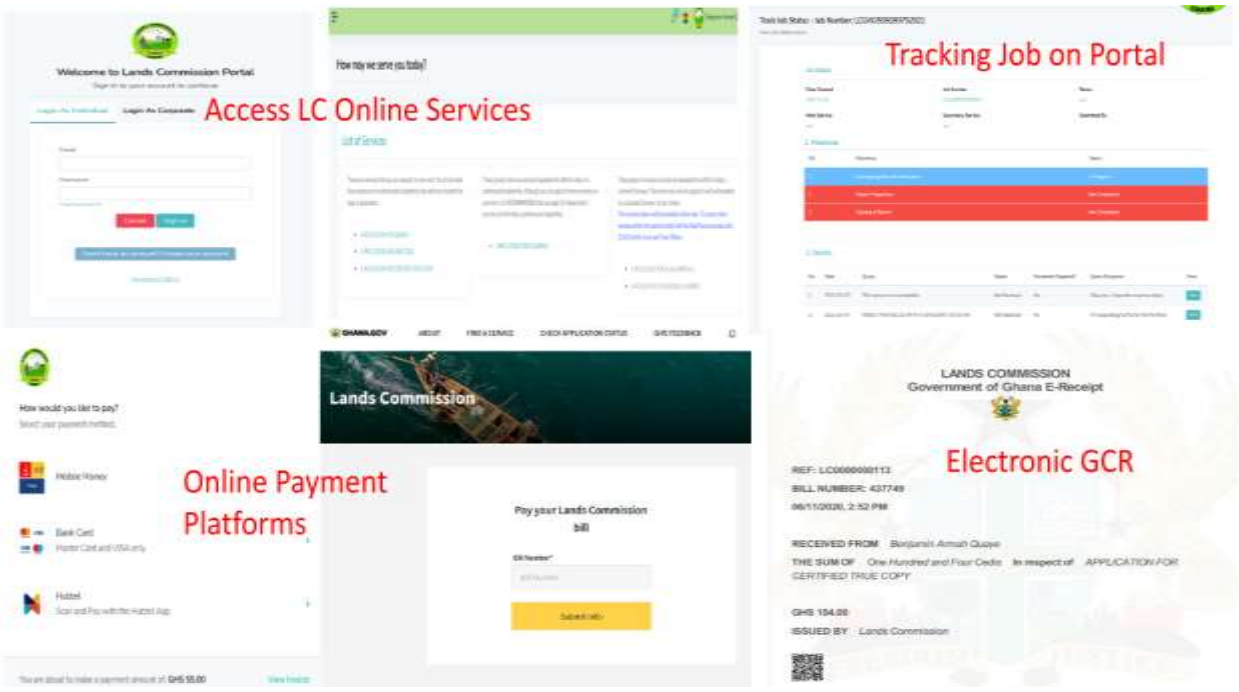


Figure 11. Lands Commission Portal

Source: (Arthur, 2022)

The interventions under the LAP was not only limited to the statutory Lands Commissions but extended to the customary land sector as well. Prior to the LAP, there were only three customary land secretariats in the country which were the Asantehene's Land Secretariat in Kumasi (see figure 12 below), the Akyem Abuakwa Land Secretariat in Kyebi, and the Gbawe Kwatei Family Land Secretariat in Accra. These secretariats were however operating informally (Brandful et al., 2020). In addition to creating about 36 new CLSs, World Bank, (2011) the LAP strengthened the already existing Secretariats including the OCLS in diverse ways including beefing up logistics like computers, printers, and scanners among others. These provided clerical support services and occasional scanning and storage of certain land documents. Currently, there exist around 108 CLSs in Ghana. Over the years, diverse attempts at evolving from manual processes and services have been made at the OCLS to help improve land delivery.

Figure 12. Asantehene Lands Secretariat/ Otumfuor Customary Lands Secretariat

Source: Field photography by Author

3.8 Data Collection and Processing Approaches

Data collection is the process of collecting, or gathering data on a phenomenon under study with the aim of gaining insights on this phenomenon. The process of data collection ranges from identifying the form of data necessary for the study, the sources of these data, how these data can be collected or gathered. After acquiring the data, the raw data will need processing to be able to make meanings that address the research problem. This section therefore presents these in the subsequent sub-sections.

3.8.1 Data Sources and Sampling

For every research study, there are two main possible sources of data. These are the primary sources, and the secondary sources. Primary sources are the firsthand information, or direct evidences the researcher collects while secondary sources are secondhand information (Mohajan, 2018). Primary sources of data usually involves direct contact with the context of the phenomenon

of study and to engage, usually humans acting within those contexts and in respect of the phenomenon of study to collect such firsthand data based on their lived experiences, and knowledge of the phenomenon. That is, the researcher spends time on-site to interact with the people being studied, or who are involved with the phenomenon being studied (Williams, 2007). Secondary sources on the other hand are the product of other people's firsthand data that has been reported, or presented in documents as textbooks, and journals which one can rely on to gain more insights into the phenomenon of study. It is important to mention that secondary sources may reflect the biases of their original writers (Leedy & Ormrod, 2014). Researchers in collecting data, and particularly from primary sources rely on sampling techniques to reach the participants for the research study as it is impossible to contact every potential participant due to time, and cost constraints (Adams et al., 2007; Bryman, 2016; Asante, 2020). Sampling enables researchers to reduce the amount of data to be collected by considering only data from a sub-group rather than all possible cases or elements (Saunders et al., 2009). Accordingly, I employed the purpose, and snowball sampling techniques in this study.

Purposive sampling is premised on the intent that the researcher wishes to discover, understand, and gain in-depth insights into the phenomenon of study and as such only selects a sample s/he believes can learn from the most (Merriam & Tisdell, 2015). That is, it focuses on identifying those participants from whom the richest information on the phenomenon of study can be collected (Yin, 2016). In this study, since the interest is on assessing the digital state of land administration from land service delivery institutions, the study institutions were purposely selected as already identified. Within these institutions, respondents from all the three study institutions were equally purposively selected based on certain criteria. First, a respondent must have been a permanent staff of the selected institution who has been assigned a working office with their own, or shared office computers as the cae might be. Secondly, the respondent must have had at least three years or more working experience with the study institution. Thirdly, the respondent must have good knowledge and possible user-experience of the digital systems at their institutions. That is, in the case of ALC, the ELIS, in the case of the KLC, the LCIMS. At the OCLS however, since the system implementation was still in progress, knowledge of the uptake, and implementation process was the requisite.

To complement the purposive sampling, and more especially as I did not by myself know possible respondents that met the criteria outlined, a snowball sampling was also employed. In this sampling, respondents who met the criteria and were interviewed, afterwards directed me to other colleagues they knew met the selection criteria to also be interviewed. This made it easier to reach the qualified respondents with less difficulty. Also, because most of the respondents were reached based on referrals by their colleagues, they granted me audience without hesitations in most instances. In all, I administered 64 interviews, and questionnaire with land professionals; 28 at the ALC, 25 at the KLC, and 11 at the OCLS. Table 5 below shows the participants from all three case study areas.

Participants	Ranks/ roles	Number sampled		
		Accra L.C	Kumasi L.C	OCLS
Management/ Divisional Heads	These are the high-ranking officers in decision making positions. They comprise the ranks as the executive secretary, divisional heads, and committee heads. They are involved in the decision making, and direction of affairs.	5	3	2
Mid-level operational staff	These are operational staff heading various offices within the divisions. They are in-charge of daily processes of land registration, titling, valuation, plan preparation among others. They oversee the works of lower level-staff in their offices, and they equally report to the divisional heads	16	14	5
Technical staff	These are the I.T related staff who are in-charge of all I.T issues, and spearhead the digital systems of the institutions	3	2	0
Lower-level operational staff	These are operational staff that do not hold specific positions but are responsible for daily functions as land registration/ titling, valuation, plan preparation among others. They usually report, and get their works signed by their office heads, or the divisional heads depending on the qualification of the office head.	4	5	4
Total		28	25	11

Table 5. Study Participants

3.8.2 Data Collection Tools

As is in line with case study research, the researchers have the flexibility of employing different data collection tools to elicit rich data for the study. Accordingly, I employed different tools to gather data for this study which included; interviews, survey questionnaire, video elicitation, document analysis, and observation.

3.8.2.1 Interviews

Merriam & Tisdell, (2015) defines interview as the approach in which the researcher and the participants engage in a conversation that is focused on questions related to the research study. Interviews are identified as a key data collection instrument in qualitative research studies, and case studies alike (Williams, 2007; Clark et al., 2013; Yin, 2016; Mohajan, 2018). Similar studies have adopted interviews to collect data (Adiaba, 2014; Oberdorf, 2017; Broni, 2019). Interviews can take various forms in a data collection exercise based on structure, as well as how contacts are made to respondents. By structure therefore, there is the structured, unstructured, and semi-structured interviews (Creswell, 2014; Yin, 2016; Saunders et al., 2016). In terms of contact with the research participants to be interviewed, research interviews can be conducted face-to-face with respondents, or via online through telephone calls, and zoom, or skype calls among others (Creswell, 2015). Accordingly, in this study, I employed on the one hand semi-structured interviews, and on the other hand both face-to-face interviews, and also online interviews via mobile phone calls in certain instances. As case study researches aim at deriving in-depth information from respondents, the semi-structured interview was considered most ideal in this regard as it allows respondents the space to speak at length on the issues raised, while still being guided by the research themes of consideration. Saunders et al., (2016) note that in the semi-structured interviews, 'the researcher has a list of themes and possibly some key questions to be covered although their use may vary from interview to interview'. The themes covered in the interview revolved around: Policies, legal laws, and political commitment; Institutional arrangements, and data standards; Technical considerations; Socio-cultural issues; Financial consideration; Collaborations, and partnerships; Leadership and stakeholder involvement; and Capacity and know-how. Within these themes, several diverse questions, or issue were raised to help elicit data on the digital status of these land sector institutions, and their readiness for a possible consideration of Blockchain technology uptake.

The interview guide developed was used to direct the conversation with respondents on the themes the study sought to cover. However, there was no strict rule on the sequence of the questioning, neither was there a limitation to just the questions that formed part of the interview guide. Rather, a conversational approach was taken in which case, I mostly first ask participants to generally narrate their experiences with, and knowledge of digital systems available to them for supporting land services delivery. In this way, interviewees were at liberty to discuss at length their knowledge and experiences. In so doing, they unknowingly touched on most of the themes guiding the interview. After this general narration, and based on each respondent's narrative, further questions were posed to probe further into most of the themes they touched on in their general narration as

well as those they had not touched on. This approach made the interviews more interactive than a questioning-and-answering type of interview. And the interactive nature made respondents more comfortable to talk at length. In some instances, interviewees' responses opened up new questions which did not even form part of the original interview guide but were found to be useful for the study objective. This is in line with what Taherdoost, (2021) said that such primary data collection allows the opportunity to add further data when required during the research process. The flexibility with the semi-structured interview was very useful as it allowed me to improve the structure of the questions, as well as the line of questioning as the study continued based on how previous interviews had gone. That is, new lines of questioning popped up as well as the need exclude some questions. This helped to shape the interview guide well and to gather the most relevant data for the study. It is important to mention that follow-up calls were done after the fieldwork to some few respondents to clarify certain responses, as well as to ask further questions in some cases. In all, 64 interviews were conducted as noted already. All interviews were audio recorded with prior consent of the interviewees purposely to allow for after-fieldwork transcription and data processing (Bryman, 2016). Although the interview guide was prepared in English language, the administration of the interview was a mixture of English language, and Twi language which is the most widely spoken local dialect in Ghana. Averagely, interviews lasted between 30-60 minutes.

3.8.2.2 Survey questionnaire

Being a mixed method research design, both qualitative, and quantitative data collection tools were employed to collect data on the study (Leedy & Ormrod, 2014). The survey questionnaire was used mainly to help measure the maturity level of the digital systems of the case study institutions. The questions were basically the Likert-scale type where respondents were asked to rate their answers on a scale. This questionnaire was the result from a critical success factor (CSF) assessment in a prior pilot survey. Based on the pilot study, I identified from respondents, certain factors which were considered relevant for consideration in the vision to improve digital land services delivery in Ghana. These were juxtaposed against factors identified in literature to arrive at the selected factors. These formed the basis of our critical success factors framed in the survey questionnaire. Out of factors presented, respondents were asked to identify those factors (focus areas) they considered contextually crucial to the success of Ghana's land administration digitalization vision. They were as well asked to rank these factors in order of importance on a scale of 3-0 where (3= highly important, 2= important, 1= indifferent, and 0= disregard). This ranking helped us in assigning weights to the different factors identified. Additionally, responses to associated questions to each factor (focus area) sought to identify the existence of these factors, or their applicability at the study institutions, and in some instances to the Ghanaian land sector as a whole. Where a factor was identified as existing, or applicable, respondents were to give a rank on a scale of 4-0 regarding the extent of existence or applicability, where (4= those factors are present and actually functional, and are also monitored/ measured, 3= factors present and functional, and ways to measure them are implemented but somehow not measured yet, 2= factors are present, and measurable indicators are defined but somewhat not implemented 1= factors are being defined, 0= not applicable/ non-existent). It is important to mention that respondents were

free to add, modify, or discard factors they so thought necessary (Karikari et al., 2002). This survey was administered using the kobo toolbox.

3.8.2.3 Observation

Merriam & Tisdell, (2015) identify that observation as a tool for gathering primary data is common in case study research although interviews are often interwoven with observations. Observations are therefore mostly not used as independent data collection tools but as complementary to interviews which form the main tool. Observation however is distinct from interview in certain ways in that it occurs in the natural setting of the phenomenon of study rather than in a prearranged, or designated location as the case may be for an interview; secondly, observed data represents firsthand encounter with the phenomenon of study as against an account given of the phenomenon by an interviewee (Merriam & Tisdell, 2015). These help to triangulate study findings with the observed data. As such, observation in this study occurred mainly during my stay at the study institutions, and during the interview sessions. However, as research ethical requirements, interviewees' were given prior notice of interviewer's possible observation of the happenings around in relation to land services delivery and all respondents willingly consented to this notice. As interview respondents were engaged during working days and hours, most of the interviews that took place were interjected by work processes, and staff attending to clients. This gave good opportunity to observe many things relevant for the study. Accordingly, I observed certain activities relating to the functionality of computers, the computer-to-staff ratio, simultaneous work on both digital versions, and hardcopy versions of document files, manual requests on certain files from other staff, clients complains of services delivery among others. In other to help keep these valuable firsthand, and unadulterated observed data, some of them were jotted down in the field note, while some others were recorded, and or photographed. This tool helped to capture much richer data which otherwise would have been missed out in the interview, and survey questionnaire.

3.8.2.4 Video Elicitation (VE)

In a similar way that observation was used as a complementary tool, VE tool was used alongside the interviews, to gather information on Blockchain technology for land administration. VE tool is used usually alongside interview to stimulate respondents' reflection on the phenomenon being investigated (Henry & Fetters, 2012; Zehe & Belz, 2016; Oberdorf, 2017) In this study, a video of the phenomenon is shown to the respondents to help them know the concept of Blockchain-supported land services delivery. The visual elicitation has the ability of stimulating memories, thoughts and understandings, better than verbal interviews especially where respondents are somewhat unfamiliar with the phenomenon being investigated. This was the exact situation in my study institutions regarding BT for land administration. As cited in Oberdorf, (2017) there are three focuses of visual based interview reflections; "reconstructing past-thinking, post-activity narratives, or the construction of reflections on present and future actions". Since the idea of Blockchain application to land administration is being explored, and is futuristic in the study cases contexts, I used the video elicitation based on the last focus, "construction of reflections on present

and future actions" to help evoke in respondents reflections on the potentials of the Blockchain system, and their view on its adoption for use. To limit biased opinion being formed based on the video which only showed the use and possibilities that BT adds to land administration, I was quick to draw respondents' attention to some of the challenges with possible BT uptake for land administration services like; the need for high-end powerful computers for mining, strong and stable electricity, large amount of electricity power, and scalability issues among others.

3.8.2.5 Document Review

Finally, to complement the interviews, and observations, I employed the document review data collection instrument (Akaateba, 2018; Asante, 2020). Documents for revision according to Hancock & Algozzine, (2006) may include materials retrieved from the internet, private and public records, as well as physical evidence. In this study I retrieved, and reviewed various forms of documents from the internet search of lands commission websites, google searches, and other relevant websites, direct verbal requests from land professionals, and also email requests to land professionals. Documents reviewed included but not limited to the National Land Policy 1999, the Lands Act 2020 (Act 1036), the Lands Commission Act 2008 (Act 767), the Electronic Transaction Act 2008 (Act 772), the Conveyancing Act 1973 (NRCD 175), the Implementation Completion and Results Report of the LAP 1, 2011, and the Implementation Completion and Results Report of the LAP 2, 2020. In addition to these policy documents, internal relevant documents as minutes of board/ Commission meetings in relation to digital land services were also accessed and reviewed, and also, noted reports from the public clients on their challenges with Lands Commission Portal that were kept at the Client Service and Access Unit (CSAU) were equally accessed and reviewed. These documents altogether contributed immensely to the study analysis of the readiness of Ghana's land sector for digital transformation and possible uptake of Blockchain technology in support of land administration transparency.

3.9 Data Preparation and Analysis

Being a mixed research, this study adopted both qualitative, and quantitative analytical approaches to make meanings, and interpretations from the raw data collected from the field.

3.9.1 Quantitative Analysis

Excel spreadsheet was employed in analyzing the quantitative data of this study. As noted in Saunders et al., (2009), various computer-based quantitative analysis software tools as; Excel Spreadsheet, and the Statistical Package for Social Scientist (SPSS) among others are available for quantitative data analysis. I first entered the raw data from the survey questionnaire into the excel spreadsheet format (see Figure 13 below). These were accordingly analyzed by means of descriptive statistics (Creswell, 2015). The resulting outputs were visualized in graphs, and charts generated in excel spreadsheet.

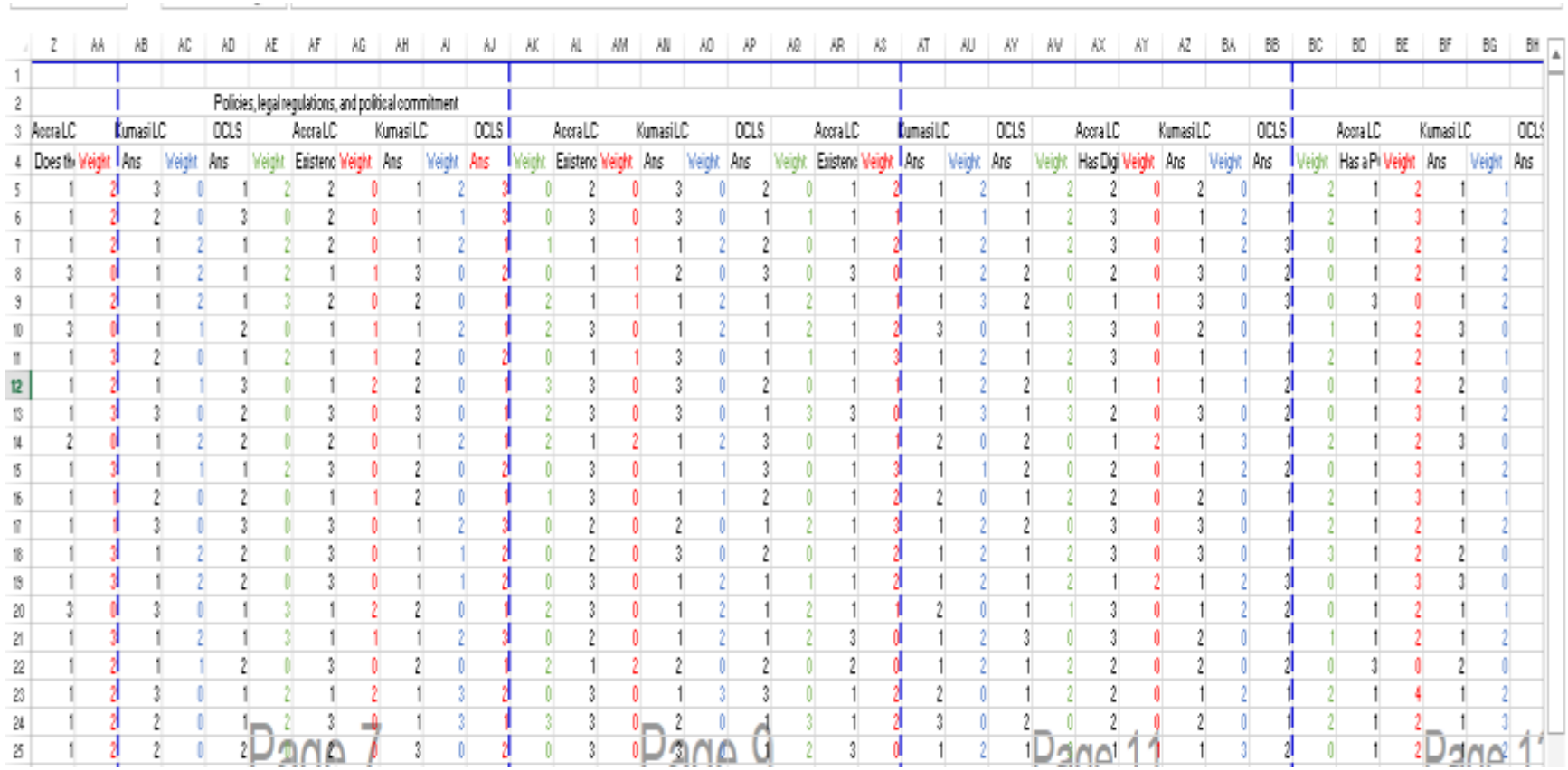


Figure 13. A snippet of excel spreadsheet input of responses

Source: Author's construct

3.9.2 Qualitative Analysis

The thematic analysis technique was employed to analyze the interview responses. However, the overall analyses followed through three main stages; data preparation (transcription, and data cleaning), data identification (identification of codes based on themes), and finally, data manipulation or interpretation (Merriam & Tisdell, 2015; Asante, 2020). The data preparation stage involved transcribing all the recorded interviews, the field notes into text formats in Microsoft Word. This approach requires typing the entire data in their raw formats without any corrections, omissions, or additions. Doing so helps to get the transcript in the original words as used by the interviewees and this helps to obtain the richness of the data as any attempt to make corrections to the original wording could risk potential loss of data richness (Asante, 2020). It is however important to mention that not everything that is written or transcribed will be used for the study due to the dense nature of all the transcripts, images and other observations (Creswell, 2014). Saunders et al., (2016) describes the task of transcription as extremely time-consuming, but rewarding by way of helping the researcher to familiarize themselves well with the data which facilitates analysis. After the transcription, the text data were read over to correct them of any transcription error by which process I cleaned the data.

The second stage is data identification where the actual analysis of the data started. It is important however to mention that since data collection was in two phases, the pilot phase, and the main data collection phase, initial analysis of the pilot phase responses influenced the latter analysis after the main data collection. A thematic analysis approach was employed as this is considered the generic approach to qualitative data analysis (Saunders et al., 2016). In the first pilot study, codes derived from responses culminated into initial themes. These initial themes were reviewed with existing literature on the topic, while comparing them to the research questions to arrive at an overarching set of themes; (Policies, legal laws, and political commitment, Institutional arrangements, and data standards, Technical considerations, Socio-cultural issues, Financial considerations, Collaborations, and partnerships, Leadership and stakeholder involvement, and Capacity and know-how). Subsequently, these guided the design of the main data collection questions and its subsequent analysis. This thus made the adoption of a thematic analysis ideal.

The analysis process employed a computer assisted qualitative data analysis software (CAQDAS) (Merriam & Tisdell, 2015). CAQDAS are helpful in organizing comprehensive textual data. It is therefore important to mention that a CAQDAS does not do the analysis but only helps as an organizing, or categorizing tool, quick retrieval of data, and especially good for comprehensive data set (Merriam & Tisdell, 2015). The CAQDAS used was the Nvivo 12. Thus, I first imported all my transcripts into the Nvivo system. As the study was already guided by certain themes, these themes were first coded. Following this initial coding of the themes, I conducted a word frequency query to refresh my mind of the most used words by the interviewees following the initial familiarization at the transcription stage (see Figure 14). Next step after word frequency query was a broad coding. By this, I read through the transcripts, identifying the main points, as well as conflicting ones. At this stage, and under each of the main themes, different codes were created which rightly captured each key statement identified in the interviews. It is important to mention

that I was flexible about the themes and the codes and therefore where certain key information was discovered in the interviews but did not appear to fall rightly under any of the initial themes, a new theme was coded , and appropriately, codes created under it that will rightly capture such key but unrelated information. Next step was the structured coding stage. At this stage, I sought to refine the initial codes and fine-tune them with conceptual insights for each of the themes. Some codes were identified as fitting much better under different themes than the ones they were initially assigned and were accordingly changed. Codes that were identified as not important to the research questions and the overall objectives of the study were also equally taken out. This iteration task was done several times until I arrived at a final set codes which were grouped in various sub-themes under the main themes. Figure 15 shows a cluster diagram of these codes from Nvivo 12. These final codes for the various themes thus were the ones focused on and interpreted during the reporting of results.

The third and final stage is the data interpretation, or manipulation. Here, I did interpret by comparing within and across the cases, the themes and sub-themes, juxtaposing these against literature, and drawing conclusions from the data (Akaateba, 2018)

Figure 14. Word cloud of most frequently used words from the interviews

Source: Author's construct

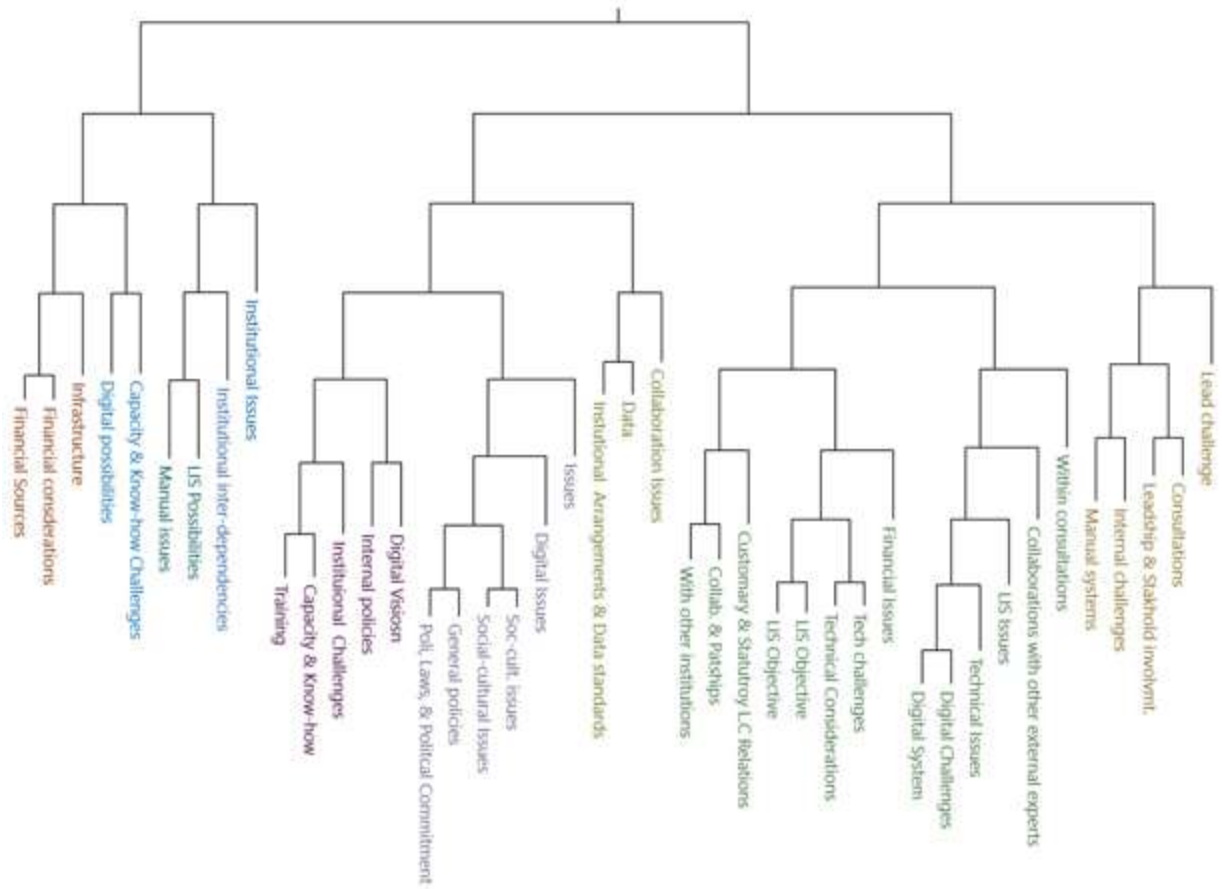


Figure 15. Cluster of some initial codes for analysis

Source: Author's Construct

3.10 Ethical Considerations, Validity and Reliability

3.10.1 Ethical Considerations

Research works that involve participants especially in a qualitative approach to data collection cannot compromise on ethical issues. Patten, (2013) notes that in planning a research, it is essential to consider the potential harm to the participants of the research that could result from their participation. Creswell, (2012) further stretches to say that in all steps in the research processes, ethical issues need to be considered. Ethical issues are more prevalent at the data collection, and in the data reporting stages of the research process. Some ethical issues in data collection involve; informed consent; deception or covert activities; confidentiality toward participants, sponsors, and colleagues; benefits of research to participants over risks; and participant requests that go beyond social norms'(Creswell & Poth, 2016). Also, some ethical issues worth considering in the reporting of data may include; reporting data in honest way without altering the findings, studies by others should not be plagiarized but appropriately cited and credit given to materials quoted or used, and

the studies being free from jargons and being understandable to those studied (Creswell, 2012). Accordingly, these ethical considerations were duly considered in this studies.

First, prior to the fieldwork, I sought permission from the Professor in-charge of the Chair of Land Management at the Technical University of Munich, Germany as is in accordance with the research guidelines in the department. This permission is only granted after the research data collection tools (questionnaires, and interview guides) had been reviewed and approved by the Professor. In acknowledgement and response to this permission, a formal introductory letter to the institutions involved in the study was issued by the Professor. This letter briefly introduced the Professor, and myself, our institutions and department, the PhD topic of study, and the purpose of the study, the data collection, and concluding with a support request by way of participation in the research study in any way possible. This letter signed and stamped by the Professor in-charge constituted the official consent, and approval of the research field data collection. It is important to mention that the interview, and questionnaire guides first provided information about myself as the student, and the purpose of the study and hence, the data collection. This was reiterated in the field in every single interview conducted whether in person, or over the telephone.

In the field, I had to first make contacts with some of the authorities in each of the institutions and to seek permission for access to carry out my data collection exercise before I could commence it. Creswell, (2012) mentions that the researcher must show respect by means of first gaining permission before entering the site. This was thus duly done. These authorities approved my request after having discussed with them my mission at the institutions, and showing my introductory letter and samples of the data collection tools which they equally went through to review. I was introduced to some other officers of the various divisions and departments in the study institutions. This made it easy for me to navigate within the institutions knowing I have informed consent from the authorities to undertake the studies. In engaging respondents, prior discussion on their availability and convenience to partake in the study was done. And when they accepted to partake, I first either gave them the introductory letter to read for themselves, or I read it for their hearing. I then explained what the study was all about, how the data will be used solely for the academic and for that matter the PhD study purpose, how anonymity and confidentiality was assured in the study, and how the data collected was not to be divulged to a third party for any other purpose except for the purpose of the study, and finally, how they were at liberty to refuse to answer any question they deemed not comfortable with for any reason. I then asked if they consented to partake in the study after having explained all the above issues to them, and when they did give consent, the data collection was conducted. By so doing, all research participant gave informed consent, and participated voluntarily. Privacy issues was duly acknowledged.

In presenting the research data from participants, ethical issues are equally observed. The confidentiality and anonymity with respondents had been upheld in that no response has been directly linked to a respondent by way of mentioning their names. Rather such terms as; official, officer, and respondent among other pseudo identifications have been used. I have also diligently acknowledged the owners of all secondary materials used in the studies by way of citing them appropriately, and providing the references to their materials where available. Also, although data was analyzed both qualitatively and quantitatively, the results have been presented devoid of

dishonesty, and or alterations but rather truly as deduced from the responses without biases. Accordingly, I followed the ethical issues considered in (Creswell, 2012; Patten, 2013;Creswell & Poth, 2016) as guiding research works from the start to the completion of this studies without compromising on the respect due the respondents, or the institutions involved in the study in any way.

3.10.2 Validity and Reliability

To a large extent, validity and reliability checks have been central to judging the quality of research works (Saunders et al., 2016; Asante, 2020). Validity relates to the relationship between the study findings and the reality, which concerns the credibility of the findings based on the data presented (Merriam & Tisdell, 2015). Reliability on the other hand relates to the extent of replicability of the study and the consistency of the results (Merriam & Tisdell, 2015; Saunders et al., 2016). It is important to note that irrespective of the research type, validity and reliability can be addressed by carefully considering the study's conceptualization and how data are collected, analyzed, and interpreted, as well as how findings are presented (Merriam & Tisdell, 2015). Accordingly, studies have identified strategies for enhancing validity and reliability of research works to include; triangulation, member checks/ respondent validation, adequate engagement in data collection (how long a researcher observes or how many people are engaged), researcher's position, or reflexivity, rich thick descriptions, and peer examination or peer review/ external audits (Merriam & Tisdell, 2015; (Creswell & Poth, 2016). These were accordingly followed in the studies as explained in the paragraphs below;

Firstly, triangulation which involves ways to corroborate findings or evidence from diverse sources to shed light on an issue, or for consistency in the data was used. This ws achieved by way of using different sources, methods, and investigations (Patten, 2013; Martens, 2014; Creswell & Poth, 2016). In this study, I employed different data collection tools; interviews, questionnaire, and observation to collect primary data, and also collected these data from several different participants. These allowed for better comparison of the data collected and to know whether or not these different data from the different collection tools, and participants corroborated each other or were inconsistent. In addition, different secondary documents of the study institutions, and on land administration were reviewed for data on the same themes which the primary investigation sought to address. The data from these secondary materials included; internal reports, online materials, land acts, and archival data like maps, and plans among others. These secondary data also offered insights to compare with the primary data for corroboration.

A second strategy used for enhancing, especially the credibility of the qualitative data was adequate engagement in data collection. This has to do with the length of time spent in the study site and close engagement with the research participants. The field visit for primary data collection was done over a four month effective period from March-June 2022. During this period, I engaged study participants, and observed their processes. This close engagement and length of period helped me to familiarize with most of the processes of land services delivery as well as built trust with the research participants which fostered the conversance on their part to talk at length on the issues raised in the interview sessions (Creswell & Poth, 2016). This not only allowed for detailed

data but also permitted firsthand information on certain processes and issues through constant daily observations. These observed data could then effectively be compared with the interview responses to assess corroboration or otherwise.

Again, peer review which allows experts to have a secondary oversight on the research output was used to enhance the validity and reliability of this research work (Creswell, 2012; Merriam & Tisdell, 2015). The study is conducted under the supervision of a professor in land administration and land management who has visited both study locations in times past, and has collaborated with, and supervised several related dissertations on land administration in Ghana. Therefore, the initial findings, as well as final manuscript outputs from the data were discussed with him, and he critically reviewed and gave expert comments for revisions and improvement. Also, such manuscripts were further sent to other experts in land administration and land management and who have experiences in the Ghanaian context for their reviews and comments. These also provided immense inputs on enhancing the rigor, and credibility of the study results. Expert reviewers of Science Citation Indexed journals had reviewed the manuscripts from the study and provided critical comments (major revision, or minor revisions) on them to help improve these manuscripts before they are finally accepted and published. The study data and findings having gone through all these expert reviews helped to improve not only the rigor, but also the validation and reliability of the study output based on these experts knowledge of the existing situations in the study context.

Finally, Akaateba, (2018) notes that case study researchers and especially where it involves a qualitative aspect need to 'self-consciously reflect on both their role and influence' in how they gathered, and analyzed the data. To show their positionality and reflexivity and how it influences and hence or affects the credibility, and or validity and reliability of the research. Reflexivity allows the researcher to disclose, or reflect on their biases, values, and assumptions in the research (Creswell, 2012). Positionality, and reflexivity according to Merriam & Tisdell, (2015) is how the researcher affects the research, and is at the same time affected by the research. Accordingly, Asante, (2020) tells that researchers are called on to identify the specifics of personal experiences, backgrounds, characteristics, and positionalities, and the bearings these have with the research findings and the presentation of same. Thus, on background, I am a male PhD researcher aged between, 30-35. I hold BSc Land Economy, and MSc. Land Management and Land Tenure from the Kwame Nkrumah University of Science and Technology (KNUST), Ghana, and the Technical University of Munich (TUM), Germany respectively. I have work experience in Ghana as Teaching and Research Assistant in Land Economy at KNUST, and also as an Assistant Land Officer (Intern) with the Lands Commission of Ghana.

The above background description gives an indication of my position as an academician, and professional in the land discipline. This background has shaped other aspects as my experiences, as well characteristics and consequently, this research. To start with, my knowledge of the Ghanaian land sector gained by studying in Ghana, and working both in academia, and in the industry provided me solid basis on the choice a research topic which looks into land administration issues in the Ghanaian context. Although I had other possibilities in topic areas relating to housing, urbanization, and real estate which are all within the broader scope of my

academic background in land administration and land management, I felt more comfortable, and confident in my abilities and command over my current research topic since my previous dissertation at the Bachelor, and Master level all related to land administration issues and had been successfully executed with publications emerging from them without much challenges.

Secondly, as an intern staff of at the Lands Commission of Ghana from 2012-2015, I was privileged to have had a hand-on experience of land services delivery and processes especially in the manual setting. Coincidentally, it was around the same periods that the LAP II data capture and conversion program had been rolled out at all the Lands Commission branches across the country. And since interns were mostly used in this scanning and conversion of paper documents, I had the opportunity to partake in this exercise over my internship periods at the then Brong Ahafo, now the Bono Regional Lands Commission in Sunyani, Ghana. This firsthand experience with the first digitization initiative in the Ghanaian land sector made it easier for me to embrace the current research topic as it sought to assess the extent to which this initiative had advanced, and prepared the land sector for more advanced digitalization possibilities all these years after the internship times.

Lastly, my background expedited easier contacts with land professionals as I knew many of them in different capacities as classmates, senior coursemates, school mates, work colleague, acquaintances, and even as a tutor from the university. Majority of officials in the different study institutions are basically graduates from the Land Economy program of KNUST, with the remaining minority from other programs as Real Estate at KNUST (which together with the Land Economy program form the Land Economy Department and mostly have joint classes on some course modules), and some other similar programs in KNUST, and other tertiary institutions with land related programs. These contacts helped me to establish easy rapport, and trust with the research participant, as well as with those that I was subsequently referred to by means of snowballing. Since these officials are experts with demonstrated practical experiences in the issues discussed, my personal experiences, and subjectivities did not imfluence the discussions in anayways (Akaateba, 2018).

Chapter 4.

Transparency of Land Administration and the Role of Blockchain Technology, a Four-Dimensional Framework Analysis from the Ghanaian Land Perspective.[3]

Abstract

Existing studies on Blockchain within land administration have focused mainly on replacing or complementing the technology for land registration and titling. An additional application to other functions (land valuation, land use planning, and land development) have not been explored. This study explores potential of using Blockchain technology to enhance transparency of all land administration functions using an integrative review methodology coupled with a framework analysis. The study draws on the Ghanaian land administration perspective to make this insightful. It appears possible to apply Blockchain across all land administration functions when using Ethereum smart contracts and a permissionless Blockchain architecture. Also, it is possible to link all the different departments, and stakeholders of land administration to Blockchain. In this way, it can enhance openness, availability and accessibility to information, and participatory processes in the system to enhance transparency. Study policy implications; immediate initiation of review of all paper-based land transactions for errors and corrections as well as comprehensive digitization of land administration transactions and processes in the country, partnership with private firms in Blockchain and land issues, stakeholder education on Blockchain land administration, and deliberations and negotiations amongst stakeholders particularly chiefs to reach consensus on Blockchain for land administration.

Keywords: Land Administration; Blockchain Technology; Land Tenure; Land Valuation; Land Use Planning; Land Development; Ghana

4.0 Introduction

Land administration involves 'the process of determining, recording and disseminating information about the relationship between people and land' (Vos et al., 2017 p.2,; Lemmen et al., 2017). UNECE defined it as involving the recording and dissemination of information about ownership, value and the use of land, as well as the associated resources, while implementing the land management policies (Dawidowicz & Źróbek, 2017). This relationship between people and land, and the functions performed with regard to ownership, value and the use of land require

[3] *This chapter has been published in an international peer reviewed journal as:*
Transparency of Land Administration and the Role of Blockchain Technology, a Four-Dimensional Framework Analysis from the Ghanaian Land Perspective https://doi.org/10.3390/land9120491

transparency. The transparency of land administration depicts the situation where land transactions and services are carried out in openness, and with maximum participation by all the concerned stakeholders (Bagdai et al., 2012). Transparency allows for land tenure security (I. P. Williamson & Grant, 2002; Enemark, 2004; Bagdai et al., 2012; Locke & Henley, 2013; UN-Habitat, 2016) Land administration transparency enables landowners and prospective purchasers to know the exact status of their land rights and interests, as well as the relation that they have with other individuals concerning pieces of land. This enhances peoples' confidence to invest in land which improves economic conditions (Bell, 2007). Transparency is noted as one of the key principles for good land governance (Phuong, 2012). A good governance in land administration is beneficial to societies in diverse ways as it ensures:

'Pro-poor support: rule of law is equal to all, and citizen has protected rights, Public confidence: greater public confidence, Economic growth: security of the land tenure and regulated transaction cost and taxation, Protection of state assets: legitimate use of state land for social and economic concessions, More effective and efficient public administration of land: formal market and reliable system, more revenue sharing for public services, Conflict prevention and resolution: equity, justice, and social stability' (Bell, 2007 p.13)

Nevertheless, land administration across the world lacks transparency and is corrupt everywhere (Phuong, 2012). Land administration systems are considered to be among the most corrupt institutions in the world (Anand et al., 2015). UN-HABITAT in 2007 observed that land offices in most countries are among the most corrupt institutions (Bagdai et al., 2009). Corruption exists where there is lack of transparency (Bagdai et al., 2012). This lack of transparency in land administration begets numerous land challenges which include; land tenure insecurity, high cost of land transactions due to informal payments, reduced private sector investment in land, less revenue for the state, increased land grabbing by officials, increased land conflicts, landlessness, and inequity in land distribution. These challenges promote social instability, exclusion and political instability through land conflicts, land poorness and landlessness. The situation leads to disregard for the ethics and standards of behavior as land titles, building permits and zoning regulations become no longer trusted by citizens (Bagdai et al., 2012; Locke & Henley, 2013; UN-Habitat, 2016). These outcomes inhibit the overall development of societies. Most countries, particularly in Africa, face stunted development and impoverishment as land dominates the economy, and provides livelihoods to the majority of the continent's population Jaitner et al., (2017); thus, the focus of this study is from an African country's perspective. The need for the transparency of land administration has not received the needed attention in years past as Bell, (2007) notes that the attention to the issue of transparency in land administration and land governance is recent.

In recent years, many studies on ways to enhance the transparency of land administration have shifted attention to the potentials of Blockchain technology (Anand et al., 2015; Spielman, 2016; Lemieux, 2017b; Rizal Batubara et al., 2019; Müller & Seifert, 2019). Blockchain is identified to enhance transparency in land administration processes and or functions though the integration of all land stakeholders, in a way that allows each stakeholder to be aware of, and to be involved in land transactions without intermediaries (land administration processes and functions have been

used synonymously and interchangeably in this study). Blockchain helps to improve trust in the system and to enhance the confidence of citizens in the land administration system (Müller & Seifert, 2019). It is identified that despite the digitization of land records and diverse web applications, the system for land records management is weighed down by various kinds of errors and inconsistencies as well as a lack of transparency Singh et al., (2018), the same problems which Blockchain technology potentially eliminates (Eder, 2019). Countries like Georgia, and Sweden, among others, have piloted Blockchain technology to land administration and reported the successful outcomes of improved transparency and enhanced citizens' trust in the land institutions (Shang & Price, 2019). Several studies on the application of Blockchain technology for land registration and land titling exist to show the potential of Blockchain technology to improve transparency in these land administration processes (Bal, 2017; Benbunan-Fich & Castellanos, 2018; Lazuashvili et al., 2019; Müller & Seifert, 2019; Shang & Price, 2019; Thakur et al., 2019; Krishnapriya & Sarath, 2020). These show the surging interest in Blockchain technology in land administration. However, despite the rising interest in the potential of Blockchain in land administration Eder, (2019), there is to date no studies that have holistically assessed the transparency of all the processes of land administration, and how Blockchain technology can help improve these. The existing studies mainly focus on land registration, and titling (Spielman, 2016; Vos, 2016; Bal, 2017; Peiró & García, 2017; Salmeling & Fransson, 2017; Benbunan-Fich & Castellanos, 2018; Müller & Seifert, 2019; Shang & Price, 2019; Krishnapriya & Sarath, 2020; Yapicioglu & Leshinsky, 2020). These, however, only fall under the land tenure processes and or functions (Yildiz et al., 2020). Other land administration processes including land value, land use planning, and land development have not been sufficiently explored, if any, in order to see how Blockchain technology can enhance the transparency of these processes and in a simultaneous way. This leaves a research gap. To focus only on land tenure processes and to conclude that Blockchain technology enhances the transparency of land administration is to miss the vast land administration processes of land value, land use planning, and land development. This leads to missing the broad concept of land administration transparency. This also presents a challenge to aptly conceptualize Blockchain technology and the transparency of land administration, and hence, this study aimed to fulfil this research gap. This study argues that understanding the transparency of land administration and the role of Blockchain technology in this regard becomes incomplete if the processes of land administration are not holistically considered. To this end, this study was guided by these objectives:

1. To identify the essential elements and relations between Blockchain technology and the transparency of land administration in the existing literature;

2. To assess the potential of Blockchain technology to improve the transparency of land administration functions—based on the Ghanaian land administration context.

These objectives are particularly important as they fill a literature gap by looking at what transparency actually means in land administration discourses, and how the widely accrued technology of Blockchain could potentially contribute to achieving this. Secondly, it helps in extending the literature on the potential of Blockchain technology in the specific context of land administration in a more comprehensive approach. The paper starts by explaining the methodology

applied to address both research questions. The subsequent section presents the elements and relations between Blockchain technology and land administration processes and applies this from the Ghanaian perspective. The section that follows afterwards discusses the possible roles Blockchain technology could play in enhancing or affecting the transparency of land administration processes. The final section reflects on the study's guiding framework and derives policy recommendations.

4.1 Materials and Methods

4.1.1 Research Approach and Boundaries

The novelty of Blockchain's application in land administration opens it up for new discourses on its potentials to land administration. On this basis, more research studies are needed as conceptualizations and theoretical models in this regard are still preliminary. Methodologically, an integrative review is considered appropriate for such new topics as compared to a systematic, and semi-systematic review methods (Torraco, 2016). Given this, I apply a review methodology based on an integrative interpretation process of existing documentation and literature, with the aim of deriving an alternative conceptualization of transparency in land administration. Such an integrative literature review methodology is suitable when investigating the extent to which a new concept or technology fits in a new context. This approach has also been used in similar studies (Snyder, 2019; Ntihinyurwa & de Vries, 2020). Furthermore, it is suitable for new and emerging topics that have not benefited from a large body of literature and conceptualizations (Torraco, 2016). Integrative reviews assess, critique, and synthesize existing literature on a topic in ways that evoke new theoretical frameworks, and perspectives (Torraco, 2005; Snyder, 2019). Integrative reviews can follow rationalist theory as an appropriate epistemology and are based on an exploratory research design which deducts the scientific knowledge and new perspectives through the critical review, analysis and synthesis of existing literature (Webster & Watson, 2002; Obeng-odoom, 2014; Torraco, 2016). According to Webster & Watson, (2002), integrative literature review methodology, compared to systematic, and semi-systematic review methodologies offers a better opportunity to assess pending developments in a field and to identify factors that are shaping the future of ideas or issues in that field through critiquing, and analyzing relevant literature (Torraco, 2016). Doing this, however, requires prior understanding and knowledge on the topic to guide and facilitate the critique, analysis, and appraisal of existing relevant literature and concepts (Obeng-odoom, 2014). In this way, integrative review aids in identifying relationships, gaps, deficiencies, and opportunities for improvement on existing literature and concepts, thereby offering a possibility for rethinking the topic and improving scientific knowledge by extension (update) and or reconceptualization (Torraco, 2016). However, integrative review analysis is criticized for not being developed in accordance with any specific standard and is mostly not truly integrative but a mere summary of existing studies. This can lead to a lack of rigor as compared to systematic reviews (Torraco, 2005; Snyder, 2019). The research underlying this paper overcame these potential critique points by employing and combining the method with the framework analysis (sometimes also referred to as qualitative content analysis). This provides a structured approach to analyze the main concepts and ideas which reveal

relationships, divergences and gaps for critiquing, leading to a better synthesis of both the emerging perspectives and existing literature in a rigorous way(Gale et al., 2013).

Following the study objectives of identifying the conceptualization and relations in Blockchain technology and land administration, and the potential of Blockchain to enhance the transparency of land administration, a conceptual organizational structure of integrative literature review is used (Torraco, 2016). In this, the main concepts of the topic provide a framework around which the review is organized to help ensure coherence and clarity on what is being reviewed, and how the concepts of the topic enjoin into a unified idea (Torraco, 2016). In order to find contextual boundaries, the literature review focused on documents which specifically addressed ongoing research and practical advantages and disadvantages of Blockchain in the context of land administration. The framework analysis creates a new structure for findings that help to summarize them in a way that supports answering the study questions (Gale et al., 2013). This provides a clear stepwise approach to follow which produces a highly structured output of summarized findings and gives a holistic, descriptive overview that allows for easy critiquing and analysis (Gale et al., 2013). The study's literature is not constrained by spatial and temporal boundaries. This allowed for the geographically unlimited literature review of all available and relevant data, from empirical, and review (secondary) literature in the English language in which a large volume of literature on the topic was found. This is not to conclude that literature did not exist in other languages, but the majority of returned literature was in English. Additionally, English is the language that the authors have mastery knowledge of. No linguistic biases were intended. The literature identification process and sources, review, analysis, synthesis, modelling/reconceptualization, and means of scientific knowledge extension on the topic follows in the next section and is summarized in Table 6 below.

	Steps	Activities	Output
1	Setting study boundaries	-Outlining spatial and geographical limits, language boundary, concepts under focus, and literature type and publication timeframe	-No geographical and spatial limitations, -Only data in English language were considered -Focus centered on land administration functions and transparency, & blockchain's application in land administration
2	Literature Identification -Search strategy -Selection -Literature sources -Validity and reliability	-Systematic literature search and spider backward search strategies. Directing typing into databases keywords and phrases like, land administration, land administration functions, land administration transparency, blockchain and land administration, blockchain for land registration, and blockchain and land transparency and using their different combinations -Focus on land administration functions, transparency of land administration, and blockchain's application to land administration -Scientific online databases including, Google Scholar, Elsevier, Springer Link, Scopus, JSTOR, Research Gate, Web of Science, and Taylor & Francis -Using different synonymous keywords and phrases, and their combinations across different scientific databases helped to check validity and reliability	-Total search results = 195 online publications -Selected publications = 81 -Spider backward publications = 16 -Total documents accepted and reviewed = 97 publications -Final documents used for the study = 75 publications
3	Initial literature review	Titles and abstract reading	-Elimination of duplicated documents, and documents that did not meet the study focus, and boundaries
4	Detailed integrative review -Critical review -Analysis	-Detailed and critical full text reading -Use of concept structure and framework analysis -Through textual narratives and visualizations techniques (Framework diagrams, tables, procedural diagrams) the main	-Theoretical basis of blockchain technology -Main potentials of blockchain technology

	-Synthesis	ideas, themes, patterns, gaps, and relationships were categorized, and summarized. –Based on logical, and deductive reasoning, analysis and synthesis of emerging knowledge was made	-Main process of the different land administration functions in Ghana and the challenges/ gaps -Potential relation between blockchain technology and transparency in the land administration functions
5	Topic reconceptualization	-Use of rationalist theory of knowledge generation, logical, and deductive reasoning, and authors' primary knowledge on the topic, new knowledge was created and implications explained	-Ways of blockchain application to enhance transparency in all land administration functions of land tenure, land valuation, land use planning, and land development
6	Conclusion and recommendations	-Study contribution to knowledge -Areas of further research, and implications for practitioners, and policy makers	-Extension of blockchain's potential to support land administration beyond just land tenure functions. -Revealing new area for further research -Explaining new knowledge's implication for practice and policy making

Table 6. Research process and design overview.

4.2. Data Sources and Research Methods

The literature search was carried out systematically based on the main concepts and ideas in the topic using keywords, and phrases like, land administration, land administration functions, land administration transparency, Blockchain and land administration, Blockchain for land registration, Blockchain and land transparency, land tenure, land valuation, land use planning, and land development. These keywords and phrases were searched for across different scientific databases including Google Scholar, Elsevier, Springer Link, Scopus, JSTOR, Research Gate, Web of Science, and Taylor & Francis. Searching with diverse synonymous keywords and phrases across the different scientific databases facilitates access to a large volume of documents on the topic and allows for a validity, and reliability check. The systematic literature search resulted in 102 documents on land administration. This number was based mainly on documents' titles and how they related to the land administration processes; land registration, land information, land valuation, land taxation, land use planning, and land development. This selection was based on sampling and is not considered to be representative of all land administration systems but for Ghana. This is because, although some general documents on land administration processes were considered, the main focus was on land administration processes from the Ghanaian perspective, and hence, more of the documents relating to this context were considered. Moreover, 26 documents on land transparency, 42 on Blockchain's application in land administration and nine on the methodological approach, making a total of 179 retrieved documents. The initial critical reading of the documents' titles and abstracts in some instances, while being guided by the research boundaries, resulted in 81 documents for the detailed and critical full text reading and review. The full text reading helped to identify the extent to which the documents discussed the topic and revealed the missing gaps. A spider backward search strategy helped to find additional sources. Through the spider backward approach, new citations and references that come up in the full text reading of selected literature and have relevance to the study are traced back to their original documents for identification and review. This strategy resulted in 17 additional online documents making it a total of 195 documents in all. The spider backward retrieved documents were also subjected to review based on the study boundaries. In the end, 98 documents in total were critically reviewed and 76 accepted and used for this study.

Based on conceptual organizational structure, and the framework analysis approach, the main ideas were categorized under different broad themes of Blockchain technology, and the transparency of land administration processes using text narratives and visual models, which are suitable for integrative literature analysis and synthesis (Torraco, 2016). This approach helped to compile the main ideas from the reviewed studies, and also evidence-based documented practical applications of Blockchain, which were all used to summarize and synthesize the study findings with respect to the research objectives (Levack, 2012). Abstractive textual and narrative modeling based on the rationalist theory, deductive reasoning, and the authors' knowledge on the topic were used to establish the potential relationship in Blockchain technology and the transparency of the land administration functions. The rationalist approach guided the justification and explanation of this potential relationship. The implications of the new and extended scientific knowledge to existing literature, practitioners and policy makers is explained, the study limitation highlighted, and suggestions for future research directions made.

4.3 Results

4.3.1 Theoretical Basis of Blockchain Technology and Its Operation

Blockchain technology refers to a fully distributed crypto-graphical system that captures and stores a consistent, immutable and linear event log of the transactions between networked actors (Karamitsos et al., 2018). Blockchain technology allows for managing the records of transactions without a central server or authority (Yapicioglu & Leshinsky, 2020). Through this network, which is made of computers (for stakeholders) that operate on a Blockchain system to execute transactions and are termed as 'Nodes', Blockchain technology works, based on what is technically referred to as 'Blocks and Hashes'. In Blockchain's operation, transaction data are stored in digital containers called 'blocks'. The first block created is termed as the genesis block Natarajan et al., (2019), and each block after it is created is linked to a parent block (the preceding block) through unique digital fingerprints termed as 'hashes' (Spielman, 2016). This is shown in Figure 16. The hashes are time-stamped in a header at the top of each block of information to give certainty on the order of transactions' creation. After creating a transaction, and before it is accepted onto the Blockchain system, the majority of the nodes will have to verify and validate that it is accurate and authentic as exists in reality on the ground. This verification and validation process is done through a system termed as 'consensus mechanism' (Vos et al., 2017). Once transactions are validated and accepted onto the Blockchain system, the information in the blocks becomes immutable and resilient against tampering or falsification. In this way, not even the one that created it can manipulate the data; and, the transaction with its data can be accessed at any time by all stakeholders, which allows for transparency (Themistocleous, 2018; Rizal Batubara et al., 2019; Shang & Price, 2019) . As compared to other land transaction management tools like modeling, database management, and workflow management, there are three main arguments for why the Blockchain technology is considered a solution with great benefits and possibly no alternative. First, in Blockchain land transaction, data, certificates, and digital IDs, cannot be manipulated. Second, there can be no double spending/sales of land since any purported attempt is automatically known to all stakeholders Shuaib et al., (2020) and thirdly, land transaction rules and requirements can be embedded into the Blockchain's 'smart contract' application which makes it difficult for anyone to manipulate the process, and it also reduces human error possibilities (Rizal Batubara et al., 2019). Smart contracts are Blockchain applications which allow for a pre-programming of a contract by defining all the conditions and requirements, and when parties have met these conditions and requirements, the contract is executed automatically. The Blockchain transaction steps are:

1. A node/stakeholder with an account signs digitally and initiates the transaction;

2. A timestamp is added to prove the time of transaction creation;

3. Transaction is broadcasted by decentralization to all other nodes on the network;

4. The transaction is mined (''which involves validation of a set of transactions (block) in the network by means of showing the computational proof of the work done") Lazuashvili et al.,

(2019 p. 20), by one of the nodes. After this, it is verified and validated as authentic, or declined if it is found otherwise by the majority of the nodes based on a consensus mechanism;

5. The validated transaction is then recorded in a new block and hashed to the previous block to form the chain of blocks as is shown after Figure 16.

Technically, three processes are identified in how a Blockchain works. Digital time-stamping, distributed verification, and cryptographic hashing (Oberdorf, 2017). Figure 16, below, shows the Blockchain transaction process, Figure 17 shows the Blockchain structure, and Table 7 shows the inherent elements that make the Blockchain beneficial to land administration transparency

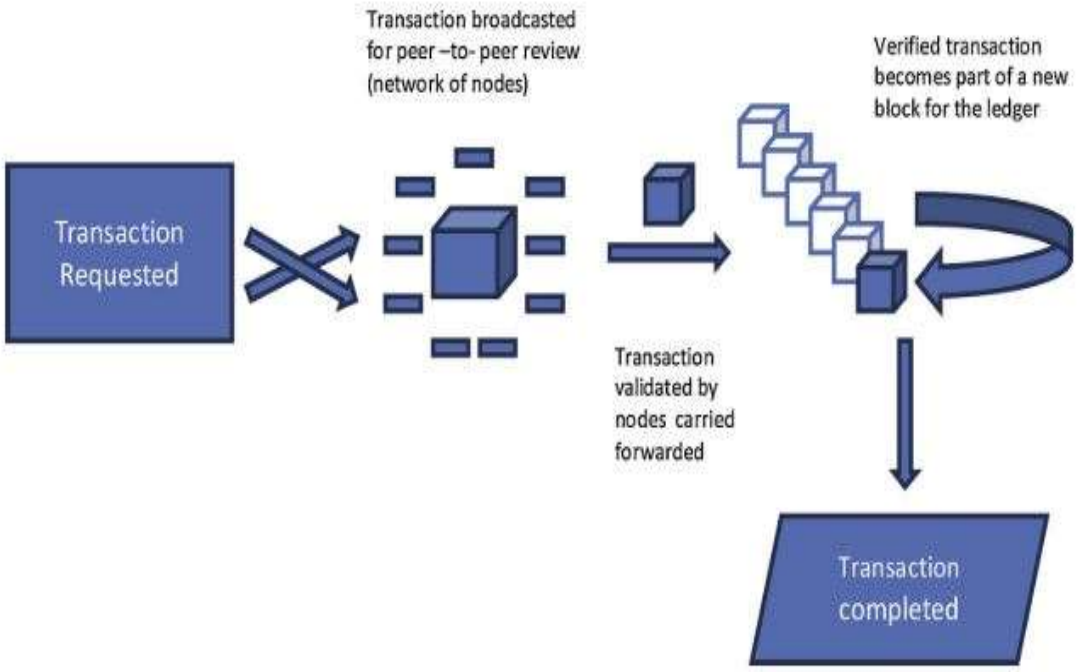


Figure 16. Blockchain transaction process

Source: (Thakur et al., 2019).

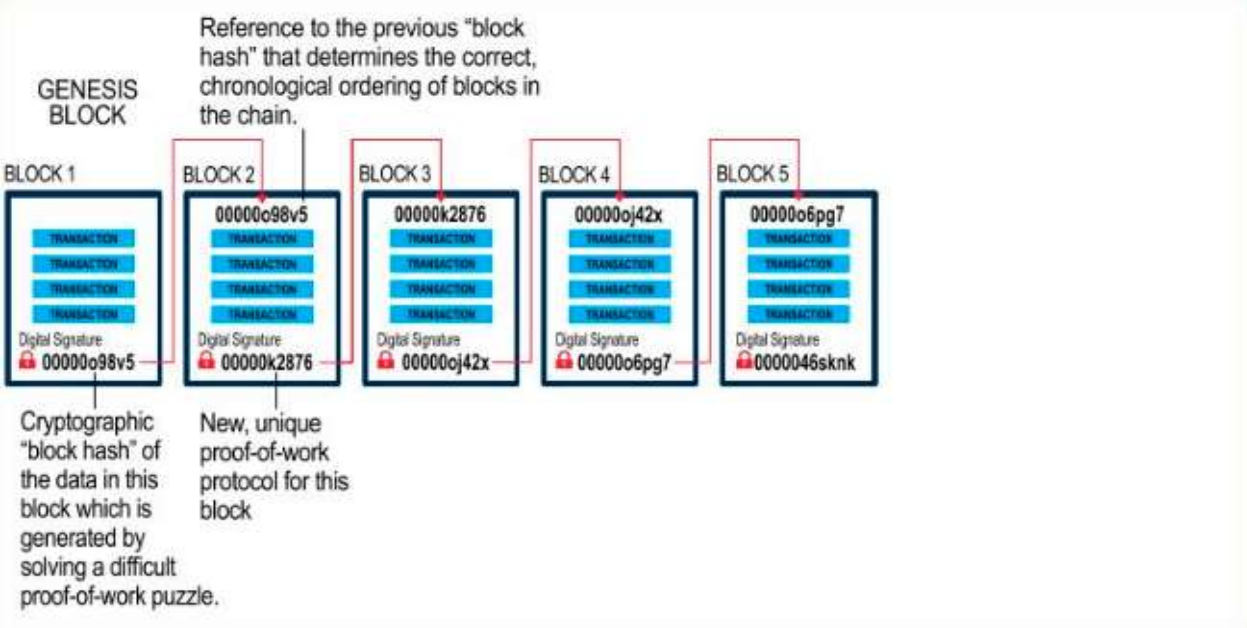


Figure 17. Blockchain structure

Source: (Natarajan et al., 2019).

Potential Benefits of Blockchain	Elements that make it Possible	References
Transparency	**Decentralization** of transactions across all nodes (stakeholders), possibility for evaluating the authenticity of the transaction by all stakeholders, and the access to all transaction and their historical records by all stakeholders	(Phuong, 2012; Peiró & García, 2017; Shang & Price, 2019; Thakur et al., 2019; (Yapicioglu & Leshinsky, 2020)
Eliminating fraud and double sales	**Decentralization.** Once a transaction has been completed, all stakeholders have copies and any further action on the transaction is known to the stakeholders. A second attempt to resell the land will be known to all stakeholders and therefore the transaction will not be validated since it has already been sold to another person.	(Phuong, 2012; Anand et al., 2015; Vos et al., 2017; Müller & Seifert, 2019)
Enhancing trust	**Immutability and consensus mechanism.** Immutability of Blockchain coupled with the consensus mechanism by majority stakeholders helps prevent manipulation of land data, as well as misrepresentation of land data in the system.	(Vos, 2016; Vos et al., 2017; Kaczorowska, 2019; Shang & Price, 2019; Thakur et al., 2019)
Establish clear ownership	**Hashing.** The existence and access to the historical facts on the transaction made possible by hashing allows ease in establishing ownership status as well as all encumbrances	(Müller & Seifert, 2019)
Eliminating corruption	**Smart contracts.** Land transactions based on and carried out using smart contract helps to eliminate all forms corrupt deals since all the procedures involved the transaction are clear and can be carried out without human intervention thus leaving no room for corruption	(Shang & Price, 2019)
Eliminates manipulation	**Decentralization and immutability**. Due to distributed copies of transactions available to all nodes; and difficulty to change Blockchain data, any purported unauthorized changes or manipulation will be detected by all the stakeholders and will accordingly be declined or denied.	(Shang & Price, 2019; Thakur et al., 2019)

Easy information access	**Decentralization.** Information stored is available to all the nodes at all times. This enhances the ease to land transaction information as there are no intermediaries.	(Kaczorowska, 2019; Shang & Price, 2019; Thakur et al., 2019)
Data quality, accuracy and integrity	**Consensus mechanism.** The verification and validation process inherent in the system ensures that the information accepted on the Blockchain corresponds with reality on the ground. Any inconsistencies, and inaccuracies will lead to rejection of the transaction.	(Thakur et al., 2019)
Enhances high participation by all stakeholders	**Decentralization.** Stakeholders become involved in the transaction at every stage due to the decentralized distribution across all the nodes. This allows all stakeholders to know about the transaction and to partake in it through the consensus mechanism	(Vos, 2016; Vos et al., 2017; Makala & Anand, 2018; Thakur et al., 2019)
Reduced human error possibilities	**Smart contract** for land transactions helps eliminate human involvement as all required actions necessary for carrying out transactions have been pre-programmed. Once a step is completed, transaction moves to the next step without human actions until it is completed.	(Phuong, 2012)
Security and resilience	**Decentralization and distribution**. Due to the decentralized and distributed functionality, data are stored in multiple databases of different stakeholders which are temper proof, immutable and encrypted. It is thus difficult to hack all the different databases same time.	(Anand et al., 2015; Lemieux, 2017b; Lazuashvili et al., 2019)

Table 7. Blockchain potentials to land administration

Source: authors' construct.

The elements of the Blockchain identified in Table 7 are reflected in the discussion section on how they help to achieve the transparency of the land administration.

It is important to point out that there are two main architectural categorizations of Blockchain technology based on access and use possibilities. These are the public and private Blockchain. These are further categorized into permissioned, and permissionless Blockchains. The public and private categorizations determine who can access and read from the Blockchain ledger, while the permissioned, and permissionless categorization determines who is able to introduce a transaction, and also participate in the consensus mechanism (Ølnes et al., 2017; Rizal Batubara et al., 2019). It is therefore important that the right Blockchain architecture is selected depending on the purpose of application. Table 8 below shows the accessibility and use possibilities available in the different Blockchain architectures.

	Blockchain Architectural Categorization			
	Public Blockchain		Private Blockchain	
	Permissionless	Permissioned	Permissionless	Permissioned
Participants	Anonymous	Identified	Identified	Identified
Data Accessibility	Anyone	Anyone	Authorized participants	Authorized participants
Initiating transactions	Anyone	Authorized participants	Authorized participants	Network operator only
Participation in consensus mechanism	Anyone	Authorized participants	Authorized participants	Network operator only
Network types	Decentralized	Partly decentralized	Hybrid	Centralized

Table 8. Blockchain architectural categorization

Source: adopted from (Rizal Batubara et al., 2019).

Some writers have advocated for the adoption of a private Blockchain for land administration, specifically for land registration (Kaczorowska, 2019). However, given the architecture categorizations in Table 8, this study considers a permissionless public Blockchain more suitable for a land administration system. This is because, permissioned Blockchains invade privacy/data protection policies with or without participants' consent since it allows participants to be automatically identified. Moreover, permissioned Blockchains 'lose their decentralized, open nature, and become less transparent and more centralized', (Petkova & Jekov, 2018 p. 152). These create difficulties in land data accessibility, lead to a lack of trust due to centrality and refute the transparency objective required in land administration. Public permissionless Blockchain on the other hand helps to adhere to privacy/data protection policies. The anonymity of participants prevents the breach of privacy policies. In land administration, however, the question of who has

what rights and to which land parcel is very critical, and therefore makes it important to be able to know participants' identity. To address this, a public permissionless Blockchain has a way to allow participants' identity to be known where required. In Petkova & Jekov, (2018) the authors noted that, in the public permissionless Blockchain, although the users' identity is encrypted and hidden, there exists a possibility that in certain contexts, the identity of the participants can be inferred based on transaction patterns or other markers. This possibility helps to make inferences to participants and their actions whenever the need be, particularly where transactions or actions might appear suspicious. These functional possibilities of the public permissionless Blockchain compared with the other architecture types make it more suitable for a public land administration system like the case in Ghana.

Notwithstanding these potentials and possibilities of Blockchain enumerated, the technology, like any other technology, has its own flaws and or restrictive factors which must be taken into account before the decision to adopt and implement it. Generally, Blockchain is criticized due to its limited storage capacity. Current public Blockchains are unable to handle large volumes of land data such as deeds, titles, and maps (Shapiro et al., 2012). This could cause problems in land administration since land transactions and data transactions occur daily. The authors in Müller & Seifert, (2019), however, recommend that an external storage for Blockchain's smart contracts and documents can be created to support the system—see Müller & Seifert, (2019) for further details. Another challenge is scalability. Due to its nascent nature, and storage capacity limitation, there are challenges to scalability of the technology, particularly with increasing volumes of data and workload. This equally affects the speed of the system (Petkova & Jekov, 2018). Moreover, Blockchain technology consumes a huge amount of electricity, and this could be a potential challenge for some developing countries that do not have an equally huge electricity supply. Other adoption considerations of Blockchain impede upon technological know-how. Blockchain in land administration is recent and immature (Petkova & Jekov, 2018). Many land professionals are therefore not conversant with the use of the technology. It is important, therefore, to train professionals prior to Blockchain adoption to be able to understand and use the technology. Finally, Blockchain operation requires strong computational power and efficiency Agyemang & Morrison, (2017), coupled with strong and stable internet connectivity to be able to perform efficiently. These have to be considered in deciding on Blockchain adoption.

4.4 Summary Overview of Land Administration Processes in Ghana

In assessing the extent to which transparency exists in a land administration system, it is important to know and recognize the differentiations and variations of the land administration processes. It is mainly assumed that the collective degree of transparency of each of the respective processes constitutes the variation of transparency of land administration as a whole. In Stefanović et al., (2018) a land administration system is defined as a formal system that is used to locate and identify a real property, and to keep the records of past and current data regarding the ownership, value and use of that property. This definition is found to be suitable in this study's context as it highlights the different processes of land administration: land tenure, land valuation, land use planning, and land development. Few studies exist on the transparency of land administration in Ghana, and

these have somewhat touched upon transparency issues in individual land administration processes of either land tenure, land valuation, land use planning, or land development (Obeng-odoom, 2014; Fuseini & Kemp, 2015; Kuusaana, 2015; Agyemang & Morrison, 2017; Kleemann et al., 2017). No single study has concurrently assessed all processes of land administration, and the possibility of achieving a simultaneous transparency in these processes—which leaves a gap where data and research are missing. However, land administration, according to Stahl et al., (2008) must fulfil land title issuance, land taxation, land transaction registrations, changes in land use, resolving land disputes and handling complaints, and facilitate spatial and land use planning. These processes fall under the four broad land administration processes of land tenure, land value, land use planning, and land development (Yildiz et al., 2020). This study thus argues that achieving a simultaneous transparency in all four main land administration processes has intrinsic and synergistic benefits that outweigh pursuing transparency in the individual processes separately. This is shown in Section 4 which comprehensively discusses the different land administration processes, and Blockchain's potential to support and to achieve a simultaneous transparency across these processes.

4.4.1. Land Tenure Processes

Land tenure processes border on the land registration activities of securing and transferring rights in land and natural resources (Enemark, 2005) and also on land information infrastructure. In these processes, Yildiz et al., (2020) note that land registration by means of land register establishment, creation of accessible land records, land transaction procedures, and the processing of information are the matters of interest. Land registration involves a process of the official recording of rights to land through deeds or titles aimed at supplying legal security to the right holders and potential buyers (Zevenbergen, 2004). The sequence of the land registration process in Ghana is summarized in Figure 18 below. For details, see (Sittie, 2006; Ehwi & Asante, 2016; Mintah et al., 2020). From an actor network theoretical (ANT) view point, Figure 18 below can best be understood not only based on the connection between the different divisions, but also, by the type of communication technology that connects these divisions and their work processes together. ANT helps to analyze the way in which actors (both human and non-human) build and maintain networks Oberdorf, (2017), for the purpose of achieving a goal. ANT is broadly advocated for in development research works particularly those focusing on technology. This is because, in a practical sense, 'there is ever-greater use of networks of individuals and organizations to deliver development and an ever-greater role for the material (especially technology) in development processes' (Oberdorf, 2017, p. 38). In the context of this study therefore, ANT theory gives a sound theoretical basis for understanding the different land administration processes, performed by the different land divisions, and stakeholders, and the role of Blockchain technology in this relation towards achieving land administration transparency.

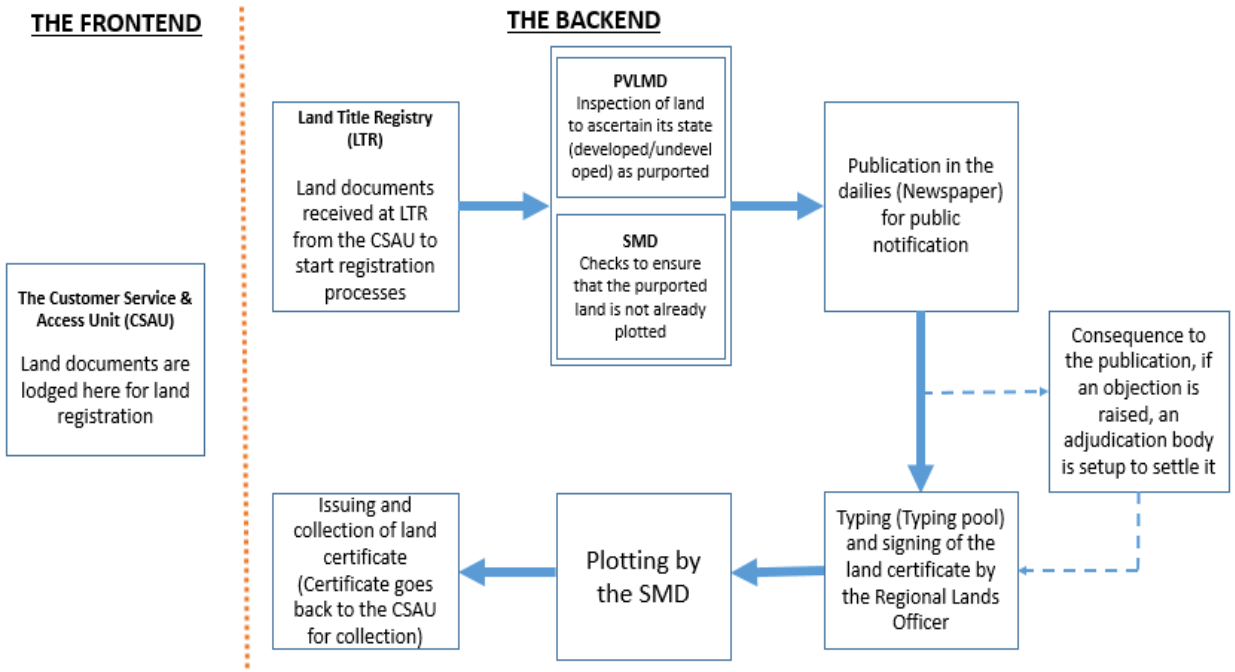


Figure 18. Land registration process

Source: Based on (Sittie, 2006; Ehwi & Asante, 2016).

From Figure 18 above, the frontend (Customer Service and Access Unit (CSAU)) serves as the intermediary between clients and the lands commission. Clients visit and submit their land documents, or complaints on any land process to the frontend desk of the CSAU. The CSAU, after certifying the documents, relays these to the right divisions at the backend, be it (LTR, PVLMD, or SMD). For land registration specifically, the CSAU first relays land documents to the LTR, from where it goes through all the formal processes with the different divisions until completed, brought back to the CSAU, and clients invited to pick up their certificates. Although other additional departments, such as the Land Valuation Division (LVD), are involved before land can be successfully registered, Figure 18 above is a simplified process which is understandable since the LTR is the first and last department involved in the registration process (Ehwi & Asante, 2016). Other incidental activities include the submission to and stamping of land documents at the LVD before acceptance for registration, and also the settling of any objections that might be raised upon the publication in the dailies. However, when all documents are found correct and no objections raised, the above process should take on average 3–5 months to complete, but depending on individual cases and circumstances, certain cases could take longer (Ehwi & Asante, 2016). Land information infrastructure on the other hand is concerned with the cadastral and topographic datasets (Enemark, 2005).

4.4.2. Land Valuation Processes

The main processes considered here are the valuation and taxation of land and properties (Enemark, 2005). Valuation is an estimate or opinion of value based on expertise to meet the supply and demand under certain conditions. These conditions may be subjective or objective

depending on the context of the valuation (Asiama et al., 2018). Valuation must be an unbiased estimate or opinion, a knowledgeable or learned opinion of value, and a supported estimate of a defined value. The value must represent a reasonable market value which according to the 2017 International Valuation Standards Council's (IVSC) definition. is *'the estimated amount for which an asset or liability should exchange on the valuation date between a willing buyer and a willing seller in an arm's length transaction, after proper marketing and where the parties had each acted knowledgeably, prudently and without compulsion'* (Shapiro et al., 2012, p. 4; Yildiz et al., 2020, p. 4). There are five different methods for asset valuation, namely (1) the market approach or comparative method, (2) the income approach or investment method, (3) the residual approach or development method, (4) the profit method, and (5) the cost approach or contractor's method, see details in (Shapiro et al., 2012). The choice of a method relies on three aspects, the nature of the asset, the basis of the valuation, and the purpose of the valuation (Asiama et al., 2018). The nature of the asset is concerned with the physical properties, characteristics and conditions of the asset. The basis of the valuation may include, market value or the market rent, worth and investment value, and fair or equitable value, while the purpose for the valuation may also include, for sale and purchase, rental, mortgage, insurance, compensation, and lease (Shapiro et al., 2012). Figure 19 below shows the valuation process in Ghana.

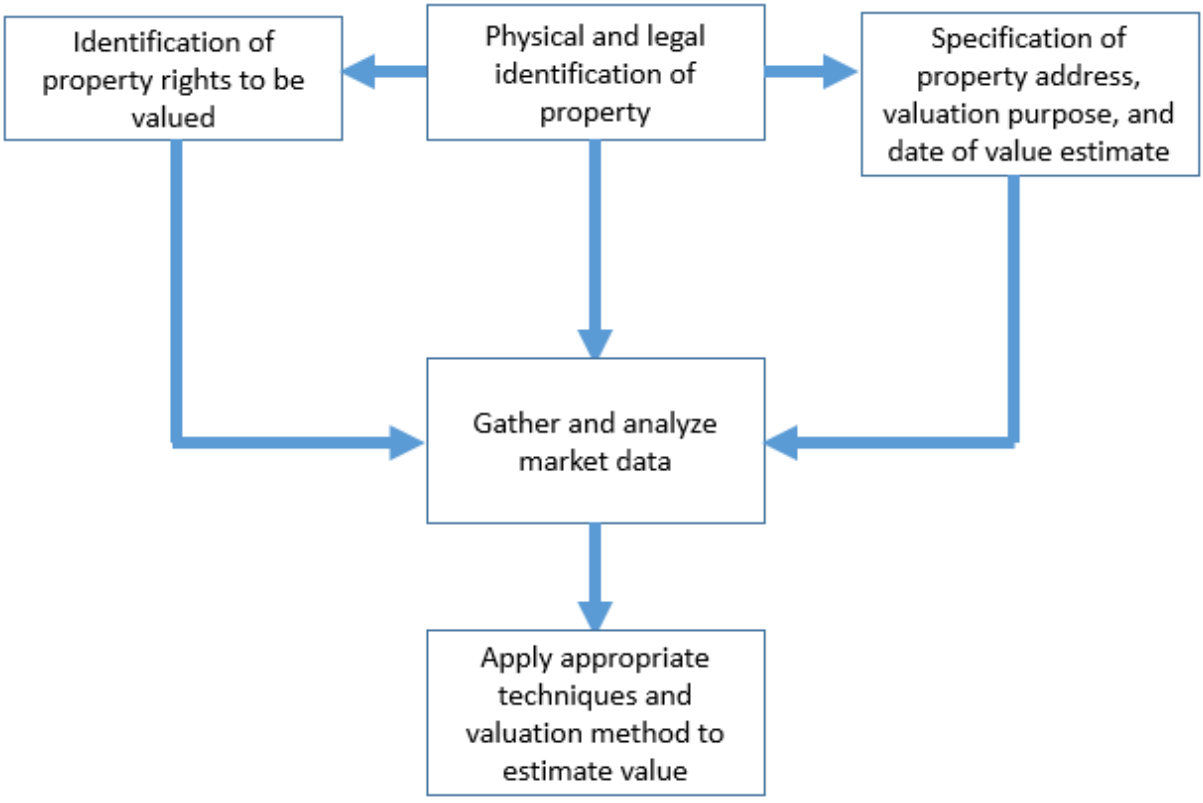


Figure 19. Land valuation process

Source: Authors' construct.

Land taxation, currently referred to as property taxation or rating in Ghana, is one of the oldest tax forms (Mabe & Kuusaana, 2016). In Ghana, this tax is paid with respect to a developed land or an immovable property (Petio, 2013). Property tax differs amongst countries as it is paid in respect of; the land only in Kenya and Jamaica, buildings and improvements on land in Kosovo, and Tanzania, or to both in Canada, Germany, Japan, some parts of Australia, the United Kingdom, Indonesia, Thailand, Guinea, and Tunisia (Petio, 2013). In Ghana, District Assemblies are the governmental institutions charged with the responsibility of preparing and levying property tax or rates in their areas of jurisdiction as per Section 144 of Act 936 (Government of Ghana, 2016b). Property taxation in Ghana is based on the replacement cost method/contractor's cost method of valuation. The tax is the replacement cost of the property after depreciation is deducted, and this should not exceed 50% of the replacement cost of an owner occupier's premises and must not be less than 75% in other cases (Government of Ghana, 2016b). The property taxation process in Ghana is illustrated in Figure 20 below.

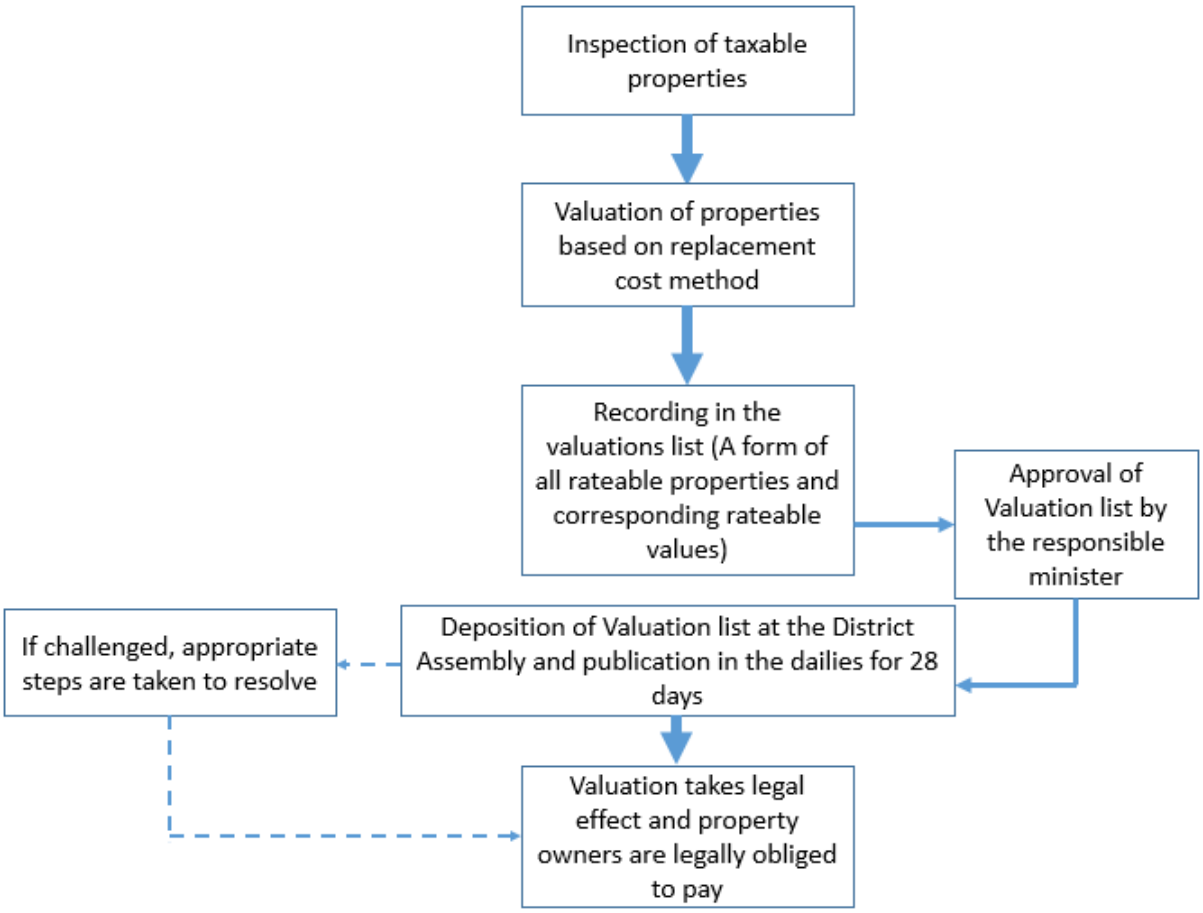


Figure 20. Property taxation process

Source: Based on (Petio, 2013; Government of Ghana, 2016).

4.4.3. Land Use Planning and Land Development Processes

Land use planning and land development are closely linked and as such discussed together (Yildiz et al., 2020). Land use planning is concerned with the planning and control of the use of land and natural resources, while the land development process is concerned with the implementation of development plans. Land development involves the building of new physical infrastructures and the implementation of construction planning and a change of land use through planning permissions and the granting of permits (Enemark, 2005). The designation of different land areas for different use types such as residential, commercial, recreational, and markets, and the actual carrying out of these plans based on the adoption of planning policies and land use regulations for a country, covering the national, regional to the local levels (Enemark, 2005). Land use planning and development in Ghana is concerned with balancing competing land uses for sustainable human settlement development (Yeboah & Shaw, 2013). The main legislation regulating land use planning in Ghana is the Town and Country Planning Ordinance, 1945 (CAP 84). Other legislations that border on physical planning in general include, National Development Planning System's Act, 1994 (Act 479), the Local Government Act, 2016 (ACT 936) and the National Building Regulations, 1996 (LI 1630) (Awuah et al., 2014; Kuusaana & Eledi, 2015). Land use planning in Ghana covers spatial, land use, and human settlement planning (Government of Ghana, 2016a). In Ghana, land use planning must ideally be based on decentralization and participatory principles (Owusu, 2004; Fuseini & Kemp, 2015; Kuusaana & Eledi, 2015). Land use and development plans are prepared at the district level, forwarded and harmonized with those prepared at the regional level, and the two forwarded to the national level to the National Development Planning Commission (NDPC), where they are evaluated, and approval can be given for implementation (Owusu, 2004; Fuseini & Kemp, 2015; Kuusaana & Eledi, 2015).

The land use planning and development process in Ghana starts with the survey and definition of an area base map. This stage entails the collection, analysis, interpretation, and presentation, in a readily understood form, of all the data that are likely to influence the proposals which will be included in the land use plan. Here, planners with the help of local community people study the area to become conversant with all the characteristics which will help in defining the broad land use categories; residential, commercial among others (Government of Ghana, 2016a). Data are gathered through different survey types including a physical survey for data relating to topography, landscape, agricultural lands, and sometimes the geology of the area, a social survey gathers data on the population and its characteristics like the size, composition, structure, and housing, traffic transportation survey data includes the occupation, place of work, or school, origin and destination of work, rail and road networks, and parking facilities.

The survey stage is then followed by the planning stage. In planning, the goals and terms of reference are established as the first stage. At this stage, the planning area is defined, and all the involved people contacted. Some basic data of the area are gathered, and followed by a preliminary identification of problems and opportunities, as well as constraints to implementing improvement. The planning period is then set. The second stage is the organization of the work. This involves listing the planning tasks and activities and identifying the people or organizations responsible for these tasks or for contributing to them. Then, the needed resources are set out, and the work plan

for the project as a whole is drawn up. Administrative matters and logistics are then arranged and provision is made for transport and other equipment. The third stage is a problem analysis which analyzes the causes of the problem in relation to the data already collected on the existing situation; population, land use, land resources, income, and occupation, among others. Constraints to change are then identified. The fourth stage involves identifying opportunities to change by first identifying and drafting a range of land use types that might help to achieve the goals of the plan. Generate a range of options for solving each problem in terms of opportunities; economic measures, land resources, government actions, the people, improved technology, and in terms of land use strategies; no change, maximum production, maximum conservation, etc. The fifth stage is the land suitability evaluation. At this stage, for each promising land use type, establishing the land requirements and matching these with the properties of the land to establish physical land suitability. The sixth stage comprises the appraisal of alternatives through social and economic analysis. That is, for each physically suitable combination of land use, the environmental, economic and social impacts, of the favorable and unfavorable, and of alternative courses of action, are assessed. Therefore, there should be an environmental impact assessment, financial and economic analysis, social impact assessment, and strategic planning. The seventh stage is the choosing of best options. Firstly, public and executive discussions are held on the viable options and their consequences. The comments from these discussions are then assembled and reviewed, and based on these, the necessary changes are made to the options. A decision is then made on which changes in land use should be made or worked towards. The last stage of planning is the preparation of a land use plan through zoning. This starts with the allocation or recommendation of the selected land uses for the chosen areas of land, followed by preparing the maps, the basic or master land use plan and supporting maps. After this, plans for how the selected improvements should be brought about, and how the plan is to be put into practice are made through an appropriate land management approach. A policy to guide the implementation is then drawn up, the budget is prepared and any necessary legislation drafted. It is important to mention the need for the involvement of decision-makers, sectoral agencies, and land users. The last stage of land use planning and development process is implementation. At this stage, the plan is put into action which is the responsibility of both the implementation agencies (mainly the town and country planning department) and the planning teams. During the implementation, there is the monitoring and revision of the plan in light of the goals defined at the initial stage as well as in light of the experiences that occur. The land use planning and development process is summarized in Figure 21 below.

The next section discusses the transparency issues inherent to these different land administration processes and the role of Blockchain technology to potentially resolve these.

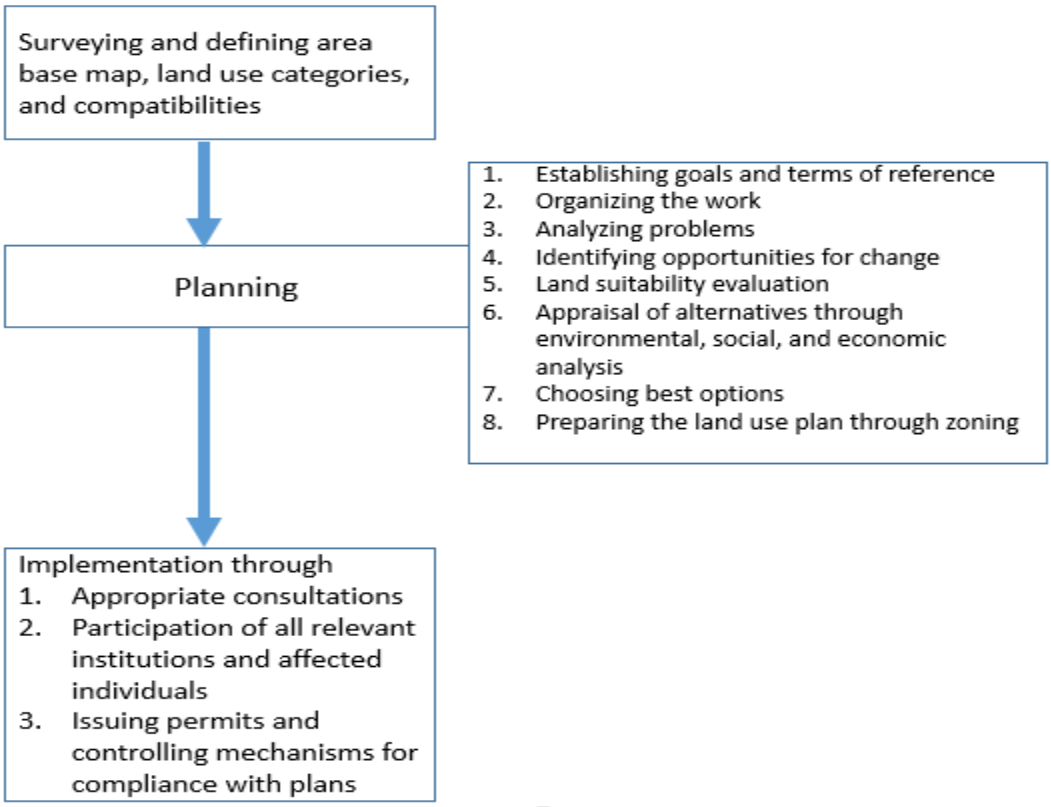


Figure 21. Land use planning and development process

Source: Authors' construct.

4.5 Discussion

Transparency Issues of Land Administration Processes in Ghana and the Role of Blockchain Technology

Figure 22 below shows a four-dimensional framework for the transparency of land administration. The framework and its subsequent analysis and synthesis comprehensively capture and identify the transparency issues in the land administration processes, as highlighted under the findings, and highpoint how these processes can be made transparent, and the role of Blockchain towards this. The transparency of land administration processes involves carrying out and sharing up-to-date information on ownership, value, and the use of land and all of its associated resources among related institutions, right holders and other stakeholders, including third parties, as well as, acting on the information in an open manner (Enemark, 2005; Yildiz et al., 2020). Transparency allows citizens unbridled access to land data, activities, organizations and professionals in an open and participatory manner in taking and implementing land decisions (Bagdai et al., 2012). The availability/sharing of and accessibility to relevant land data, openness, and participatory processes in land administration thus underline the transparency of land administration in the context of this paper. Transparency issues appear akin across the different land administrations processes. For this reason, the discussion of Blockchain's role towards addressing these issues has been integrated

so as to give a better correlation and appreciation of the issues across the different land administration processes.

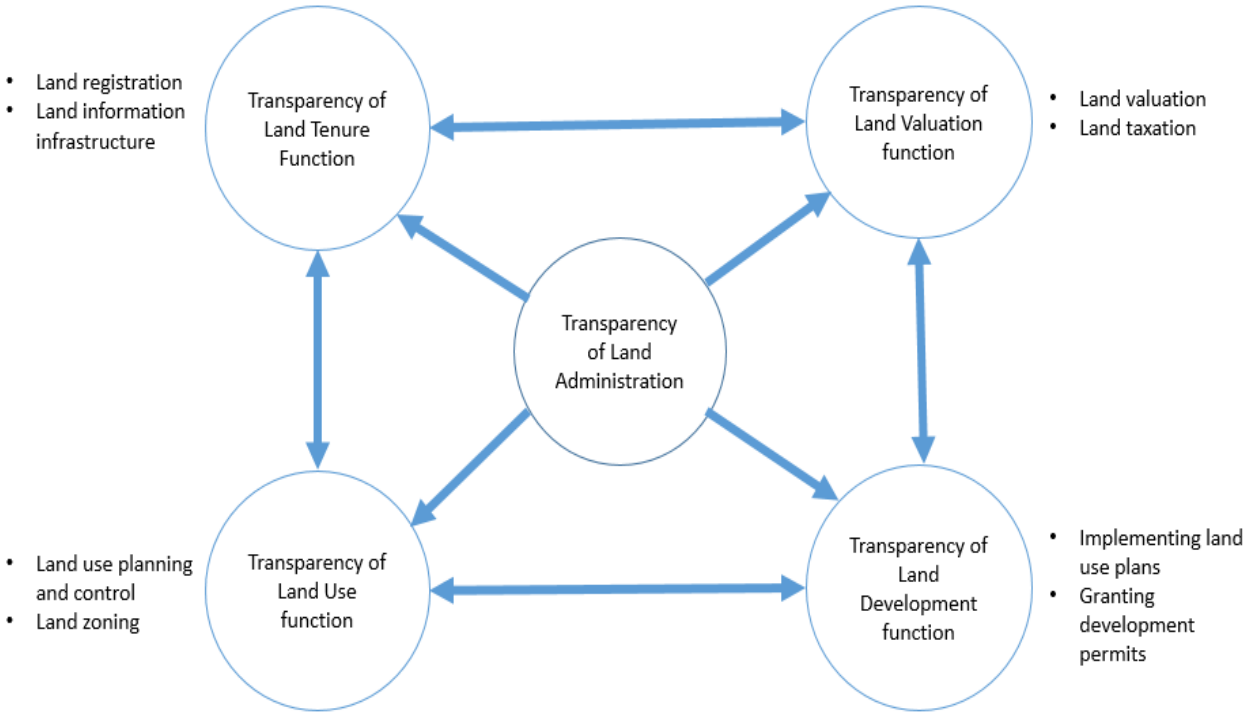


Figure 22. Transparency of the land administration framework

Source: authors' construct based on (Enemark, 2005; Yildiz et al., 2020).

Taking the inventory of tenure by land registration significantly contributes to the openness, availability of information, and transparency of who owns and uses land (Van der Molen, 2007). Ensuring transparency thus depends on the establishment of land registers where they do not exist yet, making records accessible, securing transaction procedures, and documenting processed information (Yildiz et al., 2020). When only regarding the legal context related to land registration in Ghana, one will expect openness and transparency in the system as outlined in our findings. However, Mabe & Kuusaana, (2016) note that in practice, the land registration procedure is cumbersome and fraught with lots of informal dealings, secrecy, bribery and corruption. In a 2016 survey, 69% and 9% of citizens that had received their registration certificates between 3–5 months and 6–8 months, respectively, indicated that they had paid bribes to middlemen or staff of the National Land Commission (NLC) to facilitate the process, whereas, those that had refused to pay bribes had their documents neglected, and prolonged to between 6 and 12 months to receive their land certificates (Ehwi & Asante, 2016). This malicious delay due to the non-payment of the bribe is attributed to the lack of openness and transparency in the system which inhibits clients' ability to know the status of their registration documents in order to tell if documents are being unnecessarily delayed. The author Adiaba, (2014) was correct to note that there is information asymmetry in Ghana's land sector, and that land information is monopolized by public land

institutions. There is a lack of transparency Agbesi & Tahiru, (2020) as well as information imbalance among land stakeholders, which greatly debilitates obtaining credible information due to the failure to divulge information between stakeholders, particularly to clients. This situation refutes the openness, availability and accessibility to information, and the participatory principles of land administration transparency.

On a technical level, the computerization of land registration processes can help to enhance transparency by giving citizens direct access to relevant data and also allow them to monitor process' progress (Van der Molen, 2007). Technically, introducing Blockchain in an already established registration processes is feasible (Lemmen et al., 2017; Ølnes et al., 2017; Kaczorowska, 2019; Yapicioglu & Leshinsky, 2020). Ethereum Blockchain's smart contract for example is possible in Ghana's case (Agbesi & Tahiru, 2020). Smart contract applications allow for predefined rules and requirements of the registration processes in order to be carried out successfully when these rules and requirements are met (Rizal Batubara et al., 2019). The design architecture of a public permissionless Blockchain allows all transaction stakeholders, a free accessibility to information about the transaction and its processes by integrating all of them. In this way, the ability of documents to move through the stages of registration is independent of any single NLC officer or middleman, but subject to meeting all predefined conditions of the process, which every stakeholder can monitor equally. The whole registration process, from lodgment stage, through to the issuing and collection of the land certificate, thus becomes controlled by all stakeholders in the transaction due to their integration. This will not only expedite the registration process but also ensure the trust and credibility of land registration documents and processes. It is important to mention that, the manual stages of physical inspection, as well as survey and mapping services will still remain. However, these physical stages can now be brought under the complete monitoring of all concerned stakeholders, since everyone is aware of every stage of the registration. Stakeholders can therefore monitor these physical stages when they are due. This will help stakeholders to be able to validate the outputs of these physical processes as the accurate representation of the ground realities or not. Thus, in lieu of the transparency of land administration processes, a Blockchain can boost land registration process by enhancing;

- Openness: through the decentralized broadcasting of transactions to all the integrated stakeholders, every decision or action can be known to all and no action can be hidden. Thus, although the different stages of the registration process involve different stakeholders, every stakeholder is aware of each stage, as well as, what, how, and when work is done on the transaction which allows for openness.

- Availability and access to land information: information imbalance obstructs accessibility to credible land data which breeds ignorance and permits fraudulent deals as some stakeholders become oblivious of other happenings in the transaction. The decentralized broadcasting of transactions and all associated information across the stakeholders, coupled with the verification and validation, as well as the hashing of new transaction blocks to historical blocks allows for easy accessibility to all relevant information (both current and historical) on land ownership, parcel, and rights, by all stakeholders at all times. This will help eliminate information asymmetry and its associated challenges of bribery and corruption.

- Participatory processes: the verification and validation through the consensus mechanism foster maximum participation in the entire registration processes from all stakeholders, since this allows the majority stakeholders to be part of transactions' decision making every time. The consensus mechanism takes place at every stage of the registration process until it is completed. Moreover, the broadcasting of process stages to all stakeholders automatically induces participation in the processes either actively or inactively. This is because everyone is aware of every happening and can give their contributions accordingly as and when necessary. That is, stakeholders are always privy to and aware of all the happenings and processes. This makes every stakeholder part of the transaction and registration processes in the participatory sense.

Regarding land information infrastructure, this typically relies on accurate and accessible cadastral and topographic datasets (Enemark, 2005). In Ghana, however, land information at the disposal of the different divisions of NLC is always not up-to-date because there is a lack of synchronization within the information infrastructure (Agbesi & Tahiru, 2020). This challenge sometimes allows unauthorized tampering with land documents and data by some unscrupulous officials Agbesi & Tahiru, (2020) across all divisions and in all the land processes. This is made possible because of the manual land administration system. This challenge can however be eliminated through the digitization and application of Blockchain across the different divisions (Lemmen et al., 2017). Every change on Blockchain updates automatically without human efforts. This will thus provide up-to-date data at every point in time across all the divisions of the NLC and in all their processes. In this way, in addition to facilitating the data accessibility, openness and participatory processes, the Blockchain will ensure up-to-date land data all the time to enhance all the land administration processes and decisions (Enemark, 2004; Enemark, 2005). These potentials of Blockchain if combined with the publication in the dailies stage of registration process and land taxation processes, will boost openness, transparency and participation for all citizens for transparency in the system.

Land valuation must represent an unbiased estimate, a learned opinion and a supported value estimate. Where there is no openness in the valuation processes, biases cannot be identified. Where there are difficulties in accessing market data on comparable properties, valuation will not reflect the reasonable market value. Moreover, where there is no participation in the valuation process from involved stakeholders, it will not be possible to achieve an 'arm's length transaction' since parties will have limited idea of the actual market situation. Again, maximum participation helps to avoid value conjecture on the part of some valuers who may skip some appropriate valuation steps like the physical inspection of the property and its comparables, due to the laborious and tedious nature of these valuation steps. In Yildiz et al., (2020) the authors note that land value data is useful to achieve the arm's length transaction as it gives data for comparison purposes. A major challenge of valuation process in Ghana is the access to readily available and up-to-date market data on comparable properties, either from property owners or from the land institutions. This is due to the secrecy amongst land stakeholders, lack of transparency, and also information imbalance as identified in (Mantey & Tagoe, 2012; Adiaba, 2014; Agbesi & Tahiru, 2020). The same challenges that lead to land registration challenges and lengthy processing time. These greatly affect the valuation processes and the possibility of valuation results to reflect the current market situation and factors. On this basis, if registered properties and registration processes are carried

out on Blockchain as discussed already, the valuation processes can be linked to and carried out on this Blockchain system. In so doing, since all registered properties and their data are readily available, it will facilitate access to the market data on comparables, particularly of registered properties. The openness of the system will also permit all stakeholder awareness of the valuation process to achieve the arm's length transaction (Yildiz et al., 2020) and a truly reflexive market value which is based on the prevailing market situations and factors. The choice of valuation method and its appropriateness can also be evaluated by stakeholders, particularly given that comparables with the same basis and purpose of valuation can easily be found from registered properties via the Blockchain system. Therefore, with the secure, immutable, time-stamped, and up-to-date characteristics of the Blockchain-based land administration system (Lazuashvili et al., 2019) accessibility to comparables for valuation is made easier and faster, as well as is open to the knowledge of all stakeholders. Thus, the valuation process from, identifying property owners, and comparables, through choosing a valuation technique, to actual valuation, can then be carried out via the Blockchain system. This can help to eliminate value conjecture by some valuers due to the difficult accessibility to market data on comparables, as well as ignorance on the part of other stakeholders of the valuation processes. This can also address petty mistakes like wrong addresses, incorrect party details, valuation dates, as well as the exact rights to properties since other stakeholders can identify and rectify these through verification and validation.

The valuation process is similar to the taxation process. The difference is that the valuation list for taxation is, however, published in the dailies for 28 days before they can become legally binding, in property taxation, a major challenge in making property tax administration effective in Ghana is the difficulty in connecting properties to their locations, and also where transparency is lacking in the system (Mantey & Tagoe, 2012; Boamah, 2013; Petio, 2013). To boost effectiveness therefore, there must be openness, as well as availability of and accessibility to property location and other information. Since the taxation process is just like the valuation processes, this can also be carried out using Blockchain. Blockchain will make the identification of registered property easier for taxation as they are readily listed in the system. In this way, the process involved in levying property taxes will become open to stakeholders and give easy access to information queries and clarifications, to make the system open and participatory for transparency. Moreover, taxation records can be kept securely in this system to eliminate inherent illegalities as well as to ensure that all taxes are channeled into the right government coffers since any diversion of taxes will be known on the Blockchain system.

In view of the transparency challenges of the land administration processes in the foregoing discussions, the current Ghanaian system of land use planning and development has been criticized, despite the requirement for all developments to proceed with issuing development permits (Mantey & Tagoe, 2012). The argument underlying this critique is that the system does not promote compliance (Boamah, 2013; Awuah et al., 2014). This is a problem not only in Ghana but across the sub-Saharan Africa region. The authors in Awuah & Hammond, (2014) noted that between 50% and 75% of all the new houses in the region's cities were developed on lands delivered through processes that do not comply with all the legal requirements. In Ghana, Awuah & Hammond, (2014) again noted that 31% of property owner respondents had building permits while 69% had no building permits, and neither were they in the process of or taking steps with

the aim of acquiring one. Of the 31% respondents that had building permits, only 23.3% had acquired permits prior to starting construction, while 76.7% did so subsequently to their building commencement (Awuah & Hammond, 2014). The educated and formal sector employees who were aware of land use planning and development were the most that had building permits and 'there is the likelihood for such people to have connections and influence to aid their acquisition of building permit' (Awuah & Hammond, 2014, p. 21). Without such connections and influence, a person is likely to face challenges like unnecessary delays, and the paying of illegal monies, just as was seen under the land registration process, before they can receive permits to commence developments (Awuah & Hammond, 2014). There is therefore negative trust perceptions for land use planning and development officials, and the system (Siiba et al., 2017). In Kuusaana & Eledi, (2015) the authors identified a lack of involvement and or participation and better knowledge of land use planning amongst the majority of citizens, and recommended 'the need for planning authorities to adopt participatory land use planning together with customary landholders, and educating them on the essence of comprehensive land use planning approaches' (Kuusaana & Eledi, 2015, p. 4; Shuaib et al., 2020). These problems account for the low compliance with land use planning and development regulations, leading to a high rate of unauthorized developments. Land use planning and development processes need to be as open and as transparent as possible to allow for equal awareness, better knowledge, and accessibility to the system for all citizens. Adopting participatory approaches to planning by involving citizens, particularly those affected by the planning scheme, is a means to create awareness and to boost trust for the system (Goderdzishvili et al., 2018). Blockchain technology which integrates all stakeholders in a transaction and decision-making processes can facilitate the participatory planning approaches. A permissionless public Blockchain (this allows all stakeholders to have open access, join, and partake in decisions without restrictions) is useful in this sense (Makala & Anand, 2018). Citizens have to sign up to this permissionless Blockchain via their computers or other supportive devices. They will then be assigned confidential private keys with which to sign into the system every time to be able to initiate a request or partake in discussions or transactions as seen in Figure 16 under findings. No external permission is necessary. Therefore, stakeholders can login to see all land use planning and development discussions and actions, follow it and contribute to it where necessary. To achieve this will, however, require intensive public education and awareness creation for the majority of citizens to know the use and be able to partake in the system. If this is done, it can improve more citizenry participation in processes and decisions on land use planning and development. The improved accessibility and participatory processes can consequently enhance openness, transparency, and increased trust among stakeholders. This is because it is impossible to hide decisions and processes from any stakeholder. Digitizing land use planning and development processes and data on Blockchain system will therefore integrate all stakeholders. In this way, stakeholders can monitor areas for which land use permits have been granted and areas for which they have not been granted since these data will reflect on the Blockchain system, and be known to all stakeholders. Citizens can then act as watchdogs, and to report on any developments that commence without the right approval. This can help to end the non-compliance to land use planning and development schemes, as well as the indiscriminate and unauthorized developments.

Improved participation through the use of a Blockchain system for land transaction helps citizens to have control and security over the data. This enhances the take-up and trust in government institutions and processes to support sustainable economic growth as identified in the implementation of Georgia's Blockchain land registration project (Goderdzishvili et al., 2018). A counter argument that such an improved open accessibility and participatory process can lead to opportunistic behaviors and misinformation can be made. However, Blockchain's design architecture provides for systematic review and checks for all decisions and information. This is done by the majority stakeholders through the verification and validation (consensus mechanism) of data based on the good knowledge of actual grounds work, sources, history, and credibility of the stakeholder that is making or giving such decisions and data before they are accepted as true and authentic (Thakur et al., 2019). Based on the Blockchain's elements of distributive decentralization (which integrates all land stakeholders), the consensus mechanism, hashing of records, immutability, and synchronization of data, land administration processes can be carried out in a way that is open to all stakeholders to ensure transparency, enhance trust amongst stakeholders, as well as achieve up-to-date data at all times for land decisions. This can be achieved by adopting a single permissionless public Blockchain system for the different land administration divisions and their processes. The manual land administration functions like surveying and physical inspections will still be manual but can now be done with all other stakeholders being aware. This is because, Blockchain is a decentralized technology and permits everyone on the system to know and be aware when each of the land transaction stages is due. This allows stakeholders to be able to follow, and to keep an oversight check on these processes to confirm accuracy through validation. Applying Blockchain across all processes of land administration in such a simultaneous approach has synergistic effects of real-time data update, accessibility, and openness across them. This makes it easier for each stakeholder to keep-up, and to participate in decisions and transactions. It also ensures easy access to readily available land data for all interested stakeholders.

4.6 Conclusions

This paper aimed to identify the essential elements and relations between the Blockchain technology and transparency of land administration in the existing literature, and to assess the potential of Blockchain to improve the transparency of land administration processes—based on the context from Ghana. These aims were achieved through a comprehensive review of all the land administration processes in Ghana, the inherent transparency issues in them, and the possibility of Blockchain to support and enhance transparency in these processes simultaneously. The paper argued and demonstrated that the completeness of land administration transparency is when transparency is achieved across all land administration processes, and stakeholders simultaneously. A single permissionless public Blockchain can help achieve this. However, there is the need for the different land divisions to establish standardization in the land administration processes prior to the Blockchain's application in such a compressive approach. This is because, where there is no such standardization, there is a high possibility of inconsistencies and irregularities in the processes across the different divisions which can affect the efficient working of the Blockchain system across all the divisions.

This study is relevant for all land stakeholders, as it provides a better understanding, and an interpretive approach to the social and political realities of land administration in Ghana. It has also extended the discourse on the topic and offers a quick and easy reference guide for scholars, practitioners, and policy makers as hitherto, land administration processes and transparency issues in Ghana have been discussed individually, in piecemeal and scattered across different works, which hindered a better appreciation of the topic due to the polarization and different epistemological views (Petio, 2013; Awuah et al., 2014; Obeng-odoom, 2014; Fuseini & Kemp, 2015; Kuusaana, 2015; Agyemang & Morrison, 2017; Kleemann et al., 2017).

As part of the policy implications for Blockchain adoption, there should be a review of all paper-based land transactions for errors and corrections, and a comprehensive digitization of land administration transactions and processes in the country, in addition to the public–private partnership in the Blockchain-based land administration process. Again, an intensive public education, particularly for land stakeholders, is necessary to understand the Blockchain system before implementation can begin. Finally, as seen in the findings, Blockchains will affect the institutional relations and shared authorities between all stakeholders which include government agencies, local chiefs and individual landowners. This is because, land decisions and associated activities are no longer dependent on a single party, but are going to be a shared effort. It is therefore important that this new decentralized and shared authority be deliberated, and negotiated to reach a consensus, particularly with the chiefs. This is because chiefs own 80% of land in Ghana and hence, there is a need for their consent and cooperation if Blockchain implementation can be successful. As a consequence to establishing this, Blockchain can fundamentally change the transparency variations in land administration to be more equal and homogeneous, regardless of the type of land.

The nascent nature of the topic area, and limited conceptualizations, hindered the ability to explore more options and in further detail, the Blockchain architecture types that can possibly support such a comprehensive transparency of land administration as presented in this study. We therefore recommend that future research focuses on exploring this area. Moreover, since this study focused mainly on statutory land administration processes, future research works should consider the topic from the customary land administration perspective especially, given that customary lands cover 80% of land in Ghana, are governed by different indigenous customary laws, and are based on a low level of technological how-how. Finally, future researcher works, and potential institutions for Blockchain adoption, should be aware of and take into consideration the technology's flaws in terms of limited storage capacity, the limitations to its scalability and speed, as well as the huge electricity consumption for its operation.

Chapter 5.

Toward Smart Land Management: Land Acquisition and the Associated Challenges in Ghana. A Look into a Blockchain Digital Land Registry for Prospects[4]

Abstract

Land acquisition in Ghana is fraught with challenges of multiple sales, numerous unofficial charges, unnecessary bureaucracies, intrusion of unqualified middlemen, and lack of transparency among others. Studies have suggested digitization as a way forward to improve Ghana's land management system and to address these acquisition challenges. However, none of these studies have specifically provided a clear conceptual digital framework for land acquisition. Most contemporary land literature globally appraise Blockchain technology as a potential solution to these challenges in Ghana's land acquisition process. This article applies an integrative review, mixed with strengths, weaknesses, opportunities, and threats (SWOT) analysis, and deductive lessons from a digital land registry concept to develop a Blockchain-based smart land acquisition framework solution in view of Ghana's land acquisition challenges. However, it is identified that threats of sabotage of this framework exist among some customary land owners, land officials, and private Blockchain-based land experts for various reasons. Among others, a legal basis for a public–private partnership is recommended particularly to discourage sabotage from private Blockchain-based land experts. I recommend future research works to delve into establishing a framework that can be used as a guide to assess the readiness of land management and land administration systems for Blockchain consideration in sub-Sahara Africa, particularly Ghana.

Keywords: smart land management; land acquisition process; public lands; customary lands; Blockchain; Ghana

5.0 Introduction

Land acquisition in Ghana is organized along two main lines: Customary and statutory or public. This is because, in a broader view, land in Ghana falls under customary and public management (Kuusaana & Eledi, 2015; Abubakari et al., 2018; Mabe et al., 2019). Customary lands are managed on the basis of customary laws and traditions of specific traditional/customary areas in the country. Public lands on the other hand are managed on the basis of State laws and Acts. Customary lands make up 80% of lands in Ghana, while public lands make up 20% (18% being lands compulsorily acquired by the State from customary authorities, and the remaining 2% being lands whose legal management has been vested in the state to act as trustees on behalf of the

[4] *This chapter has been published in an international peer reviewed journal as:*
Toward Smart Land Management: Land Acquisition and the Associated Challenges in Ghana. A Look into a Blockchain Digital Land Registry for Prospects https://doi.org/10.3390/land10030239

customary owners) (Quaye, 2014; Kuusaana & Eledi, 2015; Gyamera, 2018; Mabe et al., 2019). Customary lands therefore provide the largest market base for land acquisition in Ghana, both for private individuals and corporate bodies. This is similar in some other African countries like Uganda, Kenya, and Zambia (Deininger & Castagnini, 2006; Nkurunziza, 2007; Sifuna, 2009; Chitonge et al., 2017; Chimhowu, 2019; Elong et al., 2019). Quaye, (2014) noted that between 70% and 90% of land market participants across Africa rely on processes involving customary institutions when making land transaction decisions. In certain instances, the government falls on customary authorities to acquire land for governmental projects in the interest of the people (Amone & Lakwo, 2014; Udoka, 2017; Elong et al., 2019). In Ghana, government's land acquisition is usually done through the power of eminent domain/escheat, otherwise known as compulsory acquisition as provided under Article 20(5) of the 1992 constitution of Ghana, and under the State Lands Act 1962 (Act 125) (Government of Ghana, 1993; Kwofie & Afranie, 2013). Although public lands offer an alternative market for land acquisition to private individuals, and corporate bodies, land acquisition from the public lands is to an extent, on a limited basis. This is because public land acquisitions have certain restrictions that make it difficult for open accessibility by all individuals. Article 20 clauses (1) and (6) of the 1992 constitution makes this clear. Article 20(1a) permits the State to compulsorily acquire any land in Ghana for such purposes as is "in the interest of defense, public safety, public order, public morality, public health, town and country planning or the development or utilization of property in such a manner as to promote the public benefit." Clause (6) further states that "Where the property is not used in the public interest or for the purpose for which it was acquired, the owner of the property immediately before the compulsory acquisition, shall be given the first option for acquiring the property" (Government of Ghana, 1993 pp. 24–25). This clause creates a limitation on the availability of public lands to all people and this pushes most people to fall on the customary sector for land acquisition.

For public land acquisition, a prospective purchaser makes an application to the Lands Commission (L.C) (Gyamera, 2018). There are formal steps laid down such as: Receipt of the application by the lands commission, approval of the application, invitation of the applicant for inspection, and thereafter, beginning the processing of the purchase through the opening of a file on the land, preparing the site plan and cadastral plan, among other formalities. The payment of all administrative costs including costs of registration are made before the final registration in the name of the purchaser (Ehwi & Asante, 2016; Gyamera, 2018). Customary land acquisition on the other hand involves visiting the customary land owners to declare one's intentions for a piece of land to purchase. Depending on the customs of the particular customary area, and availability of land, the prospective purchaser is taken to see the land (Gyamera, 2018; Mintah et al., 2020). The necessary customs are performed and the price for the piece of land is paid (Mintah et al., 2020). Regardless of the source of land, whether it is from the public or the customary sector, land acquisition in Ghana has been criticized to be fraught with several challenges. Among these challenges are: Double sales of land, difficulty in getting reliable land information by prospective purchasers, numerous unofficial charges in the acquisition processes, issuance of unreliable land documents to innocent and unsuspecting land purchasers, fraudulent land transactions, delayed delivery of land documents, and long processing times for concluding land acquisition, among others (Maha-Atma, 2014; Quaye, 2014; Mireku et al., 2016; Gyamera, 2018). These challenges

have been responsible for many other problems in the land sector: Land disputes and litigations that lead to deaths in some cases, the use of armed thugs (commonly referred to as land guards) who are kept on the land to scare off or beat counter claimants just to protect land, and also a huge backlog of land dispute cases at the law courts of Ghana that ultimately affect the pace of delivering justice in the court system (Maha-Atma, 2014). In attempts to resolve these issues, both the public and customary land management institutions have put in measures to provide for well-structured land acquisition mechanisms through the customary land secretariats system (CLSs), the deed registration, and the title registrations systems (Mireku et al., 2016). Although these are in the right directions, the majority of the challenges still persist. This has been attributed mainly to the manual or paper-based approach to land transaction processes in the Ghanaian land sector (Mireku et al., 2016). This manual system hinders accessibility to credible land information, it does not the permit real-time update of land transaction records, and again, it hinders transparency amongst stakeholders to land transactions Ameyaw & de Vries, (2020) especially where some parties have selfish motives. To overcome the challenges of the current acquisition processes and to enhance land acquisition, digitizing land management processes have been recommended by many studies as a way forward in Ghana's land system (Oberdorf, 2017; Agbesi & Tahiru, 2020; Mintah et al., 2020). In contemporary times, many land management systems have turned to digitization given the enormous benefits of a digital land management system like faster and convenient land services delivery, improved transparency in land transactions, and enhancement of trust among stakeholders (Shang & Price, 2019). This move toward digitization is also partly due to the presence of technological alternatives in modern times (especially smart technologies like Blockchain and artificial intelligence) that support such a system. This study relies on documented secondary data on land management and land acquisition in Ghana, documented data on Blockchain's potentials to land management, and on documented metadata of a digital land registry concept by a private company, BenBen in Ghana, to address the following research objectives:

1. To assess and identify the main challenges of the current land acquisition processes in Ghana.

2. To explore opportunities and ways to address the land acquisition challenges.

3. To conceptualize a smart land acquisition process that can help eliminate the identified challenges in the land acquisition processes in Ghana.

In the subsequent section, the study provides an overview of smart land management concept and Blockchain technology. This is then followed by the theoretical perspective and then methodology. The findings follow next, and a discussion of the findings is made thereafter. The study ends with a conclusion.

5.1 Smart Land Management and Blockchain Technology

Technological application to land management is not new, as many advanced countries including the Netherlands, Germany, and the United Kingdom among others have had digitized land management systems for many years now. In some developing countries across the world like Ghana, Nigeria, and Honduras, however, this could arguably be somewhat new as land

management in these areas has predominantly been manual and paper-based (Oberdorf, 2017; Benbunan-Fich & Castellanos, 2018; Ekemode et al., 2019). Employing smart technologies for land management services and processes underline the concept of smart land management. In this context, smartness is defined by (de Vries et al., 2020 p. 5) as "*the combination of both smart citizens, who are able to use information and communication technologies to advocate and pursue their interests, and on smart information- processing, i.e. facilities which can fuse data from all types of sources and platforms*." Chigbu et al., (2018) corroborate this definition and noted that although some technologies could be employed passively, the issue of smartness goes far beyond the mere uptake of the technology, to include the alternative manners in which citizens express their voice and claim their rights. Consequently, applying smart technologies to land management, de Vries et al., (2020) define smart land management as land interventions that rely on both passive and/or active information sensors (generated by technological means and also based on voluntary and structured information contributions by citizens) before, during, and after the decision-making process with regards to land. In (Zevenbergen et al., 2015 p. 274) they also define it as "*the kind of processes that uses social technologies, volunteered geographic information, and crowdsourcing in combination with technical drivers of intelligent information systems and big, linked, and open data*." Smart land management strategies can facilitate the efforts toward sustainable development (Lü et al., 2019). This is especially true in the sub-Saharan Africa region, where the largest source of employment to the population is dependent on land Chiiweshe et al., (2013) and yet have high land institutional and management weaknesses. The discussions in contemporary land management literature on smart technologies for land management thus become very relevant in the context of the sub-Saharan Africa region. Smart technologies for land management according to de Vries et al., (2020) are persuasive and disruptive in functionality. "Technologies are persuasive if they come without coercion, manipulation, or deception and yet change socioeconomic relations, perceptions and expectations." They are disruptive where their innovations displace and replace existing socio-organizational structures and workflows, interpersonal and inter-institutional relations, utilization of technologies, and societal situations de Vries et al., (2020 p. 279). Smart technologies for smart land management operate in ways that change the conventional processes of land management systems that do not better address associated land challenges, or that are less robust to deliver the expected land management results for citizens. These changes can occur in part of a land management process or by means of a complete overhaul and replacement of a specific land management process. In essence, smart land management complements the traditional land management processes by establishing omnichannel services (i.e., enterprises that use both online and offline channels for communicating and distributing their products) (Chun et al., 2021). In addition to smart technologies application, smart land management relies on citizens that have the capacity to utilize information technology to advance their courses of actions and interests in a more efficient manner. Hence, a smart land management system is one that seeks to address land challenges through Information communication technology (ICT)-based solutions on the basis of multi-stakeholder connection and transparency. A well-known technology with such a functionality is the Blockchain.

Blockchain technology has received numerous citations in recent land studies in relation to smart land management (Miscione et al., 2020). Among other benefits to land management, Blockchain

is acknowledged for potential changes in land management by creating a more open, democratic, and trusted system (Crosby et al., 2016; Karamitsos et al., 2018; Veuger, 2018; Xu et al., 2019; Miscione et al., 2020). The potentials of Blockchain, coupled with the recent ongoing discourses and advocacy toward smart land management, form part of the underlying factors accounting for the reasons why several countries, and scholars, are piloting and writing about the technology respectively (Collindres et al., 2016; Lemieux, 2017b; Salmeling & Fransson, 2017a; Vos et al., 2017; Goderdzishvili et al., 2018; Lazuashvili et al., 2019; Shang & Price, 2019; Lazuashvili et al., 2019; Thakur et al., 2019; Khan et al., 2020; Miscione et al., 2020) . In these different studies, the benefits of Blockchain as a smart technology for land management have centered on its ability to enhance transparency, trust, and land data security. It also enhances data quality, accuracy, and integrity through a consensus mechanism amongst stakeholders, and again, it allows for easy information accessibility, traceability of land records, elimination of fraud, corruption, unscrupulous manipulation of land records, and multiple sales of land (Salmeling & Fransson, 2017a; Eder, 2019; Kaczorowska, 2019; Ramya et al., 2019; Rizal Batubara et al., 2019; Thakur et al., 2019; Ali et al., 2020; Ameyaw & de Vries, 2020; Shuaib et al., 2020). The benefits of Blockchain are not limited to land management alone, but to other public administration fields like the finance sector, and supply chain management. This has led to increasing global attention on Blockchain across diverse disciplines as is evident in the numerous international conferences, workshops, and seminars focusing on Blockchain technology. These programs aim at bringing practitioners, scholars, and policy-makers together for knowledge sharing and awareness creation on the potentials and new possibilities of Blockchain, and how to maximize these possibilities in both the private and public sectors alike. Examples of such programs in the year 2020 included: Virtual Roundtable Webinar on the Impacts of Blockchain Technologies on Land Registries and Land Governance (7th October, 2020), Blockchain Africa Conference in Johannesburg, South Africa (11–12 March, 2020), European Blockchain Convention in Barcelona, Spain (20–21 January, 2020), Paris Blockchain Week Summit (9–10 Dec, 2020), Supply Chain on Blockchain Conference in Fishburners Event Space, Brisbane, Australia (13th July, 2020), and Blockchain Expo Global in London (17–18 March, 2020).

In the recent years, different countries including the Republic of Georgia, Canada, Japan, Sweden, Brazil, India, Honduras, and Ghana among others have introduced and/or attempted the introduction of Blockchain into their land management systems on both private and public basis for different land administration functions; land titling and registration, land recordation, and land information management (Torun, 2017; Mcmurren et al., 2018; Themistocleous, 2018; Lazuashvili et al., 2019; Shuaib et al., 2020). The outcomes from these applications have been subject of professional and academic discourses. These discourses have among others focused on whether or not the technology is mature enough and ready for employment to land management given the nascent nature of the concept of Blockchain in the land sector. Many writers believe that the technology is mature enough to effect greater changes to land management, while others still argue that the technology is new and not mature enough for land management and land administration functions in full course (Lemmen et al., 2017; Vos et al., 2017; Eder, 2019; Kaczorowska, 2019; Müller & Seifert, 2019). These different positions have raised some quandaries, and questions in the land discipline at the global level. This makes further research timely and opportune,

specifically toward evaluating the application situations of Blockchain technology in the land sector. Such research works will enhance and enrich the conceptualizations and understandings surrounding Blockchain's application to land management. In the sub-Sahara African region, there exist limited literature specifically dedicated to looking at the actual application situations of Blockchain technology in support of land acquisition, despite attempts, deliberations, and/or considerations for its general application in land management and land administration in countries like Ghana, Kenya, Rwanda, Zambia, and South Africa (Tilbury et al., 2019). This study therefore fills this gap in the literature using deduced lessons from a Blockchain-based digital land registry concept in Ghana.

Following the discussion and given that the idea of smart land management looks at how existing systems and processes could be altered and/or replaced through ICT-based solutions, it evokes the notion of producing new ways, systems, or processes for enhancing land management. This idea is underpinned by production and reproduction of systems and is explained by structuration theory as presented in the section below.

5.2 Theoretical Perspective

Based on Ghana's unique land tenure and land acquisition system, the structuration theory (ST) provides a better way to understand the system (Miscione et al., 2020). Structuration is the production and reproduction of a social system interaction (Mcphee et al., 2020). ST hinges on the differences between systems and structures. "A system is an observable pattern of relationships among actors," while "Structures are the rules and resources that actors depend on in their practices." Structures underlie the patterns that constitute systems. A rule is any principle or routine that can guide an activity, while a resource is anything else that facilitates activities (Mcphee et al., 2020 p. 76). ST provides an apprehension of human work as a social interaction within a culture, and this interaction is facilitated by artifacts (resource) such as tools, rules, and procedures, which are open to change (Wanyama & Qin, 2010). Employing a technological tool in mediation of a land management process toward a desired output is thus contingent on the ST. Blockchain thus constitutes a resource or an artifact in context of its application to facilitate land acquisition processes. In (Bagla & Gupta, 2011; Miscione et al., 2020), the writers note that structuration theory is applicable to or translates into information system research. This idea "moves the traditional dichotomy between structures and agencies to an analytical (rather than empirical) level, and can help in understanding if and how a land management system reproduces existing structures by facilitating established courses of action" (Miscione et al., 2020 p. 139). Agents refer to humans who draw on structural resources (Miscione et al., 2020). Production is when agents base on rules/resources to act meaningfully, while reproduction is when those actions maintain or transform the rules.

According to (Miscione et al., 2020 p. 140) "Structuration theory is a relevant lens to look at Blockchain and land registries, because it allows us to see how social structures are reproduced, and how they may harmonize or clash when they enter in the interplay with new land registries." For example, if a digital land registry is introduced and it provides an alternative to the existing land acquisition process in Ghana, the interplay of the existing system and the digital system to

reproduce a much better system or to clash is hinged on ST. In the Ghanaian context, the existing rules on land acquisition processes allow for numerous challenges in both the public and customary land sectors. This is because structures like avenues for inquiries and for searches could unnecessarily delay the process, and this leads to unofficial payments as bribes in some instances just to get the structures to work accordingly. These issues necessitate a reproduction to transform the rules for the better. "Conceptualizing technology in use as a process of enactment opens up a better understanding of how practices change" (Miscione et al., 2020 p. 139). From a Blockchain perspective in transforming the existing land acquisition processes, the existing negotiations and contestations in the current processes will translate into the consensus building among agents on a Blockchain system. This and other effects of the Blockchain technology open up the current land acquisition process for the necessary changes.

5.3 Materials and Methods

5.3.1 Research Area, Approach, and Boundaries

This study is based on the land acquisition process in a sub-Sahara African context, specifically Ghana, as the study area. Ghana has a total land mass of 238,539 km2 (Gyamera, 2018). The 2010 population census pegged Ghana's population at 24,658,823 and an estimated 60% of this is employed in the agricultural sector (Ghana Statistical Service, 2013). This shows the imports of land to Ghana's economy. The country has a dual land-tenure system organized and managed along statutory laws and customary laws. This dual system in Ghana gives a unique feature and novelty to the idea of assessing the possibility of Blockchain technology's application to the system. This is because, in many areas of the world where the concept of Blockchain application to land management has been tested and succeeded like in Georgia, they have single land-tenure and management systems. Ghana was also selected specifically based on the authors' in-depth knowledge and experiences in the land tenure and land management system of the country. In the last decades, efforts toward better land management and land administration systems have been witnessed in Ghana and many other African countries as well. Examples include the Land Right Reform in Uganda Hunt, (2004) the establishment of the Kaduna Geographic Information System (KADGIS) Law of 2015 in Nigeria (Nwuba & Nuhu, 2018) and the Community Lands Act of 2016 in Kenya (Wily, 2018). In Ghana, some of these reforms included the National Land Policy (NLP) in 1999, and recently, the Land Bill of Ghana 2019 passed in 2020. Another reform is the Land Administration Project (LAP), which was a joint project of the government of Ghana and partner organizations including the World Bank and others. This initiative was geared towards improving the Ghanaian land sector and land services delivery. Some focus areas under this initiative were land registration to enhance land tenure security for all especially women, resourcing and revamping the customary land sector to improve customary land management, establishment of alternative dispute resolution centers to support the huge backlog of land cases in courts, among others (Ehwi & Asante, 2016). Despite these efforts, the land registry in Ghana still suffers challenges of inaccurate land data, lack of up-to-date land records, a complex web of land institutions with overlaps that lead to unnecessary bureaucracy, lack of transparency, and a paper-

based system that allows for corrupt deals, among others. Similar challenges are identified in the land registries of some other African countries like Rwanda, Uganda, and Nigeria. These challenges and given the authors' rich knowledge in the Ghanaian context make Ghana a study area worth considering in regard of Blockchain's potentials for land management, specifically land acquisition challenges.

This review study is based on secondary data combined with semi-informal discussions with field experts, particularly in the area of Blockchain's application to land. This approach was considered useful given that the topic area is new and evolving with a limited literature base which makes it appropriate to support it with expert views. A similar approach was used in (Mintah et al., 2020). Compared to other review methodologies like systematic and semi-systematic, the integrative review method is considered suitable for such new topics as this one (Torraco, 2016). The research methodology was based on an integrative interpretation process of existing documentations and literature, with the aim of re-conceptualizing land acquisition processes in Ghana. Integrative reviews assess, critique, and synthesize existing literature in ways that evoke new theoretical frameworks and perspectives (Torraco, 2005; Snyder, 2019). Based on explorative design, the study follows the rationalist theory of sense making as an epistemology to deduct scientific knowledge (Webster & Watson, 2002; Torraco, 2016). A researcher's initial acquaintance, understanding, and knowledge thus play a vital role in this methodology as these help to do a critical review and analysis in ways that offer a better opportunity to assess pending developments and to identify factors that are shaping the future of new concepts in the particular field (Webster & Watson, 2002; Torraco, 2016). The critiquing and analysis open up relationships, gaps, deficiencies, and contradictions in existing literature. This makes it possible to rethink the topic and to improve scientific knowledge by extension and/or reconceptualization (Torraco, 2016). This method has been used in similar studies (Ameyaw & de Vries, 2020; Ntihinyurwa & de Vries, 2020a). Integrative reviews are, however, criticized as a mere summary of existing studies, with no specific standards, and therefore lack rigor compared to systematic reviews (Torraco, 2005; Snyder, 2019). In overcoming this, I combined the integrative review with informal discussions with experts, and also with SWOT analysis which permits an effective analysis of an institution's resources and environment to help position it better (Phadermrod et al., 2016). This has been used in similar land management studies (Yan et al., 2015; Global Land Tool Network, 2015).

Based on the objectives of the study, the review focused on discussions on land acquisition in both the Ghanaian public and customary land sectors as a contextual boundary. However, where applicable, literature from other African countries with similarities were reviewed. A combination of text narratives and visual representations or models were used in organizing the study as these are considered suitable organizational strategies for integrative literature analysis and synthesis (Webster & Watson, 2002; Torraco, 2016; Ntihinyurwa & de Vries, 2020b). SWOT analysis was used because the existing land acquisition processes in the country have certain inherent characteristics that, together, can allow for and support the call for the need to design a better alternative. SWOT analysis provides a basis for a strategic planning framework design (Yan et al., 2015). This approach guided the study to come up with certain strategies deduced from a matching of the inherent strengths of the land sector to the inherent weaknesses (SW), and also, the external opportunities to the possible threats (OT) to arrive at SW strategies and OT strategies. These

strategies, together with lessons deduced from a digital land registry concept, guided the conceptualization of a new framework for land acquisition in Ghana. Literature based on empirical studies and review studies in the English language from all sources was used without any spatial and temporal boundaries. English is the language that the authors have mastery knowledge of and, hence, only literature in English was used to avoid any linguistic biases. The scope of the literature review centered on land tenure, land management, and land acquisition in Ghana, Blockchain and its potentials in the context of land management. The next sub-section looks at literature identification processes and sources, reviews, analyses, syntheses, modeling/reconceptualization, and the means of scientific knowledge extension. This is summarized in Figure 23 below.

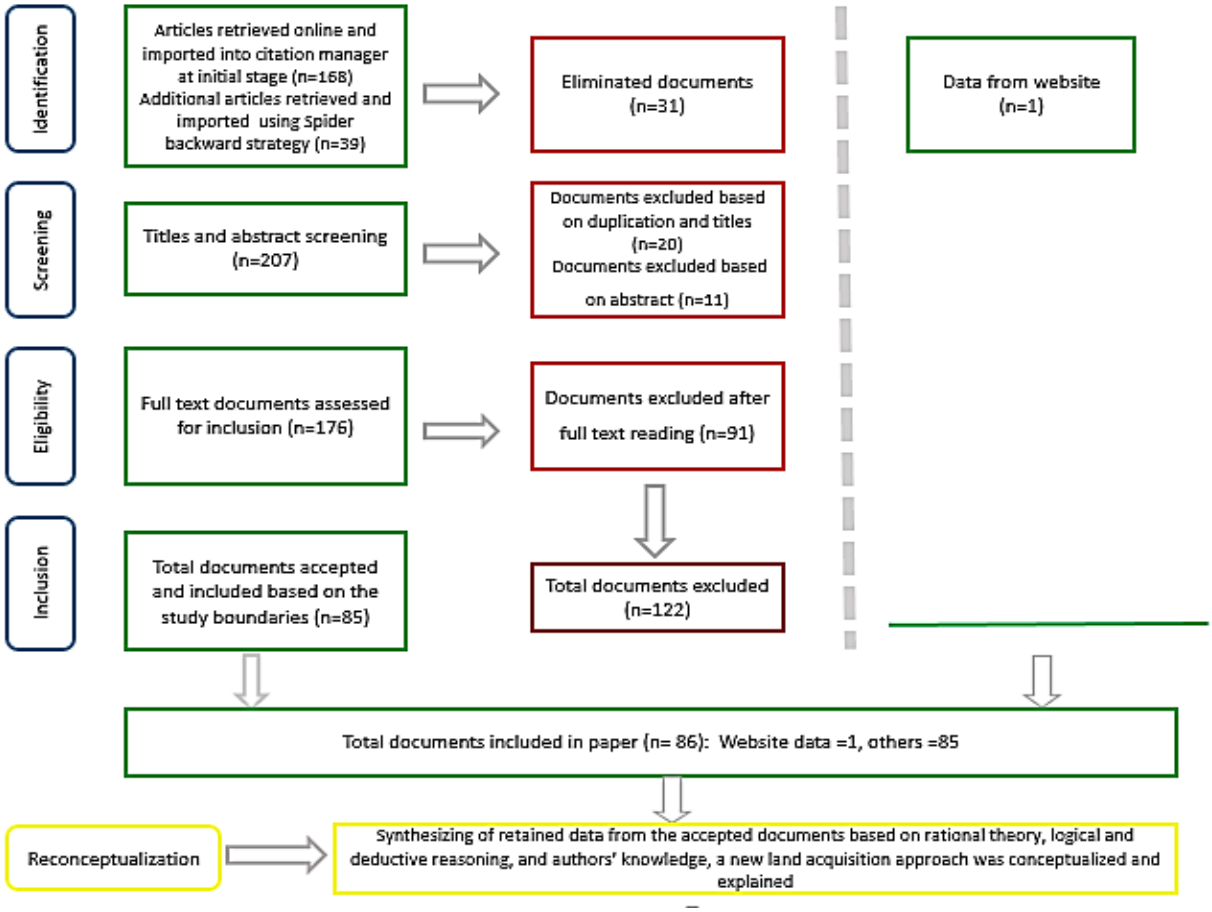


Figure 23. Overview of research design and methods

Source: Authors' construct.

5.4 Research Area, Design, and Methods

Being a review paper, the study is based on a qualitative explorative design. Secondary data were collected from websites and different scientific databases, mainly Google Scholar, Elsevier, Springer Link, Scopus, JSTOR, Research Gate, Web of Science, and Taylor and Francis. Guided by the main concepts in the study, the literature search was carried out in a systematic approach

using keywords and phrases like land management in Ghana, land acquisition in Ghana, customary land management in Ghana, land tenure in Ghana, public and or state land management in Ghana, land challenges in Ghana, smart land management, smart technologies, Blockchain technologies, Blockchain for land management, land tenure in Africa, land management challenges in Africa, and Blockchain and land in Ghana. I used diverse synonymous keywords and phrases across the different scientific databases. This facilitated access to a large volume of documents on the topic, and allowed for a validity and reliability check. The search was concluded when further searches across these different databases continually returned documents that had already been identified, and further assembling only led to duplication. In addition, as is in line with data sampling, when at a point there appears to be no new insights or data coming up other than those that have already been identified, the data gathering is considered to have reached a saturation point and, thus, there is no need to continue (Boeije, 2002; Creswell, 2014; Saunders et al., 2016). The identified documents and the ones finally accepted and used for this study are considered a representative of the topic under study in the Ghanaian context as our search covered the available literature on the topic mainly in the Ghanaian contextual boundary, although references were made to other African countries in certain instances. With regards to documents on smart land management and Blockchain technology's application to land management, they are both new concepts and have very limited literature base as the conceptualization and theorization of both concepts are still evolving. The study, however, tried and identified the most authoritative literature in this regard. Aside the above data source, email inquiries and telephone calls were also used to engage some experts in informal discussions on the topic. These provided some essential feedback that constituted some findings, and also guided the analysis and synthesis. At the end of our literature search, the initial search produced 168 documents. The review of these documents started with the reading of titles and abstracts in some instances. This led to elimination of some documents due to duplication, while others fell outside the scope of the research boundaries. In total, 137 documents were retained after this stage for the detailed and critical full text reading. The full text reading helped to identify the extent to which the documents discussed the topic, and revealed the missing gaps, similarities, and contradictions, all of which helped in the formulation of the research problem and the objectives. During the full text reading, relevant citations and references that were identified were traced back to their original sources for identification and review. This strategy is termed as the backward spider literature search (Uwayezu & de Vries, 2019). This strategy resulted in 39 more additional documents to make a total of 207 documents in all. The first review stage of these backward spider-retrieved documents, based on the study's boundaries, led to acceptance of 22 of them. In total, therefore, 176 documents were accepted for full text detailed and critical reading and review analysis. In the end, 86 of these documents were accepted and used for the study.

5.5 Results

This section and its subsections present the results that emerged from the literature review, website metadata, and informal discussions with field experts. The sections focus on public and customary land tenure management, particularly land acquisition processes and associated challenges under

both systems. It also presents our findings on a Blockchain land registry concept as identified from our informal discussions and retrieved metadata from the website.

5.5.1 General overview of Land Transactions, and Associated Challenges in Ghana

5.5.2 Public Land Tenure, Land Acquisition, and the Associated Challenges

As indicated in the introduction, public lands in Ghana fall under government's control. Article 257(1) of Ghana's constitution states that "All public lands in Ghana shall be vested in the President on behalf of, and in trust for, the people of Ghana" (Government of Ghana, 1993 p. 97). The state has absolute ownership of public lands. These are lands that, in previous times, belonged to the traditional or customary authorities but have been compulsorily acquired by the Government through the power of eminent domain, for its administrative and development functions (Gyamera, 2018). This category makes up 18% of the entire 20% of all lands that fall under government's control and management. The remaining 2% are referred to as vested lands. Although vested lands had not been compulsorily acquired from the traditional authorities, government has vested the legal management of all such lands in itself (Mabe et al., 2019). The original traditional authorities that owned these lands, however, continue to hold and enjoy the beneficiary interest and are entitled to certain percentages of proceeds or revenues that the government realizes from such lands (Mabe et al., 2019). Despite the differences in public lands and vested lands, there is not much difference in transactions pertaining to both land forms. Lands commission (L.C) is the mandated governmental institution that oversees the management of all such lands on behalf of the government, Article 258(1a) (Government of Ghana, 1993). Prospective purchasers go through the lands commission to access both forms of lands. An application for land is first made to the commission and a decision is made on the application. Figure 24 below shows the various procedures involved in acquisition of public lands in Ghana.

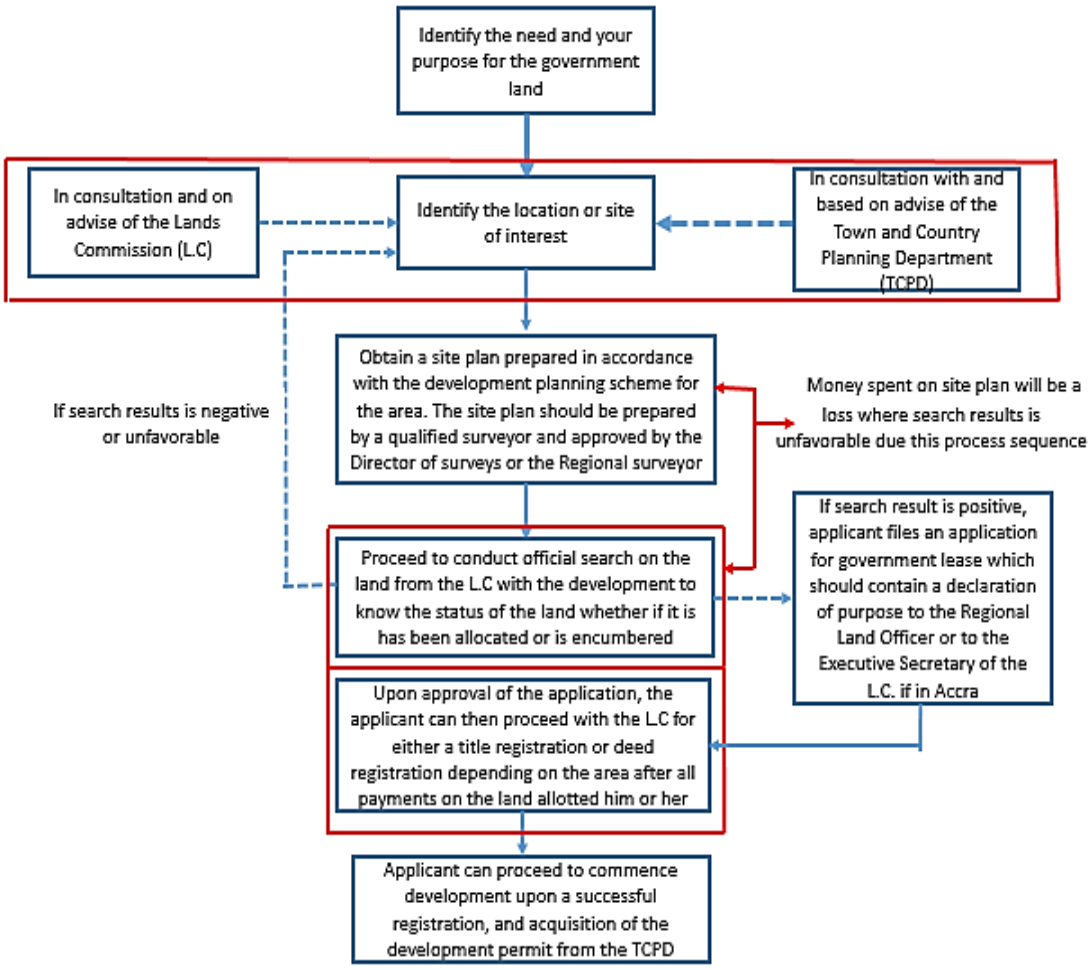


Figure 24. Public land acquisition process in Ghana

Source: Author's construct based on literature.

One will think that the above procedure appears very logical and sequential that—if followed accordingly—could provide for smooth land transactions. However, there are inherent challenges in certain stages of the process that are worth considering. The areas captured in the red boxes above are fraught with certain challenges. The foremost challenge is the high cost involved (Antwi & Adams, 2003; Danso & Manu, 2013; Khan et al., 2020). The process has been criticized to be highly costly, which has been attributed to numerous informal charges at the different stages. Besides the actual purchasing value to be paid for the land and other official administrative charges, there are numerous unofficial charges at the different stages of the procedure, which worsen the plight of prospective land purchasers (Ehwi & Asante, 2016). As the process is mainly manual and activities between clients and officials are hardly known to other officials, some unscrupulous land officials use their offices to perpetuate the bad ethic of taking unofficial monies from prospective purchasers before they go ahead to carry out their mandated official services, although clients have already paid all official charges. This is made possible due to the lack of transparency in the process and among institutional divisions, and among stakeholders (Oberdorf, 2017; Ameyaw & de Vries, 2020). This problem is very pronounced at the second stage of the

acquisition process where the clients deal with the different divisions of the Lands commission, and also with the officials of the Town and country planning department (T and CPD). Many such unofficial payments happen at the different offices of these different institutions. In addition, at the stage of conducting a search on the land, most clients usually make unofficial payments to obtain search results. This can be attributed to the fact that within the manual file records-keeping system, it is sometimes very difficult to manually search through many thousands of other files looking for one particular paper file. This could be a daunting task for officials and, in many instances, could take days to weeks to identify such files. This tedious task in many cases is a hurdle and demotivation for officials to start the search process. To get officials to conduct the search as quickly as desired by the clients, most of the clients end up paying unofficial monies to the officials just so they can be motivated to conduct the search and deliver results on time.

A second challenge to land acquisition is the fragmented institutional arrangements, coupled with the overlap of functions due to the lack of consultations and real-time synchronization of actions amongst land institutional divisions, which lead to unnecessary bureaucracies and overlaps (Antwi & Adams, 2003; Maha-Atma, 2014). This is also found mainly at the second, fourth, and sixth stages of the acquisition process. At the second and fourth stages, as the L.C and the T and CPD work together, it would have been expected that a single search can be conducted at the L.C and results should include the results of the T and CPD. This is, however, not the case, and therefore, clients are faced with dealing individually with these institutions during the search. In addition to this and within the L.C, there are four different divisions, Public and Vested Land Management Division (PVLMD), Land Valuation Division (LVD), Survey and Mapping Division (SMD), and the Land Registration Division (LRD) that clients will have to deal with. Again, at the sixth stage during the registration of the deed or title, which is usually tied to public land acquisition, a prospective land purchaser has to deal with the identified divisions and also the T and CPD. Some of the activities at this stage end up overlapping. For instance, there is an inspection conducted by the PVLMD, as well as the LVD. These are activities that could have possibly been harmonized to simplify the process, which is not the case. Some other less obvious activities, particularly office administrative functions, among the different divisions end up overlapping, which complicates and prolongs the acquisition process with unnecessary bureaucracies and many unofficial expenses.

A third challenge is identified in the sequence of the land acquisition stages. There appears a disarray in the order of the land acquisition process. From the above process in Figure 24, given the order of stages 3 and 4, a prospective purchaser will have to contract a qualified surveyor to prepare a site plan and cadastral plan for them, and pay for it before they proceed to conduct an official search on the status of the land with the plan. This order is criticized on the basis where the search result is negative; the money spent on the plan becomes a loss to the purchaser. However, this order is the case, mainly due to the fact that without such a plan, it becomes extremely difficult for the lands commission to obtain the records on the particular piece of land for the prospective purchaser. Ordinarily, it would be expected that this should not be the case since such lands already fall under the commission's management and must have records of all their lands in that respect. Conversely, the commission largely uses manual records keeping, hence, although most lands that are public and fall under the commission's management, it hardly have the records captured in their system, especially in newly developing areas where land use planning

might not have covered or reached yet. By consequence, when a plan is prepared and the exact plot number and location of the land among other details are known to the commission, an effective search can be done. This is seen as a challenge for prospective purchasers because they could end up wasting so much time and money in the process only to end up with negative search results.

The final challenge identified in the acquisition process is not so much embedded in the stages but associated with a weakness in implementing and enforcing policies that guide the acquisition process (Antwi & Adams, 2003). Not only in Ghana is this problem prevalent but very significant across the African continent (Abubakari et al., 2018). This weakness has made way for intrusions of unqualified middlemen into the system (Quaye, 2014). These unqualified middlemen intercept the different stages of the acquisition process, which make it challenging for prospective purchasers. Despite the many divisions and departments involved in the land transaction process, institutional weaknesses in coordinating the works of these divisions, as well as in implementing and enforcing policies, has made way for a lot of unprofessional middlemen to invade the system. Most of these middlemen hang around the lands commission premises, identifying themselves with different offices, and dealing with unsuspecting prospective land buyers. These middlemen in most cases have connections with some of the commission's professional officials that allow them the opportunity to deal with unsuspecting prospective buyers. Apart from complicating the acquisition process stages with unprofessional advices to clients, these middlemen also charge and take huge unofficial fees from the prospective purchasers just to be able to have enough for themselves and for their professional colleagues who help them to be able to carry out such deals. In the worst case situation, a middleman could dupe an unsuspecting purchaser of money and elope with it.

After the above process and identified challenges, when a prospective purchaser's application for the land is finally approved, they then proceed to register the land, and also to get a development permit from the T and CPD before development can commence. These two processes, similar to the acquisition process, are also fraught with many challenges including bribery and corruption, lack of updated land data, lack of transparency, openness and participation for all stakeholders, and difficult accessibility to reliable land information. See (Ameyaw & de Vries, (2020) for details on the procedures involved in the registration and associated challenges.

5.5.3 Customary Land Tenure, Land Transaction, and the Associated Challenges

Customary land tenure holds the remaining 80% of all lands in Ghana, and management is by individual traditional authorities. The traditional authority holds the highest allodial interest (Nara et al., (2014a) in the land, which cannot be alienated. In principle, therefore, it is a usufructuary interest in the form of a lease that is bequeathed to prospective purchasers from the traditional authorities. Different customary areas have different customary laws that govern the management of their lands (Abubakari et al., 2018). Just like the government that holds public lands in trust for the people of Ghana, traditional authorities only hold the land in fiduciary duty for the larger community of the land owning group (Kwofie & Afranie, 2013; Maha-Atma, 2014; Abubakari et al., 2018). The "State shall recognize that the managers of public, stool, skin and family lands are fiduciaries charged with the obligation to discharge their functions for the benefit respectively of

the people of Ghana, of the stool, skin, or family concerned and are accountable as fiduciaries in this regard" Article 36(8) (Government of Ghana, 1993 p. 33). On this basis, and especially in the past, acquisition of land from the customary custodians could vary depending on whether a person belonged to the land holding group or not. In recent times however, due to the high demand for scarce land, Gyamera, (2018) note that land acquisitions do not necessarily consider whether or not a prospective purchaser belongs to the land owning group, although some considerations are possible in certain instances for some customary authorities. This and others account for the differences in customary land management amongst the different customary authorities in the country. For instance, in the Kumasi traditional area, Quaye, (2014) notes that land acquisition is in three stages: (1) Allocation of land by the caretaker or sub-stools, (2) approval by the Asantehene (King of the Ashanti kingdom) as the overlord, and (3) preparation of the lease document within the formal sector. Although formal sector registration under customary land tenure is not compulsorily tied to land acquisition, Quaye, (2014) notes that it is linked to the acquisition procedure under the Kumasi traditional area. In other traditional areas, one is likely to not see this as a compulsory custom attached to land acquisition and thus highlights another difference among the customary traditional authorities.

It is important to mention that although customary land transactions are not under any compulsion for them to be registered within the formal land registration, certain constitutional provisions and Acts on land render all of such customary land transactions ineffective and invalid from the official and legal point of view until they are formalized within State-established land institutions (Antwi & Adams, 2003). This makes land registration necessary even where the land is acquired from the customary sector. Land acquisition under the customary land tenure is consequently linked to the formal land sector, and hence, certain aspects of the acquisition process do involve the government land sectors. Figure 25 below shows the land acquisition process under the customary land tenure system.

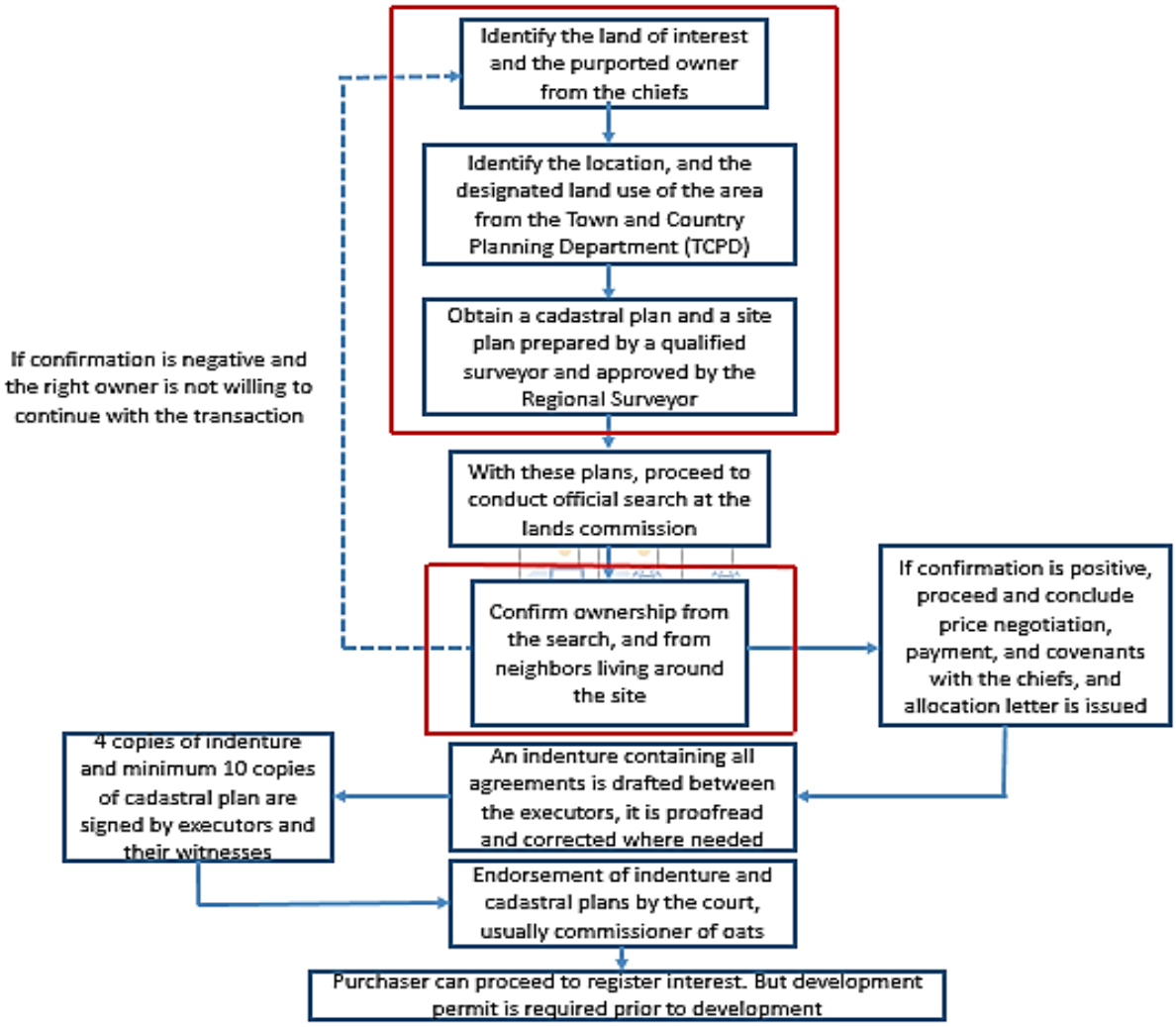


Figure 25. Customary land acquisition process in Ghana

Source: Authors' construct based on literature.

The summarized process above has some inherent activities (customary practices) that need to be highlighted. At the first stage of identifying the land and purported owner, a prospective purchaser visits the customary authority, usually a sub-chief's palace (in the case of the Kumasi traditional area). At the palace, and before the prospective purchaser is welcomed and permitted to disclose his or her mission, they are required first to offer "kola" to the palace elders (typical with the southern part of Ghana). This custom in modern times is represented by an undisclosed amount of money (Mintah et al., 2020). After this payment, and disclosing one's mission, a visit, in the company of some elders from the palace, is made to the site if there is any vacant land available. For this visit, the prospective purchaser again pays some money to the elders (Ameyaw & de Vries, 2021). Crucial to mention is that these monies are not part of the actual land value. The prospective purchaser after the visit can then verify the designated land use of the site shown to them from the T and CPD. Ideally, the applicant should then follow through the remaining stages, i.e., 3, 4, and 5, to the negotiation of the land value to be paid. However, in many customary areas, especially

where registration of the land is not compulsorily attached to the purchasing of the land, this is usually not done. That is, some prospective purchasers fail to consult with the TCPD and/or the lands commission, but instead, go straightaway to conclude the land transaction with the price negotiation and payment. A survey in Koforidua, one of the southern regional capitals of Ghana, for instance, revealed 68% of respondents failed to consult any land professional during their land acquisition, and the majority of those that did were victims of unqualified middlemen that have intruded the sector (Kwofie & Afranie, 2013). This finding is however different from that which was found in 2014 in Kumasi where an overwhelming 97% of respondents had had some interactions with the formal land sector (Quaye, 2014). These differences can be attributed to the fact that land acquisition in the Kumasi traditional area is invariably linked with registration within the formal sector (Quaye, 2014). The failure to involve land professionals on the part of some prospective purchasers further compounds the already inherent challenges in the system Kwofie & Afranie, (2013) particularly given that government administrative requisites of valid customary land transactions are usually completely different from the terms that such purchasers enter into with some customary and/or private land sellers (Government of Ghana, 1993). After negotiations and payments are concluded for the land, the purchaser is issued an allocation letter from the sub-chief (in the case of the Kumasi traditional area), with which he could go ahead with other documentation processes (Mireku et al., 2016). This allocation letter is, however, not valid until the overlord for the traditional area has endorsed or signed it as it is in the Kumasi traditional area (Mireku et al., 2016; Mintah et al., 2020).

In line with the acquisition process presented in Figure 25 above, the first challenge for prospective purchasers is the payment of different monies, Kola money, and site visit fees, which happen at the first and second stages in the process above. These monies go into making the whole land acquisition process expensive and a daunting task for many people, especially the local people in most instances. Payment of the kola money precedes the telling of one's mission, and so, if after the mission is disclosed, it is found that there is no vacant land available, the purchaser loses the money. Both the first and second stages preceding the site plan preparation stage, i.e., third, and the search stage, i.e., fourth, are seen as not in the right order. This is because most prospective purchasers end up wasting much money in instances where the official search results turn out that the land is encumbered and cannot be purchased. This challenge provides room for criticisms of the system as one could argue it out as a deliberate extortion in certain instances.

The subsequent challenges of the acquisition process are rather as a result of the manual system of customary land transactions and management. The first is due to the lack of transparency in the land acquisition process (Kwofie & Afranie, 2013; Quaye, 2014; Agbesi & Tahiru, 2020). In many instances, the information received at the chief's palace becomes the only authoritative information to be relied upon to conclude the acquisition, particularly where no formal sector institutions are contacted. Some dishonest chiefs capitalize on this situation to perpetuate the double sale of the same piece of land to different purchasers, which usually lead to land disputes and conflict

Finally, another challenge is that just like under the public land acquisition, this acquisition process is bedeviled with many bureaucracies that lead to prolonging and sometimes frustrating the acquisition process unnecessarily. First, the prospective purchaser has to deal with the sub-chiefs,

followed with the inspection team, and then with the overlord king of the bigger traditional area who will have to sign the allocation letter after it has been issued by the sub-chief (Quaye, 2014). These processes could take too long particularly while awaiting the endorsement and/or signature of the overlord (Abubakari et al., 2018). The time for the acquisition to be completed, coupled with all the incidental monies to be paid aside the actual value of the land, tends to make the entire acquisition process very cumbersome and challenging for many people (Mireku et al., 2016).

The findings presented on the land acquisition processes under both the public and customary land sectors and the associated challenges call for the need to rethink how these processes can be restructured to eliminate all such procedural challenges. The study uses insights from a digital land registry concept to deduce some lessons helpful for conceptualizing a Blockchain-based smart land acquisition framework for Ghana. The next sub-section presents our findings on the digital land registry concept.

5.6 Blockchain-Based Digital Land Registry Concept

Blockchain technology has many different connotations but all draw on the same underlying principle of a decentralized ledger for managing records of transactions in a shared and transparent manner amongst stakeholders. It is defined by Karamitsos et al., (2018) as a fully distributed cryptographical system that captures and stores a consistent, immutable, and linear event log of transactions between networked actors. It is a distributed ledger technology that acts as an open trusted record of transactions between and amongst multiple parties that is not stored by a single central authority (Edrees, 2019). This underlying principle of Blockchain has caused it to be heralded as the technology to transform the way business transactions are conducted (Janssen et al., 2020). As iterated by Rijmenam and Ryan in 2019, "it seems that almost any industry that deals with some sort of transactions or tracking mechanisms can and will be disrupted by Blockchain" (Mintah et al., 2020). Blockchain technology has different architectural configurations, mainly public and private, each of which is sub- classified as either a permissioned or permissionless Blockchain based on accessibility possibilities. For detailed discussion of these architectural configurations, the Blockchain structure, and how the Blockchain technology works, see (Ameyaw & de Vries, 2020).

BenBen is a private Blockchain-based digital land registry company based in the capital city of Ghana, Accra. The aim of the company is to create a reliable land information and transactions' system Oberdorf, (2017) using Blockchain technology. The idea behind this land registry concept is to bring together various actors in the land market such as financial institutions, land sector agencies, and real-estate agencies, and to build end-to-end digital platforms for facilitating trusted, secured, and risk-free land market transactions (http://www.benben.com.gh/). This reduces the manual hustle of maneuvering through all the actors during land transaction as identified under Section 5.1. Through the digital Blockchain database, land data are secured on the Blockchain platform, and citizens are permitted to access these for all land transactions (Broni, 2019). The challenge of double sale and ownership on the same plot of land particularly underlies this Blockchain land registry concept (Broni, 2019). It seeks to bridge the gap between formal and off-market land data and transactions, by offering land market actors a secured digital environment

for accessing rated land information and facilitating land transactions. This is achieved by authenticating the land records of different land market sources with the records in the government's land registry system (Broni, 2019). The authenticated records and all other relevant documents are then harmonized and stored in the digital land registry to support land transactions. Figure 26 below shows the digital land registry concept.

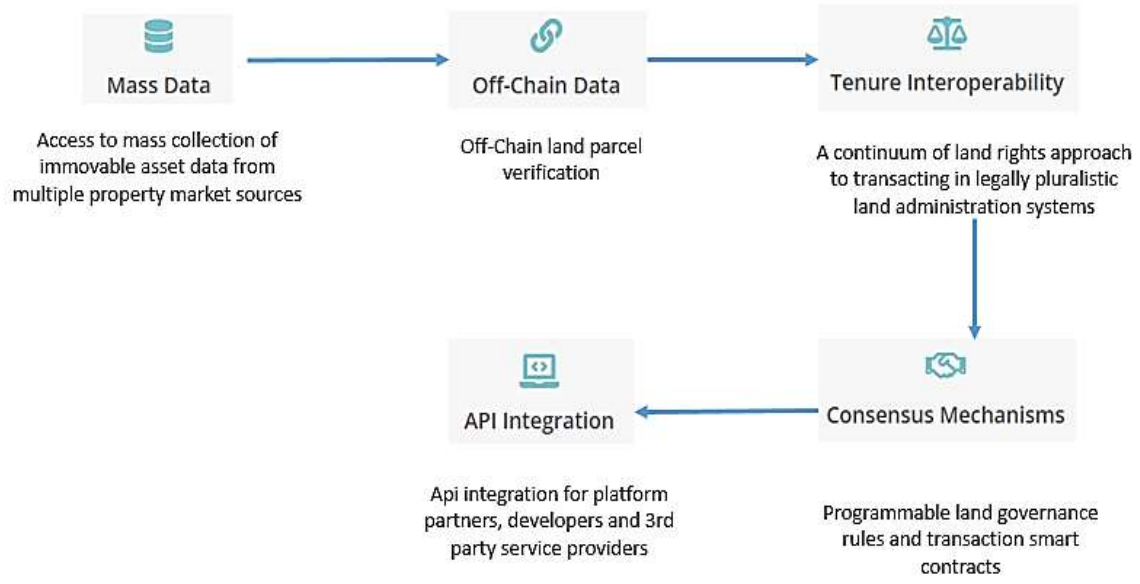


Figure 26. Digital land registry concept

Source: (Janssen et al., 2020).

5.7 Discussion

5.7.1 Connecting Blockchain's Potentials to the Identified Challenges to Develop a Smart Land Acquisition Framework based on a SWOT Analysis Output, and Lessons from the Digital Land Registry Concept

5.7.2 SWOT Analysis Output

The findings presented above show similar challenges across both public and customary land acquisitions. Nevertheless, an assessment of the land management system under both tenure forms reveals certain inherent traits and characteristics that can allow for and support the introduction of Blockchain technology to help resolve the identified challenges. Our assessment is based on the SWOT analysis (strengths, weaknesses, opportunities, and threats). Strengths represent the internal traits and assets in the current system, weaknesses represent the innate shortcomings of the current system that undermine land acquisition, opportunities are the potential external factors that can

improve the current system, and threats represent the potential external factors that can deter and/or thwart efforts to improve the current land acquisition processes. Table 9 below shows the results of our SWOT analysis. This SWOT output combined with insights from the digital land registry concept guides the conceptualization of a new smart land acquisition framework.

5.7.3 Lessons from the Digital Land Registry

From the digital land registry concept presented in our findings, the mass data from different land market sources idea in this concept is crucial to developing an integrated Blockchain land acquisition framework for both the public and customary land sectors. This is because, without such a multiple source, the framework can be compromised due to the monopoly power of one sector. This will in the end lead to citizens going back to the land market that is outside of the Blockchain system, and the identified challenges will resurface and continue.

Strengths	**Weaknesses**	**SW Strategies**
• Formal sector involvement at certain stages in customary land acquisition provides good grounds for further collaboration • The two sectors have co-existed in harmony and with sanity over decades, which gives sound basis for collaboration	• Lack of proper consultations amongst and within both systems	• Establishment of an independent team including both public and customary land officials to oversee credibility of off-chain activities and data, before being brought onto the Blockchain system
• Efforts have started toward digitizing land documents in the formal sector	• Lack of transparency in the systems and amongst stakeholders • Poor and paper-based record-keeping system	• Extension of land records digitization to the customary sector to permit the possibility of Blockchain introduction • Participatory processes in digitization to allow for all stakeholders to confirm data accuracy before transferring onto Blockchain
• There exist enough land-related professionals to support the system (Gobal Land Tool Network, 2015) • Existence of constitutional provisions and Acts that support both sectors, and also good political will toward land management (Gobal Land Tool Network, 2015)	• Limited knowledge of officials in Blockchain • Intrusion of unqualified middlemen in both public and customary land acquisition systems • Bribery and corruption in both systems	• Government together with customary authorities must collaborate to absorb qualified land graduates that are middlemen and train them in Blockchain-land uses to support the new system • Government's strict enforcement of legal sanctions against all forms of illegal land activities
Opportunities	Threats	OT Strategies
• Existence of BenBen and Bitland private Blockchain companies that deal in land issues provide good learning grounds	• New roles and pressures of middlemen who will seek alternative ways of compensating their loss of influence and income	• All middlemen who have studied and graduated as land experts but unemployed can be given the right

		orientation and integrated into both land sectors
• Lessons could be picked from the success stories of countries like Georgia to serve as a guide	• Due to the newness of the technology and limited knowledge of staff from both sectors, external private experts could relent on their support for the system on the basis that it might kick their companies out of the land market	• Establish and provide legal basis for a public–private partnership (PPP) with private Blockchain-land experts to support the efforts of both public and customary land sectors
• Some chiefs have well-established customary land secretariats: Asantehene land secretariat and the Gbawe Family land secretariats. These could be good starting points of collaboration on a systematic approach to roll out the system.	• Possibility of chiefs, as well as some public land sector officials, to undermine any system that will try to make their activities more transparent and accountable	• A consensus should first be reached with customary authorities to solicit their commitment and support for the system

Table 9. SWOT Results

In addition, the off-chain activities can be used to ensure that any land data generated are accurate and true to the grounds reality. This idea can be adopted on the basis of the public–private partnership (PPP) OT strategy in our SWOT output. In this way, parties from the public and customary sectors, as well as private Blockchain experts, will be involved in the verification and acceptance of land data off-chain before credible land data are uploaded onto the Blockchain system. The off-chain data verification will involve activities of checking for land ownership status, encumbrances, boundaries, correctness of relevant documents, and their authenticity, and also transaction histories among others. This is especially important for customary lands as the challenges are more pronounced in this sector. The team that undertakes this exercise must include customary people with in-depth knowledge on customary land issues, Blockchain experts, as well as specialists like surveyors, land economists, planners, and valuers, from the formal land sector who can ensure data accuracy based on expert knowledge. This PPP is very essential particularly in this area of Blockchain introduction to land management as it has been a main contributory factor to the success case in Georgia, and was also employed in Sweden's case (Salmeling & Fransson, 2017b; Goderdzishvili et al., 2018; Mcmurren et al., 2018; Shang & Price, 2019; Ali et al., 2020). The PPP is possible in Ghana's situation given the harmonious coexistence of both land sectors, and the extent of collaboration between them. It is however dependent on the implementation and enforcement of the SW Strategy, which suggests an independent team to oversee such collaborative activity areas. The combined knowledge and expertise of the team can support acquisition and transfer of land data off-chain and onto the Blockchain system successfully. These data can then be distributed amongst all actors including the lands commission, town and country planning department, customary/ private lands owners, financial institutions that grant finance for land transactions, and also real-estate agencies. The relevant actors to a particular transaction will then review and validate the data through an inbuilt consensus mechanism in the Blockchain system, see (Ameyaw & de Vries, 2020). The validated and reliable data become available in the Blockchain system.

Finally, the application programming interface (API) integration for platform users, developers, and third-party service providers also provides sound basis for how our pro- posed Blockchain land acquisition system can be designed. As there are many parties involved in land transactions, including financial institutions, real-estate agencies, among others, the system must be designed in such a way to integrate all of them. These actors must be able to have access to the system and be abreast with all transactions that concern them. After developing such an integrated interface application, prospective land purchasers can then access the data and purchase land after successfully creating a user profile account on the Blockchain application system. In this way, a prospective land purchaser will only log into the Blockchain system using their user accounts, assess all the relevant information on the land, and make a decision whether or not to purchase the land without going through the stress and hassle identified under the current processes as presented in Section 5. Upon purchasing and a successful payment of the land value, all necessary changes will then be effected and validated in full awareness of all relevant actors to the transaction. Documents can then be transferred to the Blockchain account of the purchaser, as well as shared with all other actors like financial institutions where necessary. The picking up of original hard-copy documents can be arranged between the executors. This system can help eliminate any

possibility of double sale as a purported second sale will be identified in the system. There will be no avenue for unofficial charges as all work processes are under scrutiny of all the involved actors and any unnecessary and deliberate delay will be identified. In addition, all overlaps and unnecessary bureaucracies will be discarded as all steps are programmed, and finally, as the acquisition process occurs largely online, the interruption of middlemen will be eliminated. Land records will also now have security and can be trusted as well, as any unauthorized change will be identified and corrected by all the stakeholders. Registration of the land can follow using the same Blockchain platform. See Ameyaw & de Vries, (2020) for the proposed Blockchain-based land registration process.

5.8 The Proposed Blockchain-Based Land Acquisition Framework

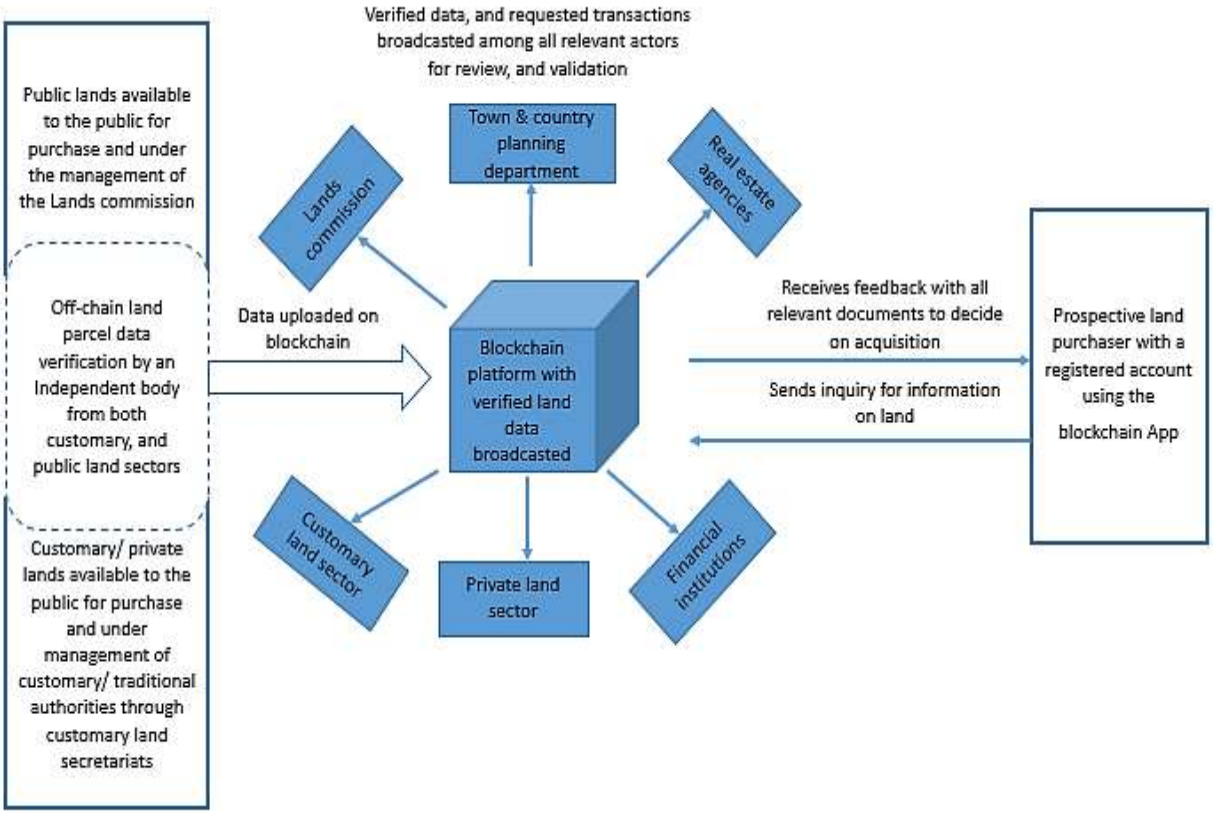


Figure 27. Blockchain-based smart land acquisition framework

Source: Authors' construct.

This proposed framework will disrupt and replace the already existing processes in certain ways as is in accordance with smart technologies (de Vries et al., 2020). The main disruptions will include the elimination of intermediaries in land information accessibility and elimination of unofficial charges. The incurring of cost that could become a loss to the prospective purchaser if a search result turns out negative will also be eliminated. Finally, the unnecessary bureaucracies due

to the overlap and repetition of functions will eliminated to shorten and simplify the existing cumbersome land acquisition process.

5.9 Conclusions

This study has drawn on the new concept of smart land management, specifically, Blockchain's application to land management. Through a SWOT analysis and deductive insights from a digital land registry concept, the study sought to identify how Blockchain as a smart technology could be employed to enhance land acquisition in a pluralistic land management system fraught with countless challenges. It supports the epistemology that the machinery with regard to land transactions that is clear, understandable, fair, and reasonable in its operation and implementation, and supported by a computerized system to provide quicker accessibility to updated land data, is a necessity for effective land management and land administration processes (Gobal Land Tool Network, 2015). The study demonstrates that bridging the extreme ends of customary and public land acquisitions through a Blockchain-enabled system is possible.

The main contribution of this study to knowledge in the topic area is that it has conceptualized a new smart Blockchain-based land acquisition framework, figure 27. This framework and its underlying concept are relevant for addressing land acquisition challenges not only in Ghana but in the many other developing countries especially in the sub-Saharan Africa that have similar dual land-tenure systems and land acquisition challenges. The framework will permit accessibility to land information devoid of intermediaries and eliminate unnecessary bureaucracies and unqualified middlemen to shorten and simplify land acquisition processes. It again eliminates unofficial charges from the process. This makes the framework useful in the context of other African regions like Rwanda, Kenya, Nigeria, and Uganda (Amone & Lakwo, 2014; Thontteh & Omirin, 2016; Ali et al., 2017; Greiner, 2017).

It is essential to mention that threats of system sabotage from some corrupt land officials, and customary authorities who might not wish for transparency in their deals, exist. In addition, the private Blockchain-based land companies could equally undermine the system for fear that it will eventually kick them out of the land market. Additionally, the eliminated middlemen will try to find alternative approaches to intercept the system. To forestall these threats, I recommend: Initial consensus with customary authorities to get them to understand, accept, and pledge their support for the framework. Provide legal basis for PPP to assure private Blockchain experts of a continuous stay in the land market. Again, government should collaborate with customary authorities to absorb most of the graduates in the land discipline that have turned into middlemen due to lack of employment. Finally, legal sanctions should be strictly enforced against any illegal land activities identified and which threatens the system. Other policy implications including expansion of land records digitization in a participatory approach, and public education on the use and how the Blockchain system works among others, as identified in (Ameyaw & de Vries, 2020) are relevant in this study's context.

This study was limited by the scarce literature on both smart land management and Blockchain's application to land management, particularly relating to contexts of a pluralistic land tenure system

such as that found in Ghana. This limitation is also partly due to the fact that this study is the first to specifically look at the possibility of Blockchain's application for both customary and public land acquisition in a simultaneous manner in the Ghanaian context. More research works in this topic area are therefore encouraged. Specifically, considering that the concept of Blockchain application to land management is still elementary and continues to evolve, the study recommends that future research works should look into establishing a framework that can be used as a guide to assess the readiness of land management and land administration systems in sub-Sahara Africa for Blockchain consideration especially in Ghana.

Chapter 6.

Blockchain technology adaptation for land administration services: The importance of socio-cultural elements

Abstract

The adoption of efficient technologies in support of land administration services is still a challenge in Ghana. Data on land ownership, use, and value in Ghana remain fragmented, and technological systems enabling information services automation, and accessibility to reliable land information remain inefficient. This continues to cause societal problems like; double sales of land, unauthorized changes to land documents, corruption, and bribery. In this study, I argue that the absence of a context-focused guide for technology adaptation is a major factor for failures in previous technology adoption attempts in Ghana's land sector. I evaluate how a past technology (GELIS) adoption at Accra Lands Commission in Ghana was executed and why it led to unrealized expectations. I relied on elicited expert views followed by content analysis, and validated against a meta- synthesis qualitative review methodology of secondary data. I then extrapolated these results to possible outcomes and trajectories for the adaptation of a new technology like blockchain. Based on blockchain's interdependent feature, Ghana's contextual land issues, and the GELIS adoption experience, I develop suggestions covering an extended TOE framework to include socio-cultural elements as a guide for blockchain technology adaptation in Ghana, and other developing land administration systems with similar land issues as Ghana. Policy implications underlining these suggestions are highlighted.

Keywords: Land administration; TOE framework; Blockchain technology adaptation; GELIS; Ghana

6.0 Introduction

A successful land administration system is contingent on efficient and effective flow, and accessibility to reliable information on land and landed property, between, and amongst land sector agencies, as well as between these agencies and the public (Cheremshynskyi & Byamugisha, 2014; Deane, Owen, & Quaye, 2017; Babalola & Uyi, 2019). This is usually underlined by automated processes. Unfortunately, a comprehensive land administration system, that is supported by a well-functioning, and efficient technological tools that are capable of integrating data on land ownership, use, and value, as well as allowing for effective flow, and accessibility to reliable land information to enhance land administration services delivery has been a major problem in Ghana's land sector, and many other developing countries' land systems (Forkuo & Asiedu, 2009; Cheremshynskyi & Byamugisha, 2014; Thontteh & Omirin, 2016; Ali, Deininger, & Duponchel, 2017; Siriba & Dalyot, 2017). Development organizations like the World Bank, and some researchers, have proposed the adoption of computer-aided technology systems in support of these land sectors as this is considered a way forward towards addressing the land information integration, and accessibility challenges (Karikari, Stillwell, & Carver, 2003; Karikari & Stillwell,

2004; World Bank, 2013; Adiaba, 2014). Subsequently, different attempts towards technological tools' adoption for land information management in support of land administration services have been made in the years past in Ghana. However, successes with such adoptions had not really matched the expectations (Cheremshynskyi & Byamugisha, 2014; Biitir & Assiamah, 2015;Deane et al., 2017).

One of such technology adoption projects was the Ghana Enterprise Land Information System (GELIS) by the Lands Commission, Accra. GELIS was adopted to facilitate automation of many land administration services, and to ease the cumbersome manual services delivery. Building of the underlying software for GELIS and its implementation started in 2016 (Deane et al., 2017). It was implemented to strengthen the policy framework for land administration and geospatial information management by providing for a quick accessibility, and ease of data retrieval from a computer-based land information system that keeps graphical (spatial) data, and accordingly links these to the textual or attribute data (Deane et al., 2017). Notwithstanding this, the outcomes from this technology adoption had been somewhat below expectations as efficiency of the processes under GELIS is questionable (Biitir et al., 2021). The problems with information production and information access remained similar as compared to before the introduction of the technology as full automation was still problematic (Biitir et al., 2021). To improve the situation, the Commission introduced a new system, the Enterprise Land Information System (ELIS), in a way as an upgrade to the GELIS. Surprisingly enough, from the beginning, the operational requirements became even more complex, and difficult as operational staff now had to work with both the GELIS and ELIS systems simultaneously. This operational difficulty rather led to a slower pace of services delivery resulting in a larger volume of land transactions backlog. This raises a paradox as it is unknown whether the Commission did not make use any technology adoption guide, and if so, why?. It is also unknown whether there isn't a way to make use of better technology adoption procedures in similar technology adoptions in the future to help achieve expected outcomes. These challenges with new technologies adoptions in the land sector are not limited to Ghana but profound in many other countries, especially developing countries where the land administration systems are still evolving from the predominant manual land administration structures, and processes.

Consequently, the objective of this study is to identify recommendations that can guide adaptation of Blockchain technology for land administration services especially for developing countries that are making the efforts towards a more efficient digital systems of land administration. I consider Blockchain technology because it is currently being explored, and used in different land administration systems to address similar land challenges as found in Ghana (Goderdzishvili, Gordadze, & Gagnidze, 2018; Lazuashvili, Norta, & Draheim, 2019; Shang & Price, 2019; Alam, Rahman, Tasnim, & Akther, 2020; Sladi´c, Milosavljevi´c, Nikoli´c, Sladi´c, & Radulovi´c, 2021). There have been different research studies on blockchain and Ghana's land sector (Oberdorf, 2017; Demah, 2018; Agbesi & Tahiru, 2020; Ameyaw & de Vries, 2020; Miscione, Richter, & Ziolkowski, 2020; Mintah, Baako, Kavaarpuo, & Otchere, 2020; Ameyaw & de Vries, 2021;Mintah, Godwin, Tetteh, Gaisie, & Kwame, 2021). Nevertheless, none of these studies focuses solely on providing a comprehensive guide for block- chain adoption, although few of them discuss in piecemeal, certain relevant factors. This leaves a research gap in the Blockchain

and land studies in Ghana which this research seeks to fill by providing answers to the research questions below.

1. What could be the underlying reasons why Lands Commission did not fully achieve the expected outcomes on land services delivery with the adoption of GELIS?

2. What experiences exist in the GELIS project and how can these shape future adoption of a technology like Blockchain?

3. How can we develop a guide for the Commission, and similar land administration systems in other developing countries to make use of a technology adoption procedure in a future adoption of Blockchain technology?

These research questions are not only important to Ghana's Lands Commission, but also to the many other land administration systems in other developing regions particularly in sub-Sahara African context due to the similar features, challenges, and technology adoption outcomes in the land administration systems in the sub-region.

6.1 Blockchain technology and its application in land administration

Blockchain technology is a distributed ledger for managing transaction records in a consistent, immutable, and linear manner among connected stakeholders. As against other transaction records management ledgers, some uniqueness of Blockchain technology center on; the traceability of records which are linked to each other in a linear chain system, the immutability of records, and the decentralized nature of the technology's operation that requires consensus building among connected actors to a transaction before it can be completed. These features have caused Blockchain-based transactions to be associated with transparency, trust, security and resilience, elimination of fraud possibilities, corruption, and data manipulation among others (Ameyaw & de Vries, 2020,Yapicioglu & Leshinsky, 2020, Umrao & Patel, 2022). These issues are equally the challenges bedeviling the land sector in many countries, particularly developing ones, and threatening property rights protection. It is no wonder that many developing countries lag behind in the competition for foreign direct investments (FDI) as against other developed economies given that there exist a positive relation between the degree of property rights protection, and the inflows of FDI (Gillpatrick et al., 2022). The features of Blockchain technology, and the associated benefits have been recognized useful in land administration, and land management. This is due to the fact that there are many interests, and stakeholders involved in land transactions, and this makes security of data, trust, and transparency extremely important in these transactions. Subsequently, this has led to the proposition for adoption of Blockchain, and actual adoption for land administration in some countries; India, Honduras, Bangladesh, Cyprus, Kenya, Georgia, Sweden, Ghana, and Rwanda, among others (Goderdzishvili et al., 2018 Eder, 2019; Lazuashvili et al., 2019; (Shahriyer & Monim, 2019; Yapicioglu & Leshinsky, 2020; Ameyaw & de Vries, 2021; Umrao & Patel, 2022). Supriyadi et al., (2021), identified that block- chain use case was highest in land administration and land management as compared to other government administration services.

In 2017, Georgia took a step towards a Blockchain-based land registry system (Goderdzishvili et al., 2018; Umrao & Patel, 2022). This initiative came partly because the National Agency for Public Registry (NAPR) which is the state registering authority in Georgia wanted to simplify land registry process, as well as to allow more stakeholders to partake in land related services given that the initial NAPR digitized database could not resolve the public trust issues in government agencies as officials could still manipulate land data in this database (Shang & Price, 2019). A pilot of the Blockchain system was therefore started in 2017. A review of this system shows that it led to increased transparency in land transactions and services, increased safety, and security of citizens' data, and improved data traceability (Shang & Price, 2019). Additionally, it increased the pace of land title delivery such that as at 2018, about 1.5 million land titles had been published on the Blockchain system which guaranteed the security, and immutability of these records, and were successfully issued in Georgia (Shang & Price, 2019; (Thamrin et al., 2021) far more than titles issued in previous years.

Also, in Sweden, the Swedish land registration authority, Lantmateriet, announced the use of Blockchain for land registry in 2016, and as of July 2017, it begun an official use of Blockchain technology for land registry although on a small scale (Chavez-Dreyfuss, 2016; Mcmurren, Young, & Verhulst, 2018). This initiative was in response to certain challenges in land transactions especially to eliminate information asymmetry in the system so as to enhance transparency amongst all parties to a land transaction. According to the Lantm¨ateriet, the Blockchain solution enhances trust by increasing security, transparency, and accuracy of the process in land transfers by permitting all parties to a particular land transaction to be able to digitally track it from start to end (Mcmurren et al., 2018). The Swedish use case according to Salmeling & Fransson, (2017) and Goderdzishvili et al., (2018) saves over 100 million in monetary value annually for the society through faster transactions, fully digitalized processes, enhanced security, and data redundancy, as well as the removal of physical storage, paper-based systems. Another Blockchain-based land application case is in the State of Andhra Pradesh in India which has also piloted a Blockchain-land registration with the help of the Blockchain firm, ChromaWay from Sweden (Tsankova & Marinov, 2018; Müller & Seifert, 2019). Although quite recent, the system has been able to secure 100,000 soils in the test period and hence attracting other Blockchain-based firms (Thamrin et al., 2021).

In the African context, some countries have equally identified the Blockchain potentials, and to a certain extent, piloted its application for land administration services. In Rwanda, despite the successes chalked under the Land Tenure Regularization Program (LTRP) between 2009 and 2013 in which over 10 million parcels of land were registered in the country, and about 7 million certificates of land titles issued out (Ngoga, 2019; Hughes et al., 2022) there still existed certain pertinent land administration challenges like; double sales of land, identity fraud among land market participants, and repudiations in land transactions among others (Hughes et al., 2022). To help tackle these challenges, the land sector institutions recognized the need for innovative solutions. Consequently, the Rwandan Land Management and Use Authority (RLMUA) together with other sector institutions developed the Ubutaka App. The Ubutaka App, a very interoperable web-based application seamlessly integrates with already existing systems of some national institutions to securely receive, process, and transmit citizens' data for land transaction purposes

(Hughes et al., 2022). The operation of this App is based on biodata, public key infrastructure (PKI), and a public Blockchain (Hughes et al., 2022). These components of the App, coupled with its integration with already existing institutional systems, and the interoperable nature allows it to ensure certainty of land ownership, and eliminates fraudulent transactions, and repudiations in land transactions since the signatures, photos, and fingerprints of transaction participants are permanently captured as evidence of their presence, and consent to the transactions (Hughes et al., 2022). Additionally, the Blockchain recording of the transactions allows for "a permanent, independently verifiable, and tamper proof record of the time and details of the transfer for all involved" (Hughes et al., 2022). This enhances security, and trust in the land data, and improves land tenure security for beneficiary land title holders.

In Kenya, the predominantly manual land information system, and a large percentage of rural unregistered lands Mark et al., (2019) among other challenges with the negative repercussions on land tenure security, and land administration drove a move towards a Blockchain-based land registry pilot project by Land Layby, a Blockchain company based in Kenya with offices in Melbourne, London, and New York (Mark et al., 2019). Land Layby developed an Ethereum-Blockchain land register system to produce one register of land ownership records that is immutable and incorruptible (Sladi´c et al., 2021). Although the system is public, there are different levels of permission to deliberately keep certain aspects, like sensitive personal information private (Sladi´c et al., 2021). The system helps enhance a faster land transaction due to easy access to land information source, and elimination of unnecessary intermediaries. It also checks fraud deals due to improved transparency in transactions, and the immutability of both current, and historic trans- action data (Mark et al., 2019).

In Nigeria, there have been calls for the uptake of Blockchain in support of the land administration system as Ibrahim, Daud, Azmi, Noor, & Yusoff, (2021) believe the uptake of the technology can help resolve up to about 85% of the land challenges in Nigeria. The land challenges have been identified as being a result of the use of ineffective traditional land administration system that lacks transparency, and allows for double spending, tamper with documents, and third party interferences among others which ethereum Blockchain system with smart contract functionality can resolve (Seun et al., 2020). All of these application cases reiterate the growing attention on Blockchain in the land sector. In other studies, the concept of Blockchain in land administration, use cases, features, architectural categorizations, operation, use steps, and relevance for land administration in Ghana have been thoroughly discussed (Ameyaw & de Vries, 2020, 2021). The different use cases, and calls for Blockchain in land administration makes it important to identify factors, and or suggestions that can help in the adaptation of the technology in different contexts across the world.

6.1.1 Technological, organizational, and external considerations in Blockchain adaptation

For every technology adoption, technical, organizational, and external issues cannot be underestimated as they go a long way to influence the success or otherwise of the adoption outcomes (Singeh et al., 2020). Technological factors consider issues that relate to technological

complexity, technology asset and compatibility, relative advantage of the technology, privacy, and security issues associated with the use of the technology among others. Organizational factors according to Baker, (2012) relates to the characteristics and resources of an institution. This embraces those structures that link the employees, intra-organization communication channels and processes, and also, organizational size. It also includes the mechanism that connects the internal sub-divisions of the organization, as well as the organizational structure: which can be a decentralized one or otherwise. In a decentralized structure, there are strong emphasize on team work, and staff have a high degree of fluidity in their responsibilities. There is the promotion of lateral communication, and communication along reporting lines. Organizational factors also relate to issues of; Management's behavior and attitude, employee, IT experience, organizational readiness, and innovativeness among others (Koster & Borgman, 2020; Chiu et al., 2017; Clohessy & Acton, 2018; Koster & Borgman, 2020) On the external factors, issues within the organization's broader industry of day-to-day operations that impact either positively (opportunities) or negatively (constraints) on the technology adoption are considered (Leung et al., 2015). These external issues consider structure of the in- dustry in which the organization finds itself, the availability, or absence of essential service providers in support of the technology adoption, supportive partners for the intended technology to be adopted, and the regulatory environment within which the adoption takes place (Baker, 2012). It also includes government interactions, support infrastructure for technology, and also industry dynamics (Leung et al., 2015; Chiu et al., 2017; Koster & Borgman, 2020; Badi et al., 2021). Table 10 below, shows the TOE factors that affect Blockchain technology adoption in different public administration services including the land sector.

No	Author	Technological parameters	Organizational parameters	External parameters
1	(Barbieri & Gassen, 2017)	Technical infrastructure readiness	All staff involvement and cooperation	Public-private partnership
2	(Batubara, Ubacht, & Janssen, 2018)	Security, scalability, flexibility, compatibility	Organizational readiness, acceptability, new governance models	Laws and regulations
3	(Barnes III & Xiao, 2019)	Perceived usefulness, compatibility, relative advantage, complexity, scope of technology	Top management support, organizational readiness, firm size, firm centralization	Competition, trading partner support, technology vendor support, government support, customer support
4	(Broni, 2019)	Technology availability	Awareness (organizational readiness (human, and business resources), commitment (top management support)	Government E-readiness (government support and regulations), market forces E-readiness (market competition), industry support
5	(Clohessy & Acton, 2019)	Technology innovation availability	Top management support, organizational size, organizational readiness	Technical support in the industry
6	(Clohessy, Acton, & Rogers, 2019)	Perceived technology benefits, complexity, compatibility	Organizational readiness, top management support, organizational size	Regulatory environment, market dynamics
7	(Krigsholm, Ridanpää, & Riekkinen, 2019)	Right application of technology, complexity, security and data protection	Staff knowledge and use of technology	Societal values and attitudes
8	(Mohammed et al., 2019)	Cost of technology	Adoption, and organizational readiness	Industrial support
9	(Reddick et al., 2019)	Cyber-security	Organizational governance effectiveness	Political stability
10	(Schuetz & Venkatesh, 2019)	IT features	Staff support	User characteristics, market externalities, market characteristics

11	(Tilbury, de la Rey, & vab der Schyff, 2019)	Technological applicability	Stakeholder acceptance	Stakeholder support, legal regulatory framework
12	(Clohessy et al., 2020)	Complexity, perceived benefits, security	Organizational readiness, top management support	Market dynamics, the regulatory environment
13	(De Castro et al., 2020)	Technology compatibility, complexity, relative advantage	Top/middle management support	Financial economies of scale
14	(Janssen et al., 2020)	Speed, scalability, security, (standardization)	Norms and culture (knowledge, and understanding of the technology, and acceptance), Organizational readiness (integrating blockchain to the existing business processes and technology)	Governmental legislation and regulations, governance by stakeholders, market structure (dynamics),
15	(Koster & Borgman, 2020)	Realness, local applicability of technology	Top management support	Regulatory environment, hype versus resistance
16	(Kouhizadeh, Saberi, & Sarkis, 2020)	Security, access to the technology, maturity of technology	Top/ middle management support, cost, technical knowledge and expertise, organizational policy readiness	Governmental policies, market uncertainties and dynamics, external stakeholders' involvement
17	(Orji, Kusi-sarpong, Huang, & Vazquez-brust, 2020)	Compatibility, complexity, security and privacy, perceived benefits, infrastructural facility, ease of being tried and observed, availability of specific blockchain tools	Top management support, firm size, presence of training facilities, organizational culture, perceived cost of investment, capability of human resources	Government policy and support, competitive pressure, stakeholder pressure, Market turbulence
18	(Pirotti & Roknifard, 2020)	Compatibility (integration with existing systems and networks), security, privacy, speed	Trust-building or trust support	Government regulation

19	(Vergouwen et al., 2020)	Interoperability of blockchain	Top management support, focus on innovation, problem match	Competitive pressure, standardization
20	(Supriyadi et al., 2021)	Governance, platform/ architecture, infrastructure, expertise	Strategic plan, information system readiness, initiatives, awareness, commitment, budget	Regulatory support, collaboration, user education, socio-economic characteristics

Table 10. TOE factors necessary for consideration in Blockchain adoption.

Table 10 above identifies from different Blockchain adoption projects, the TOE considerations that are necessary in the adoption of Blockchain technology. These considerations act as parameters which institutions that seek to adopt Blockchain can use as a guide for the adoption process. These considerations provide a guide on when, how, and the favorable conditions under which to adopt any novel technology including Blockchain (Leung et al., 2015). The study thus assesses the GELIS adoption project to see the extent to which this had been guided by the TOE factors, and to accordingly deduce the relevant lessons that can guide a future Blockchain technology adoption project. However, from the table 10 above, the general considerations on Blockchain technology do not bother so much on the social elements of different contexts particularly in countries where different social structures exist. The sub-section below thus looks at the socio-cultural elements of Ghana's land tenure and land administration system as these elements play significant roles in any land administration decisions.

6.1.2 Socio-cultural elements of the Ghanaian Land Tenure as a missing gap in technology adaptation for land administration services

Socio-cultural elements in the context of this study denotes the socio-cultural and political arrangements within which the land tenure systems operate, including values, norms, and customs of the Ghanaian society. For technology adoption in Ghana's land administration, the land tenure system cannot be overlooked as it is the basis for land administration. According to Payne, (2002) 'land tenure systems are the product of historical and cultural factors, and they reflect the relationships between people, society and land' cited in (Global Land Tool Network, 2015).

This social relationship between members of the community with respect to land is an important element of consideration in any land administration decision. The Ghanaian land tenure system is 80% customary, and 20% fall under statutory management (Ehwi & Mawuli, 2021). This makes the customary tenure arrangement in Ghana more influential in terms of land administration policies and initiatives, regardless of whether such decisions are emanating from the statutory, or customary sector (Quaye, 2021). This is because, the customary tenure dominates land transactions in Ghana (Quaye, 2014). Customary tenure is however founded on a socio-political setup in which land is considered as belonging to the entire community of the living, the dead, and the generations to be born (Bugri, 2012). Chimhowu, (2019) defines customary tenure as "collectively owned land usually under the authority of traditional leadership". This shows the importance of social and cultural elements in a land administration system that is dominated by customary tenure. Community involvement is a key characteristic of decision making in customary land administration in Ghana. This is because, the traditional leadership in customary tenure systems only acts in fiduciary interest for the larger landowning community (Nara, Mwingyine, Boamah, & Biitir, 2014; Aha & Ayitey, 2017). This means, they are accountable to the community as they only hold the land in trust, and are charged with the responsibility of ensuring its proper administration to inure to the benefits of the entire community (Aha & Ayitey, 2017). This underlying social principle of customary land tenure in Ghana translates into land administration decisions even at the formal statutory level. This is because, majority of land transactions at the statutory land sectors emanate from the customary sector (Quaye, 2014). Accordingly, without

acknowledging the values, norms, and customs guiding land tenure relations, as well as the socio-political arena of Ghana's most dominant customary land tenure system, a land administration decision is likely to face challenges. This therefore makes consideration of these social, and cultural elements indispensable in a possible Blockchain adoption. Barbieri & Gassen, (2017) indicated that Blockchain adoption not only requires technology expertise, and infrastructure readiness, but also cooperation from all involved stakeholders, as well as mechanisms for overcoming resistance from entrenched interests. In the customary land sector, several socio-cultural issues of land rights, like local inheritance systems, gender segregation, and oral land contracts among others sometimes create challenges for land administration. This is because, in the conventional land administration, standard land rights execution steps are mostly followed, and based on document proofs of land relationships. These standard systems in most cases do not take into consideration the diversity of these socio-cultural issues of land rights. This sometimes leaves certain lapses in the cases of land rights executions that emanate from the customary sector, and which proceeds to the statutory sector to finalize. However, Blockchain technology has the advantage of being a bottom-up type of technology. That is, the block- chain system starts from the socio-cultural dynamics on the ground in relation to a land transaction as against conventional approaches that mostly deals with proof of documents. In Blockchain's application to land administration, Ameyaw & de Vries, (2021) identified that an off-chain verification is necessary. It is in this verification process that diverse socio-cultural land right issues will be identified, resolved, and or validated, and appropriately incorporated into the Blockchain land administration system. It does creates the space for all socio-cultural issues of land rights to be dealt with, and incorporated in the land rights execution processes. Despite this potential, it is important to indicate that Ghana is seen as a normative thinking society that cherishes and hold on to traditions, norms and customs, and perceives societal change with suspicion (Demah, 2018). Therefore, it important that education on such technology and its benefits to the land sector be intensified to overcome the normative societal attitude challenge. Such an education will go a long way to foster involvement of all relevant stakeholders in land administration decision making particularly at the customary local level. Quaye, (2021) notes that it is prudent to consider the socio-cultural aspect of land tenure in the adoption of any technology (Blockchain) in Ghana, and other countries with similar land administration systems like Uganda, Kenya, and Zimbabwe (Chiiweshe, Mutopo, Ncube, & Mutondoro, 2013; Siriba & Dalyot, 2017; Keilitz & Wiipongwii, 2017; Ogwang & Vanclay, 2019) as such elements are usually taken for granted in many technology adoption projects as was seen in Table 10.

Interestingly, Singeh et al., (2020) identified that the TOE framework is flexible, and allows for extension, and inclusion of additional elements. Consequently, Koster & Borgman, (2020) extended the framework to include an inter-organizational perspective to increase its explanatory power. Accordingly, in this study, I further extend the framework to include socio-cultural elements as highlighted. This I believe augurs the explanatory power of the TOE framework on block- chain technology's adaptation for land administration services. Figure 28 below shows the TOE framework with a fourth element to encompass socio-cultural elements.

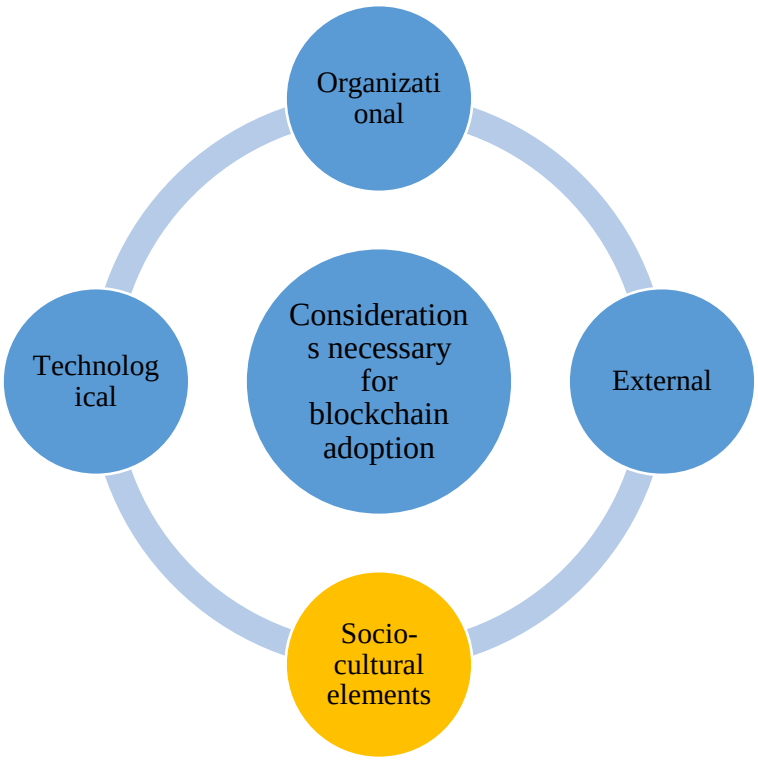


Figure 28. TOES framework for developing suggestions for Blockchain adaption for land administration

Source: Authors' construct (2021).

6.2 Methodology

6.2.1 Research design

This is a qualitative case-study research designed to explore the experiences that professionals of the Accra Lands Commission have with the adoption of technologies, specifically, the GELIS technology for land administration services delivery, and to help identify factors that can guide a future technology adoption. A qualitative case study research by its explorative nature enables researchers elicit contextually rich data on the topic at hand (R. K. Yin, 2016). Case studies permit the use of different data collections procedures to collect detailed information that supports in-depth analysis of particular cases such as a program, or an event (Creswell, 2014). This study started off with review of literature on the Ghanaian land administration system, and the underlying technologies for land information management and other services delivery. This review helped to identify the research problem which needed to be explored by means of a case study with the GELIS technology adoption project as the focus. The literature review mainly provided secondary data for the study, and was coupled with interviews for primary data. Explorative case study research works are more qualitative and thus closely associated with interviews among other data collection approaches (Creswell, 2014). Qualitative research interviews can be categorized as; structured or formal, semi-structured, and unstructured or informal (M. Saunders et al., 2016).

Structured or formal interviews, and semi-structured interviews are underlined by a set of standardized pre- determined interview questions that are formally designed either as close-ended, or open-ended respectively, and are administered to respondents. On the other hand, unstructured/ informal interviews do not have predetermined set of standardized questions, but are based on informal conversations or discussions with the respondents in which the interviewer has a clear idea of the study topic, purpose, and scope of issues that he, or she wants to explore or discuss in the interview (Saunders et al., 2009; Zhang & Wildemuth, 2009). Therefore, despite not being guided by a set of prepared standardized interview questions, the researcher has an implicit agenda of the study questions, and is guided by research protocols which makes unstructured or informal interviews not random, and non-directive (Zhang & Wildemuth, 2009;Yin, 2015) although the researcher may vary the questions as posed to the different respondents based on the context, and setting of each interview (R. K. Yin, 2016). Unstructured interviews have been criticized to violate research ethics as respondents might in some cases not be aware that they are being interviewed. However, it is argued that the relaxed atmosphere of respondents' unawareness of being interviewed helps to avoid some bias sources associated with formally structured interviews, and questionnaires, and also helps uncover data that closely approximate respondents' personal feelings, and experiences as opposed to 'public' sentiments that might be reported in structured interviews (Yin, 2015; Moeller, Mescher, More, & Shafer, 2018). This method has been used in some other studies (Fusilier & Durlabhji, 2001; Ritchie, Burns, & Palmer, 2005; Moeller et al., 2018) among others. The current study being an exploratory one, I adopted the unstructured or informal interviews/ conversations/ discussions. This inquiry approach was considered more appropriate as against the formally structured, or semi-structured interview guide because it helps to find out the actual happenings, and to understand the context of study (Saunders et al., 2009; Mueller & Segal, 2014). It also allows to expose unanticipated themes from the responses which gives a better understanding of respondents' personal, and social realities of the topic of discussion from their own perspective which otherwise could be missing if they were to respond to standardized structured questions (Zhang & Wildemuth, 2009). That is, follow-up questions usually emerge based on the responses and as such, this approach is also sometimes termed as informant interview as the interviewee's responses, perceptions, and experiences also guide the conduct of the interview, and topics discussed Saunders et al., (2009) while keeping in mind the objective, and purpose of the study.

6.3 Data collection approach

With secondary data, the study collated, and synthesized the many different ideas, and factors relating to technology (Blockchain) adoption. Based on discourse analysis, and interpretation, I model a framework of recommendations and or suggestions considered relevant, to guide the adoption of Blockchain technology. The study adapts a meta-synthesis approach, which involves a qualitative review of literature Uwayezu & de Vries, (2019) on the concepts of Blockchain, and technology adoption. This review methodology, following the process in Levack, (2012) involved five stages; 1. Identification of the research questions; 2. Description of the criteria used for literature exclusion and inclusion in the study; 3. Description of literature identification and selection; 4. Critical appraisal of the identified literature for rigor and quality, and extraction of

data (themes, concepts, categories, and ideas) 5. Discourse analysis and synthesis of data to interpretatively create new understandings or perspectives, and present same.

The first stage involved the identification of the research question as highlighted in the introduction, and problem statement section where through literature review, I identified that the Lands Commission had not fully realized the expectant results from the GELIS technology adoption. This led to our framing of the study objective to delve into why this expected results were not fully realized, and what experiences can be gained from the GELIS adoption project that can guide a future adoption of another technology like Blockchain. Stage two; shown in Table 11 below details the definition of exclusion and inclusion criteria.

The results of stages three and four, being the identification of literature, and quality appraisal of the identified literature is respectively shown in the Figure 29.

Inclusion/ Exclusion	Stage	Article Description/ Focus
Exclusion	Before importation into mendeley reference manager	Non-English articles, articles with missing abstracts and full-texts, and poster articles
	During title screening	Duplicated articles General articles on blockchain but with no relation to land administration, and or its adoption in a public administration service
	During abstract screening	Articles mainly focusing on technicalities, and or software related issues of blockchain rather than on blockchain's application and or adoption in land administration, or in other public administration services
	During full-text screening	Articles that had different meanings other than relevance to the research objectives
Inclusion	During full-text screening	Articles relating to blockchain technology adoption
		Relevance on blockchain technology and its relation to land administration, and other public administration services
		Relating to land administration and land tenure
		Relating to technology adoption

Table 11. Exclusion, and Inclusion criteria

In stage three, relevant articles were identified based on the topic area. The main scholarly databases used included: Web of Science, Scopus, Google Scholar, and Research Gate. The keywords, and phrases included, "GELIS"; "technology adoption"; "technology adoption theory"; "Blockchain" AND "land"; "Blockchain" AND "adoption"; "block- chain" AND "land registration"; "Blockchain" AND "land administration"; "Blockchain" AND "land management";

"technology adoption theory", "Blockchain" AND "TOE"; "land" AND "technology adoption"; "Blockchain" AND "adoption factors". Additionally, article titles were used to search for the articles in some instances by keying them directly into the search engines of the databases. Retrieved documents included published journal papers, conference proceedings, books, book chapters, and theses. The initial search and retrieval resulted in 419 documents. Additional search after revision of manuscript resulted in 103 documents making it a total of 522 documents.

Stage four followed with the construction of the final set of articles after a screening of the abstracts, and a detailed review of both the initially sampled articles, and other articles that were identified through the spider backward strategy otherwise known as snowball effect (Daluwathumullagamage & Sims, 2020). One hundred and nine (109) documents were retained from stage four's detailed review. The result of stage four led to classifying the final articles into the major evolving themes, and ideas. Through a discourse analysis, and synthesis, the themes, and ideas were interpreted in the final stage.

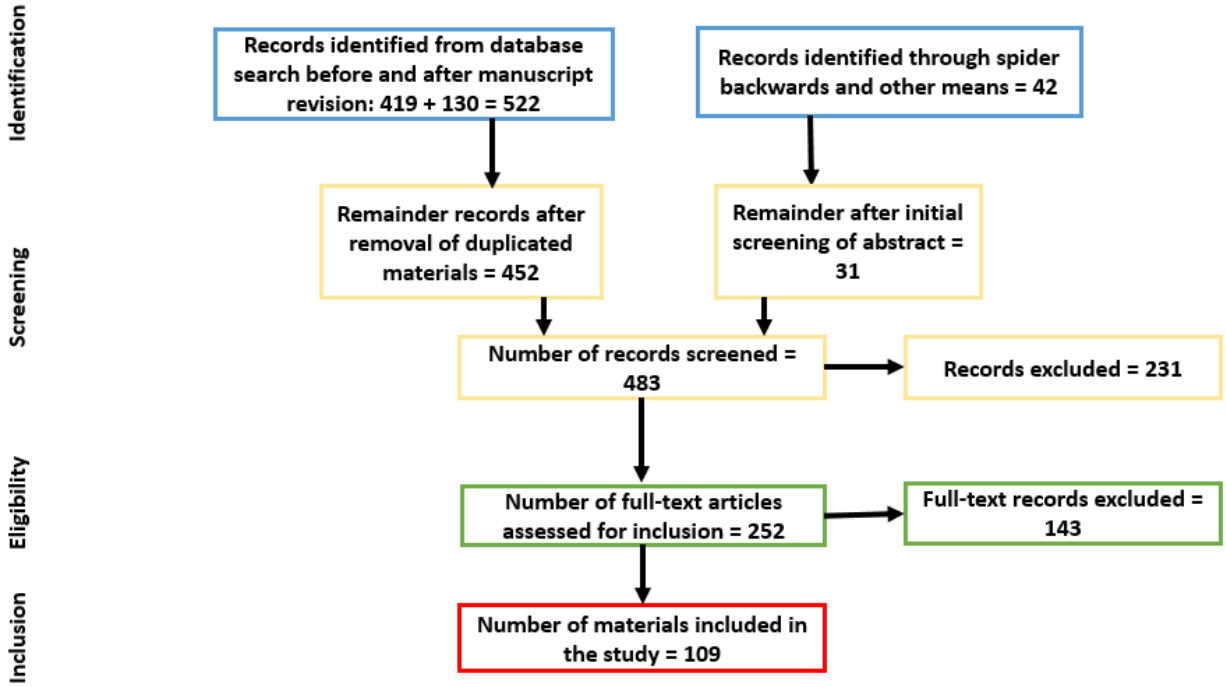


Figure 29. Overview of literature identification and review methodology

In stage five, I followed Levack, (2012) who notes that a "qualitative meta-synthesis requires an element of interpretation, whereby findings from multiple qualitative studies are combined or reconstructed through some process of reanalysis in order to create new understandings or new perspectives on a given topic". This analytical process helped to summarize and synthesize the study findings with respect to the research objectives. The results of these analyses were finally presented by means of narrative modeling, figures, and textual descriptions in tabular framework for- mats in the discussion section. The developed recommendations' framework was shared, and discussed with experts and professionals in the land sector to seek their views and opinions on the relevance of this recommendations in their work settings, and for validation of same. These

recommendations are relevant to the many developing countries with similar land administration challenges as identified in Ghana.

Primary data, which followed the informal interview conversations, or discussions primarily occurred via phone conversations, and through one-on-one interaction with a selected group of land professionals of the Accra Lands Commission in Ghana. A total of seven professionals were engaged in our informal interactions between April, and August 2021. Three female staff and four male staff of different ranks including: Senior Valuation Officer (1), Lands Valuation Officer (2), Senior Valuation (Assistant) Technician (2), and Assistant Geomatic Officer (2). These staff were purposively selected based on their length of professional practice with the Commission, knowledge of the GELIS adoption project, and experiences in the Ghanaian land administration system. The protocol for our discussion was purposely unstructured to allow for a free flow from the respondents of their experiences of the GELIS project. This made the interview last longer than ordinarily a structured interview will as there had been series of interactions with the expert respondents on different occasions as and whenever the opportunity arose for the researchers to engage respondents. Yin, (2015) notes that the series of interview sessions with the same respondent is very typical of unstructured / informal interview discussions which together makes them take much longer than structured interviews. Despite the unstructured and informal nature of our interactions, I was able to obtain rich data for the study. This was made possible because I engaged my respondents in an informal approach, and at their convenient times which allowed them to talk at length on the issue at hand. The informality allowed for flexibility, and ability to give in-depth details on the issue. Discussions focused on the GELIS adoption project as the main subject while inter- locking it intermittently with Blockchain for land administration issues. Our data centered mainly on the GELIS technology adoption, usage, challenges faced, and on suggestions that will be relevant for consideration in a future technology (Blockchain) adoption project. Data gathered were subjected to qualitative content analysis, and interpretation, as described in (Gale et al., 2013). This approach was used because it helps to reduce the data in a way that can support answering the research questions by providing a structured approach to analyze the main themes and ideas which leads to a better synthesis of both the emerging perspectives and existing literature in a rigorous way (Gale et al., 2013). From the synthesized primary, and secondary data, I complemented the method with an adapted criteria suggested by the Organization for Economic Co-operation and Development (OECD) for the derivation of guiding parameters for development programs Visvaldis, Ainhoa, & Ralfs, (2013) to help arrive at the proposed Blockchain adoption recommendations.

6.4 The GELIS adoption project case study and lessons emerging

Based on the GELIS adoption, implementation, use of the technology, and the challenges encountered, this study learns from the experiences to chart a path towards suggestions for Blockchain adaptation for land administration services. From the expert responses and secondary data retrieved, it was revealed that being part of Ghana's Land Administration Project phase two (LAP 2), the adoption and implementation of GELIS followed the procedure below:

1. Issuance of terms of reference by LAP 2 for provision of the required system elements for GELIS

2. Project Tendering

3. Development, testing, and deploying GELIS software

4. Procurement, installation, and commissioning of hardware

5. Data conversion and loading of data to the system.

6. Rollout of GELIS software to selected offices

7. Knowledge transfer, and capacity building for staff

The GELIS database, had different sub-systems (valuation register, document manager, register of spatial objects, register of parties, user management, case manager, address register etc.). The database configuration mirrors the hierarchical structure of the Commission's divisions. In the GELIS system, permitted users can only enter and process data that are based partly on locally existing manual records and maps (Deane et al., 2017). The GELIS project was aimed at supporting the Commission, and other land sector agencies like the Land Use and Spatial Planning Authority (LUSPA) to process their own data electronically on full automation of land administration services (Biitir et al., 2021). Contrary to this expectation however, expert responses indicated that the project adoption and usage had been fraught with several challenges which limited achievement of the expected outputs. This finding is synonymous to the findings in (Biitir et al., 2021).

From a technological perspective: the whole GELIS idea was part of the LAP 2 project under which stakeholders were interested in developing a digital system for land services delivery within the project timeframe. Hence, to a large extent, attention focused issues as; getting the expertise to develop the system, digitization of hardcopy documents, the different component parts that the system will encompass, and the financial source for carrying out the project scope among others. How- ever, issues of technological assets of the Commission, and technology compatibility had affected the ability to easily move to and use the GELIS platform efficiently. That is, many necessary technological asset, like, large format scanners that would have supported, or made it easy to adopt the new technology were problematic (Biitir et al., 2021 pp. 28). Also, some of the staff were unfamiliar with the technology and had difficulties with its use. This I attribute to limited technological proficiency, and training period for the use of the technology as some respondents indicated their displeasures with the approach used to educate operational staff on the use of the system. It is however important to note that technological considerations in the adoption of new technologies include; technological infrastructure readiness, ease of use and adaptability, as well as the maturity of the technology among others. Where attention is more focused on the availability, and readiness of the new technology at the expense of these other factors, the adoption could hit challenges that can have equal negative impacts on its success, and sustainability. In the GELIS adoption, the findings show some lapses in the technological factors necessary for considerations as was identified in the absence of large format scanners which were necessary to support of a well-functioning GELIS system (Biitir et al., 2021 pp. 28). Also, strong and stable

internet connectivity, and the presence of servers needed in support of the adoption had been a big challenge. A respondent added that the internet problem, and lack of servers partly contributed to the inability to have extended the scope of the GELIS project to other regions.

Regarding organizational aspect, resources by way of lack of financial sufficiency led to the cutting down of the GELIS project's initial scope to about only 60% of the software functionality. This led to the exclusion of certain sub-systems like the valuation register, and the rent collection and management (Deane et al., 2017). These exclusions affected the full scope functionality, and automation of services delivery as was the initial objective of the adoption project. This slack in financial resources affected not only the scope of the project but the planned timeframe of the project as well. Another issue identified through our informal discussions was that the Lands Commission's operational staff who are the actual people to work with the technology were not fully involved, and or engaged in the adoption process. A respondent, (Land Valuation Officer) noted that after the whole process of adoption and implementation was concluded, a one-day training was then organized to brief them on how the system works and that was all. This finding is similar to that in Biitir et al., (2021 pp. 27) who found that decisions concerning work at the Commission is taken from top management. However, it is important to mention that top-level-focused management approach mostly results in operational difficulties since everything becomes new to the operational staff when they are only brought into the picture at the point of usage. This approach resulted in operational difficulties for some of the staff after the rollout of the GELIS system. A member of the adoption team noted that although they had organized a training session for the staff on how to use the system, they had to go over again couple of times after the actual rollout to still assist some staff in the use of the system because they had forgotten what was taught at the training session. He added ".and one particular issue I had that came up was in the naming of the pdf. That is, what they have scanned, they should not leave any space in the pdf naming. They should just do that as one word or they should just use underscore to keep it as one word but I realized a lot of them were using the spacebar. And so when they attach a document, anybody behind at the back office cannot see the document. So I had to go into the applications to find a way to resolve the issue". Also, to an extent, limited human resource and capacity to support the adoption is another challenge that made the workflow process a complex one than was expected. Due to this, the design of the adoption was such that some of the Commission staff be involved to develop their knowledge and skills by working with the GELIS development team which was an externally sourced one. This was to enable them be able take up the role in such future developments (Deane et al., 2017). Despite this, a respondent in Biitir et al., (2021 pp. 24) cited an example that had contributed to this challenge by saying; '*one of the critical staff who had been trained to handle disputes on documents resigned just when the proposed workflow process was to be implemented*'. Such unforeseen and unplanned incidents could easily ruin the entire project outcomes.

From the external perspective, adoption of the GELIS was a component part of the bigger project of reengineering the Lands Commission's work processes under the National Geospatial Policy (Deane et al., 2017). The bureaucracies involved in this bigger project thus, equally affected the GELIS adoption. For instance, due to the change in governance in 2016, and the reconstitution of a new cabinet under the new government, the approval for the project's memorandum which was

supposed to have been done by the previous cabinet could not happen and so had to be done by the new cabinet (Deane et al., 2017). These political changes, to an extent had caused some delays in the timely adoption and implementation of the GELIS. Also, from the GELIS adoption and implementation procedure outlined already, I identify that the public stakeholder or clients' involvement in the adoption process is missing. This I attribute to the fact that the GELIS system was meant to be used by the staff without a frontend interface for clients. Notwithstanding this however, I find it a great omission in the GELIS adoption process since the clients play a crucial role given that it is their land transactions that are the subjects of the technology adoption. Unfortunately, it appears from the outlined GELIS adoption process that they were not involved. However, for the ELIS system rollout, notices were posted at vintage points at the Commission premises to notify the public clients and also to outline the processes involved.

These TOE shortfalls in the GELIS adoption project are contributory to its inability to achieve full automation by way of offering contactless land services delivery, neither did it speed up work processes to any much appreciable level as was the initial objective. Therefore, to build upon GELIS and to achieve full automation of services as was initially envisaged, the Commission introduced the Enterprise Land Information System (ELIS). The reason for introducing ELIS was to complete the digital system for land administration services delivery. With the ELIS introduction, one respondent explained that the introduction and adoption process of the ELIS, just like in the GELIS, had not been the best. This according to the respondent is because, ELIS was introduced to them as a replacement for the GELIS, and just as was done in the adoption of the GELIS, this introduction of ELIS to the operating staff was made after the whole adoption and implementation phase was completed. It only happened that a training session was organized to train the staff on the know-how and use of this new system. In the respondent's opinion, the introduction of an upgrade or new technology in place of the old one was an opportunity for the Commission to have involved and engaged them right from the start. This would help to take their views in respect of the challenges faced in working with the old system so that the old challenges could have been improved in the new system. Finally, when ELIS was also rolled out for use, numerous un- foreseen challenges and difficulties with use were encountered including user-unfriendliness, among other complexities. This situation led to a halted system for about two weeks at the Commission as indicated by a Lands Valuation Officer respondent. He added that 'land services delivery almost came to a standstill during these two weeks period'. As a way for- ward, most of the land professionals resolved to working partially with the limited possibilities they could in the ELIS, while combining it with the old system in the GELIS, and also with the manual processes in some cases just to redress the pressure of workload, and backlogs. All of these challenges from the TOE perspective contributed to unrealized expected outcomes (Biitir et al., 2021). Notwithstanding this however, one major aspect of the Ghanaian land tenure and land administration system that significantly affects land decisions' success which was missing in the adoption project is socio-cultural elements. These are very crucial in the land administration systems in many parts of sub-Sahara Africa due to the dominance of customary land systems and values.

6.4.1 Lessons from the GELIS adoption project from a TOE perspective, and the importance of socio-cultural elements in technology adaptation for land administration

6.4.2 Technological

Technologically, it is important for any organization that seeks to adopt a technology to first assess the actual need of the technology to be adopted, and its usefulness over an already existing system. An adoption decision becomes relevant if the existing system can no longer deliver the expected results to a satisfactory level for people Cordella & Tempini, (2015) and as such resulting in slower, or less efficient output. There has been an increasing rate of contentious, and conflicting land relationships in the Ghanaian land market over the years (Danso & Manu, 2013; Kwofie & Afranie, 2013; Obeng-odoom, 2016). This results mainly from shortcomings in both the customary, and statutory land administration services. It can therefore be said that both existing systems, to an extent have failed to provide satisfactory results for the society. This situation necessitates the need for new approaches, and or technological support for Ghana's land administration system. Block- chain technology, with its unique features, makes it possible to enhance transparency, trust, ease of land information accessibility, and high participation of stakeholders in land transactions. It eliminates fraud, corruption, double sales of land, and manipulation of land data, establishes clear land ownership status, supports data quality, accuracy, and integrity, reduces human error possibilities in land transactions and recordation, and also provides security and resilience to land records (Ameyaw & de Vries, 2020). With these promises of the technology, a possible use of Blockchain comes in handy if the land challenges in Ghana could be effectively tackled as it has become crucial to find a lasting solution to these challenges.

Also, technological sufficiency, and compatibility in support of the new technology to be adopted is very important. This is because Supriyadi et al., (2021) note that the adoption of Blockchain needs to be supported by other technologies. This is needed to avoid such challenges as was experienced in the GELIS adoption where the scanning of large format maps was impossible with the existing scanning machine of the Commission. Such incompatibility situations usually lead to poor functionality in the new technology. Technological compatibility can help staff to understand, adapt, and to use new technologies with ease, and to achieve the desired output. Again, interoperability of the technology due to the different divisions and departments involved in land administration is crucial. This will help achieve easier sharing and exchange of land information in the day-to-day services among all land professionals. And since such shared data are in the similar formats, it is much easier adapting, or migrating them to a new system. It is however important that all institutions, departments, and or divisions that are involved in the land administration both directly, and indirectly be equipped and introduced to how the new system operates. This can be done through engagement of these other bodies' right from the beginning in the adoption procedure, and training programs to help effect a smooth adoption and adaptation, interoperability, and acceptance of the new technology.

6.4.3 Organizational

As seen from the GELIS adoption experience, organizational structure, and communication channels at the Commission is a top-down approach. This shows power dynamics within the Commission. The power dynamics play a crucial role in the success of any technology adoption project and is best explained in the stakeholder salience theory (Mitchell et al., 1997). In this theory, power attribute centers on the ability of those stakeholders who possess comparatively much power than others to bring about the results that they desire. That is, the most salient stakeholders have more control power over the adoption process than other stakeholders with less control power. A typical example is the power dynamics between top-level management, and middle-level operational staff. Therefore, where such power dynamics dominate decisions concerning a technology adoption process, it has the tendency to negatively affect the overall outcome, and sustainability of an adopted technology. This is because, such power dynamics could cause the less salient or powerful stakeholders' input into the adoption decision to be suppressed, and or not considered. Power dynamics, and Power-plays in organizations therefore need to be checked to ensure that it is balanced towards achieving the broader adoption objectives of the organization. Ensuring the involvement of all stakeholders, including the public clients, as well as the customary sector in the adoption of a new technology for land administration services will therefore enhance a balanced interplay of stakeholder power dynamics in any technology adoption process. Also, where the organizational structure and communication channel is a lateral one with clear reporting lines that encourages all staff involvement in decision making, the probability of technology adoption success is high (Baker, 2012). Reconsideration of the organizational structure, and communication channels such that it promotes all-staff input, ideas and suggestions during technology adoption processes thus becomes necessary in a future Blockchain technology adoption. Such an organizational structure encourages all staff to sup- port the adoption process which has a higher tendency of contributing to success. This is also vital in Blockchain adoption since the operation of Blockchain technology is a decentralized one that is based on stake- holder consensus and or participation. Therefore, where the operational staff input isn't the best in the adoption process, such consensus and or participation requirement for Blockchain technology's operation could be problematic as a result of entrenched positions of some staff.

Also, Blockchain is an interoperable technology and as such intra- organizational, and inter-organizational understanding and acceptance is ideal in the technology's adoption. That is, organizations will have to first accept, and agree to be bound by the technology, and to not object to its requirement of releasing and sharing genuine land information. It is this agreement, and a commitment to it that can allow for a smooth running of the Blockchain system. However, where some divisions are willing to comply with technology operational requirements, and others decline, for example, to release and upload the right data, the whole technology system will run into naught which can render the system unusable. Therefore, it is very important that the different institutions, and divisions comply with the system, and their datasets be streamlined to fit into the new system to be adopted. Organizational acceptability will therefore involve such actions as digitization, and possible con- version of differing data formats of the different land sector divisions into formats acceptable in the new system to allow for easy adaptability. This will ensure

easy migration of all existing datasets onto the new system, and enhance efficient interoperability, and ease of data sharing across all relevant divisions, and stakeholders.

Another factor to consider is employees' technical orientation and experience. This is very important since it will be difficult to optimally use such technologies as Blockchain in an arena where the technical inclination of employees is very minimal. Management could help in this regard by inculcating continuous-professional-development (CPD) programs that are more technically oriented, and find the right experts to help in such programs. Furthermore, more of land-related technically oriented graduates like Geomatic Engineers be employed to handle to most technical aspects of such technologies, while other less technically inclined operational staff can be given on-the-job training in these technical aspects of land administration.

Again, Management-subordinate communication structure is an important consideration if Blockchain technology adoption can be successful. The organizational culture in Ghana like many other African countries is such that where Management's communication relationship with staff is a good one, the subordinate staff are well motivated to support and assist with Management initiatives and to contribute to its success. That is, closeness in communication promotes timely, appropriate supportive behaviors (Vaux et al., 1986). It is generally established that where the communication structure does not make subordinates feel part of decision making, there is unwillingness and or reluctance on the part of subordinates to support Management initiatives. This can sometimes lead to subtle sabotage on the part of some subordinate staff. However, an approachable attitude, and behavior of Management with subordinates can influences successful adoption. This becomes even more imperative in Blockchain's adoption given that the technology's operation is a decentralized one that eliminates central authority influence in decision making. Finally, financial sufficiency is an important consideration for any new technology adoption, and adaptation. This is a key consideration right from the planning/ preparation stage. This is because, the infra- structure that are critical to the adoption and implementation of the technology might not already be in existence and the cost of acquiring them could equally be expensive particularly for developing countries (Castro et al., 2020). It is therefore important that the financial outlay for Blockchain adoption project be known in advance, and the source of finance and capacity to handle it be established. This is important for the reason that financial insufficiency during the adoption process could lead to inability to completely deploy the full scope of the Blockchain technology. Such a situation will then only result in an inability to deliver the desired expected outcomes from the technology.

6.4.4 External

External factors worthy of attention in Blockchain technology adoption for land services include, acceptability of the technology from the broader industrial stakeholder perspective. Cordella & Tempini, (2015) note that a transformation should occur when people/ stake- holders show the necessity for a new approach to serve customer needs. Where it is evident that the broader stakeholder shows the need for a new approach, acceptability of any move towards the new approach becomes easy. For instance, a good external stakeholders' acceptance accounted for the successful case of Blockchain land registry project in Georgia (Benbunan-Fich & Castellanos,

2018). External factors may include the legal framework within which the technology adoption project is carried out, the governmental approval of the project, other industry partners' approval, the public/ clients' acceptance among others, However, securing these external factors are sometimes missing in a technology adoption project. For instance, identifying the public-stakeholder acceptance was missing as seen in the GELIS adoption process outlined earlier. Such situations can lead to societal acceptability issues particularly for an advanced technology like Blockchain (Habib & Shah, 2013; Biitir et al., 2021). Public-stakeholder acceptance is however dependent on their aware- ness, and understanding of the technology. Therefore, through mass media communication channels, seminars, workshops, and conferences, the public-stakeholders could be informed, sensitized, and educated about the technology, and as well be convinced on why it has become necessary to adapt such a new technology. This can facilitate public acceptance of the system.

Also, external regulatory and political factors do play a role in Blockchain technology adoption. Due to political bureaucracies, and periodic changes in government which sometimes could have implications on initiatives of the past government particularly in some sub- Saharan African countries, a decision to adopt Blockchain must consider the perspective of political governments on the technology and be able to ascertain possibility of political support as this could hinder or prove problematic for a successful Blockchain adoption. An instance of political interference in a Blockchain adoption process was in Honduras where political resistance led to a stop in a land registry-Blockchain adoption project (Benbunan-Fich & Castellanos, 2018).

Again, it is important that consideration be given to existing data security and privacy laws in the country, and to ensure that Blockchain by its functionality features complies with the legal framework. Where the law contradicts or does not completely support adoption of the technology, steps will need to be taken to redress this in good time. For instance, Eder, (2019) notes that Ghana's Security and Exchange Com- mission (SEC) has been hesitant to the issuance of regulations on cryptocurrencies. Therefore, where there are such hesitations within the responsible authorities in government and measures are not taken to- wards it, such positions could prove challenging to the technology's adoption.

Other external consideration worthy of noting particularly in developing countries with energy challenges include: Stability of electricity energy/ power supply. Over the past years, Ghana, Nigeria, and some other developing countries have been experiencing occasional erratic electricity power supply that can greatly affects the well- functioning of activities dependent on the national power grid. Mean- while, Blockchain as computer based technology, requires huge electric power and stability (Ameyaw & de Vries, 2020). Thus, avenues for a stable electricity power support are an important consideration for Blockchain adoption. It is good to note that big institutions as the Commission usually have standby power source as alternative to the national grid. It is however important that authorities ensure that these alternative power sources are readily available whenever necessary. For instances, Responses from some respondents indicated that it sometimes could takes several minutes to hours for the standby power to take over during power surges. And during these time gaps in the power switch, a digital system will automatically be done to affect services. Another consideration is a, reliable and strong internet connection. Like many other

developing countries, strong and reliable internet connectivity at reasonable costs could be a problem for a proper functioning of digital technologies. Better arrangements with internet service providers for a good and strong connectivity at a much better charges can greatly contribute to a successful Blockchain adoption output. Again, a factor borders on support from other industry players especially private experts on Blockchain technology. This is crucial considering that block-chain is relatively new to land sector in many African, and other developing countries. Just as has been the way to its adoption in different countries like Georgia, Sweden, Kenya, and others, partnership with private Blockchain firms is a good way to go. Fortunately, there are some private firms Benben (Accra) and Bitland (Kumasi) that are engaged in Blockchain-based land solutions in Ghana. These private firms can provide tremendous assistance towards the adoption process. Therefore, possible collaboration, and or partnership with these indigenous firms needs to be considered in a Blockchain adaptation process.

6.5 The importance of socio-cultural elements in Blockchain technology adaptation

Important is the recognition of customary land governance, and authority in a Blockchain adaptation especially in countries with customary land tenure system. As noted earlier, customary tenure holds 80% of all land in Ghana. Land administration system in Ghana can therefore not be complete without a good cooperation from customary landowners, especially the traditional authorities who act as custodians of customary lands. These traditional chiefs wield so much power, and control over the management and administration of customary lands although the Commission exercises supervisory role over these power, especially the power of disposition as stipulated under Article 267(3) of Ghana's constitution (Government of Ghana, 1993). Since land in Ghana is considered as belonging to both the living, the dead, and generations to come, it forms a social bond between the people. This belief according to Paaga & Dandeebo, (2013) provides a significant reason to regulate the activities of customary land managers. Thus, in addition to the regulations stipulated in Ghana's constitution, the new Land Act 2020, Act 1036 further makes provision for regulation of customary land sector activities. It provides for the recording of customary interests, and rights by the customary land secretariats (CLS). Act 1036 also provides for electronic land transactions. The Act 1036 in Chapter one, section 14 (4) now recognizes activities of the customary sector through the CLSs and requires that the CLSs keep a proper record of all transactions at the customary sector, and to submit all such records to the Commission on monthly basis. It also establishes recognition for electronic conveyance under the chapter 3 section (73) (Land Act,2020. Act 1036, 2020). These provisions of the new Land Act provide better grounds for operationalization of the proposed Blockchain adaptation framework. This is because, the requirement of the CLSs to record and submit land trans- action records to the Commission is only contingent on recognition of customary land tenure structures, governance, and authority and this is what the socio-cultural elements of land tenure are about. This study's suggestions framework provides a guide for adopting Blockchain technology in support of land transactions via digital means. This is thus consistent, and offers a guidance means towards achieving electronic conveyance system as is recognized in the new Land Act. Blockchain technology aside other

possibilities also offers digital signatures, and time-stamping (exact time and date of a transaction's creation) functionalities which are the mandatory contents required for electronic conveyances as noted in section 78(A&B) of the new Land Act, Act 1036. Again, given that the operation of Blockchain technology is based on transparency and decentralization of authority, and the fact that there exist some connections in land transactions that involve both statutory, and customary sectors Ameyaw & de Vries, (2021), it is expedient that customary land governance, and customary authority be recognized, and engaged in the Blockchain technology adoption to help eliminate any unnecessary overlaps in activities. This is important because the major source of land in Ghana is the customary sector, and will therefore be easier to capture the genesis of many land transactions within the operation of the Blockchain system, once the customary land authority are recognized and made part of, and to support the Blockchain system. This can help salvage most of the challenges in the land sector as the majority of these challenges begin from the customary level. It is no wonder that land cases constitute the highest percentage about 45–50% of all court cases in Ghana (Nara et al., 2014; Broni, 2019). We can achieve cooperation and support from the customary sector by engaging, and collaborating with the customary authorities through their customary land secretariats (CLSs) which are the land administrative units for the customary authorities. Where the larger customary sector is on board, and in support of a land initiative like Blockchain application, it will be much easier for adaptation based on both customary, and statutory tenure tenets.

Furthermore, trust is a fundamental element that influences behavior and as such makes it critical for technology adoption (Umapathy, 2009). Where there is no trust, citizens, and especially the customary authorities are likely to resist a Blockchain system. Trust is a cultural value that influences most actions in any society, and much especially in societies where technology advancement is limited and so most interactions be- tween people are based on trust. Unfortunately however, there is a high level of mistrust in Ghana's land sector (Kwofie & Afranie, 2013; Biitir, Nara, & Ameyaw, 2017). And where the public has no trust in the land institutions, it becomes difficult to accept and support these institutions in their initiatives. Therefore, in considering the adoption of such an all-stakeholder centered technology like Blockchain, there needs to be public trust in the initiative, and in the technology. They need to be convinced of the technology's capability at resolving the challenges currently plaguing the sector. By providing credible information to the public on the technology, its potentials, source, and the investors involved, society could be convinced. Also, there must be avenues where citizens' questions and concerns on the technology and its adoption could be addressed. These avenues must be as accessible, open, and transparent as possible. These measures have the potential to persuade, convince, and boost trust in the initiative which is necessary for acceptance.

Social-capital is another important element to consider in Blockchain technology adoption. Social capital looks at resources available to the society to enable them use the technology. Educating people on the technology and its usage might not be all. Being aware of the resources available to the public that can help them use the intended system is very important to help adapt the system towards such resources. For instance, where the requirement of a smart mobile device to access the system could be problematic to majority of people, the adopting authority could then be looking at possibility of offline deployment so as to adapt well to the majority of people. But where this

isn't considered, and many people lack the necessary resources to help them use the system, it could be a challenge to their acceptance. Also, awareness of the cost implications of the adoption on the citizens is vital. The financial status of people in the society is an important social consideration for taking any initiative for which the society will pay for its use. Where a block-chain system leads to better services at a comparatively reasonable or cheaper cost, the community can better take advantage, and use the system. However, where the cost implication of land administration services on the citizens rather becomes exorbitant due to the adoption of a Blockchain system, people might be unwilling to accept and use.

From the ongoing, it is thus important that in considering technical, organizational, and external issues in a Blockchain adaptation for land administration service project, socio-cultural elements of the society cannot be overlooked as they equally play important role particularly in societies with customary land tenure.

6.6 Suggestions for Blockchain adaptation for land administration services

Based on the TOE framework, and the importance of socio-cultural elements I sought to derive suggestions that can be used to assess, and or evaluate the readiness of a land sector for Blockchain adaptation. These suggestions are to help know if existing conditions are positive to contribute to a successful Blockchain adoption and outcomes, or if there is the need to improve on these for the Blockchain adoption. Derivation of these suggestions follow the recommendation by the Organization for Economic Co-operation and Development (OECD) for developing guiding parameters for development programs as cited in (Uwayezu & de Vries, 2018). OECD recommends use of simple parameters that can be tracked over a timeframe in order to provide information on trends in the condition of a phenomenon, or the achievement of a development program (Visvaldis et al., 2013; Uwayezu & de Vries, 2018). These parameters according to Visvaldis et al. (2013) are simple measures that are related to something more complex and of prime interest. They act as pointers that show the state of a situation or condition (Uwayezu & de Vries, 2018).

From the analysis and discussion done, I identify four main principles as underlying a successful technology adoption. These principles are even more relevant for a new, innovative, and an enterprise technology like Blockchain. The principles provide basis that sets an organization in better position for a successful technology adoption. It is from these principles that I deduce the suggestions for consideration in a Blockchain for land administration adaptation project. The principles are thus associated with the derived suggestions both explicitly and implicitly. The principles posit that for a Blockchain adoption in support of land administration there must be:

1. Technological readiness
2. Organizational readiness and acceptability
3. External industry support
4. Adaptations to local socio-cultural elements

Technological readiness helps to ensure that all technical requirements are in place and suitable to support the technological demands associated with the new technology to be adopted. For instance, Blockchain adoption requires high computational power and resources particularly for a mining process on a public Blockchain network.(Mukne et al., 2019). It is therefore imperative to be aware of this and accordingly to prepare in that direction. This will foster technological readiness.

Similarly, organizational readiness, and acceptance focus on preparing all the land sector institutions that will be involved in the operation of the technology as a unit that has a common goal towards a successful adoption. This principle focuses on bringing all staff from top management to lower-level operational staff on board to contribute to- wards the adoption, as well as positioning the organizations and their structures in ways that facilitate the technology's adaptation. The principle fosters better teamwork towards a common goal. Where this principle is missing in a technology adoption procedure, individual interests, and differences may conflict and can sabotage a successful Blockchain adoption and adaptation.

Again, external industrial support focuses on embedding the adoption goal within the broader industry operations and environment. That is, it seeks to align the adoption of Blockchain, taking into consideration, the Blockchain features, and any other relevant requirements, within the external industry support. This principle helps to identify the role of every relevant external player in the adoption, and to negotiate such a role beneficially. Examples include: navigating through security laws on Blockchain, collaborating with other land sector institutions, as well as securing government, and parliamentary approval and possible support where necessary.

Finally, adaptation to local socio-cultural elements focuses on recognizing local land tenure systems and arrangements, laws, norms, customs, and values among others, and ensuring that the adoption of Blockchain and its operation does not conflict with these long-held socio-cultural elements and traditions on land. The principle therefore helps to rather adapt, and align the operations and functionality of Blockchain in ways that will not lead to its resistance based on local socio-cultural elements of land tenure systems.

Deducing from these principles, I propose the suggestions in Table 12 below as useful for Blockchain adaptation for land administration services.

TOES perspectives	**Proposed suggestions for Blockchain adaptation**
Technological	Actual need of the technology and the appropriate Blockchain architecture type
	Availability of the technology software developers
	Existence of technological asset to support Blockchain adoption
	Compatibility of Blockchain technology with already existing technologies of the Commission
	Complexity challenges of Blockchain and how to overcome
	Comparative advantage Blockchain over existing technologies
	Cost of Blockchain technology and its affordability
Organizational	Staff technological knowledge and know-how in relation to Blockchain

	Availability of staff training facilities and experts on Blockchain technology
	Staff involvement and engagement in the adoption
	Staff acceptance and support for the adoption
	The Commission's financial sufficiency for Blockchain adoption
	Intra-departmental acceptance and support.
	Approaches needed to convert to Blockchain-based services. i.e., gradual/evolutionary (during which multiple systems co-exist for a long time), disruptive / revolutionary (a discrete change / conversion to the new system), rapid (not a drastic sudden change, but still a change within a fixed timeframe)
	Staff performance expectancy (i.e., believe that the new technology will help them attain gains in job performance)
	Top-management and low-level staff work consultations
	Positive communication structure within the organization
External	Availability of a prototype Blockchain projects in the industry from which lessons could be borrowed
	Governments support and approval
	Existing land policies
	Land sector institutional structures in place
	Political/ government changes and impacts on Blockchain acceptance and sustainability
	Existing data security laws on the operation of such technologies as Blockchain
	Consideration of public-private partnership approaches
	Electricity power/ energy availability and stability
	Internet availability, connectivity, and strength
	Level of public awareness and knowledge on Blockchain the through education in the media, conferences, seminars, posts and others
	Existence of avenues in the industry for Blockchain-based expertise capacity development
	Existence of technical expertise in the industry to support the adoption
	Intra-institutional acceptance and support (including: town and country planning department, real estate agencies etc)
Socio-cultural elements	Recognition and involvement of customary land governance and authorities
	Consideration of the land tenure types in existence (customary, statutory, and others)
	Society/ customers' confidence in the information and the intentions of the investors and actors from outside the community
	Available avenues for confirmation/ and or clarification of the public's concerns with the technology adoption
	Community's awareness and engagement level
	Community's acceptance of the Blockchain adoption decision

	Distributional justice (How costs and benefits associated with the adoption will be shared)
	Procedural justice (fair decision making process giving all relevant stakeholders an opportunity to participate)
	Community's past experiences with similar initiatives must be analyzed and actions taken to improve those experiences in the adoption of Blockchain
	Community's computer attitude (the extent to which people like and feel comfortable with usage of computers for such public services as land administration)
	Community's computer anxiety (the level of fear, or apprehension that people feel when they use computers, or consider the likelihood of computer usage for activities and or interactions)
	Social capital (resources available to the citizens to enable them take advantage of the technology)

Table 12. Suggestions for Blockchain adaptation for land administration services.

Source: Authors' construct 2021.

The above table 12 summarizes the prime areas under technological, organizational, external, and socio-cultural elements necessary for consideration in Blockchain adaptation for land administration services. It is important to mention that these suggestions relate not only to Blockchain adoption but other technologies as well. However, depending on the technology in question, and the context of application, all suggestions might apply at same scale of relevance or at different scales. This is because different technological tools have different features and operational modes. However, for Blockchain technology's adaptation in Ghana's land sector, I consider these suggestions as applicable at same scale of relevance, and therefore worth considering for a Blockchain technology adaptation.

6.7 Conclusion and policy implications

I sought to develop suggestions to help Ghana's Lands Commission professionals make use of for a future Blockchain technology adaptation. The underlying argument is that where such suggestions are ignored, a possible Blockchain technology adoption in Ghana's land sector may likely lead to unsatisfactory outcomes or expectations. Our study adapted the TOE framework to guide the analysis of our findings. For the specific case of Blockchain adoption in Ghana's context, our findings led to an extension of the TOE framework to include a socio-cultural elements in addition to the technological, organizational, external aspects of the framework.

Study findings showed that a lack of adequate grounding in the GELIS technology adoption to an extent contributed to lower outcomes than was expected. This inadequate grounding manifested in diverse ways including: compatibility challenges between existing technologies and the GELIS technology system, inadequate financial capacity to complete full scope of GELIS project, low technical know-how and capacity on the part of some staff, and also governmental bureaucracies and political changes. As a way forward, and applying both framework analysis, and meta-analysis, I scooped useful lessons from the GELIS project and other technology (Blockchain)

adoption literature. Finally, following a recommendation by the OECD for the development of parameters for development projects, I derived suggestions covering technological, organization, external, and socio-cultural elements of land administration for a future Blockchain technology adaptation project. Although I used the GELIS technology adoption project in Accra Lands Commission as a case study, the results of the study, and the suggestions provided here are not limited to the Ghanaian situations alone as these are equally applicable to some other developing land administration systems both in sub-Saharan Africa, and in the global south. This is because, similar land challenges like; lack of transparency in the system, corruption, fraud, and land litigations among others as identified in the Ghanaian system have been identified in the land sector in other regions like Nigeria, India, Uganda, Honduras, Pakistan, Thailand, Vietnam, Kenya, Indonesia and others (Van der Molen, 2007; Benbunan-Fich & Castellanos, 2018; Seun et al., 2020; Aquib, Dhomeja, Dahri, & Malkani, 2020). Chigbu, Bendzko, Mabakeng, Kuusaana, & Tutu, (2021) noted that some fit for purpose approaches to land administration identified in Ghana, Kenya, and Namibia could be applicable in other areas like India, Fiji, or Indonesia if their context land situations are similar. Thus, recognizing such similar land challenges, and tenure systems in Ghana in other regions makes the suggestions to a large extent equally relevant for these other areas with similar land is- sues. However, it is important to point to the international audience that due to the difference in certain socio-cultural elements in other areas with similar land issues as Ghana, applicability of the suggestions will need to be adapted as much as possible to contextual situation.

The major contribution of this paper lies in the development of the proposed suggestions for Blockchain adaptation in Ghana and other countries with developing land administration systems. This fills the missing gap in literature on Blockchain technology and land administration issues in Ghana. It makes the study timely especially with the coming into force of the new Land Act, Act 1036 which makes provision for electronic land transactions. It will also help avoid many of the past mistakes in technology adoption projects going into the future with focus on Blockchain technology adaptation. Also, the extension of TOE framework to reflect socio-cultural elements which are very influential in any development programs, Chigbu et al., (2017) is very novel. This is particularly important in relation to land matters in a sub-Saharan African region as it draws attention to an aspect of consideration that is taken for granted in land technology adaptation projects despite the customary land tenure systems prevalent in some of the countries in this region. Lastly, the TOE framework, being an information science theory that has been well conceptualized and extended in this land administration discipline that usually uses database, and computer science theories, is a novel approach that broadens the theoretical bases in land administration literature.

The study's limitations lie in the fact that Blockchain-based studies are still evolving in the land sector and hence, conceptualizations, and literature coverage especially in the sub-Sahara African context are still in the burgeoning stage. I however overcame this through borrowed literature on Blockchain's application in other related disciplines in both developed, and developing country contexts to complement the ones identified in the land discipline. Another limitation is that the extent, applicability, and validity of the proposed suggestions is subject to empirical test and

validation especially in Ghana's land sector. I therefore recommend further works in this direction to help advance the applicability strength of the proposed suggestions.

Finally, regardless of the potentials of our proposed suggestions for Blockchain technology adaptation, policy implications become necessary if these suggestions will lead to better outcomes in land administration. These implications include: Citizenry and customary leadership engagement and participation, capacity building, system support, acceptability, and increased adaptability.

Chapter 7.

Digital Readiness of Ghana's Land Administration System for Blockchain Technology Uptake. Empirical Assessment of Three Land Sector Institutions[5]

Abstract

Ghana's land administration system is on a trajectory towards land digitalization despite challenges of the still predominant manual processes and use of hardcopy documents. Recent discourses emphasize Blockchain Technology's potentials towards revolutionizing the sector digitally to enhance transparency of land administration services, and processes. Nonetheless, it is crucial, to first understand the land sector's digital maturity status to know the extent to which BT can be adapted. This knowledge is missing in ongoing discourses. Using secondary, and empirical data from three case land institutions, this study develops an 8 focus area assessment framework with 66 indicators to assess the land sector maturity level, and its readiness for BT uptake. Results show the sector is currently emerging and hence unready at the current state for immediate BT uptake. However, SWOT analysis shows inherent strengths and opportunities in; legal and policies presence, industry partnerships possibilities, and human resources, while challenges revolve around finance, data quality and standardization, and stakeholder involvement and consultations. We identify SWOT strategies to guide policies, and practical implementations on improving the sector's digital maturity for BT uptake consideration.

Keywords: Digital readiness, Digital transformation, Blockchain Technology, Land Administration, Ghana.

7.0 Introduction

Land tenure defines the relationship people have with land. This relationship is influenced by several factors, including culture, and social values, all of which evolve and change with time.

This makes it expedient that land administration practices of recording and disseminating information on ownership, value, use, and development of land and its related resources be dynamic and progressive in the face of changing land tenure situations. The transformation from manual to digital land administration processes is one change that many land administration systems have embraced in recent decades due to the complicated, slow, and somewhat expensive nature of manual land systems (Ali, Tuladhar, & Zevenbergen, 2010). Wernicke, Stehn, Sezer, & Thunberg, (2023) note digitization as simply the conversion of analogue information into a digital

[5] This chapter is a submitted manuscript under review in Land Use Policy Journal

format. Chanias & Hess, (2016) define digitization as technologically transferring data, and tasks onto a computer while digitalization involves using digitized information in operations to produce value. A digital land administration system is therefore one that is based on digitized systems, processes, data and documents. Digitalization has become crucial in today's land sector across the world for the purpose of dispensing efficient, accurate, and transparent land services (Kusmiarto, Aditya, Djurdjani, & Subaryono, 2021; Rodima-Taylor, 2021). Bludnik (2022) noted that digitalization of land administration is growing globally in recent times and is more pronounced in the Global South, where they are introducing computer-based programs to '*collect, process, store and use digital information on land and other natural resources*'. Currently, Ghana has a quasi-digital land administration system. That is, it has an intertwine of digital and manual land administration processes. In this study however, I focus on assessing the status of the digital aspects. Efforts towards digital land services in Ghana date back to 2003 under the Land Administration Project Phase One (LAP 1) Ehwi & Asante, (2016), although the National Land Policy of Ghana had already proposed the adoption of a digital land information system (Government of Ghana, 1999; Karikari, Stillwell, & Carver, 2003; World Bank, 2013). Subsequent to LAP 1, the Ghana Enterprise Land Information System (GELIS) forms one of the earliest attempts at digitalization of Ghana's land administration system. This system, unfortunately had been thwarted mainly by financial constraints following the LAP closure (Deane et al., 2017). This was however replaced with the Enterprise Land Information System (ELIS) as improvement on the functionalities of the GELIS (Ameyaw & de Vries, 2023). After over two decades of a vision, and efforts into land digitalization in Ghana, the need to revisit to assess the digital status of the sector becomes necessary as this can proffer lessons, and guides for advancement especially in current time where most countries are embracing land digitalization.

Several innovative digital solutions in the land sector have emerged including; Artificial intelligence (AI), Internet of things (IoT) and Blockchain Technology (BT) among others that are causing disruptions in land administration systems (Bludnik, 2022). The one tool that has gained prominence amongst these in the land sector is BT (Shang & Price, 2019). Different studies have identified the potentials of BT in land administration, especially, in the Global South where most land administrations systems are predominantly manual, and fraught with numerous corruption related challenges (Ameyaw & de Vries, 2020). Specific to Ghana, (Mintah, Baako, Kavaarpuo, & Otchere, 2020; Ameyaw & de Vries, 2021; Ameyaw & de Vries, 2023; Owusu, Voss, Obeng, & Yahaya, 2023) have shed light on the conceptualization of BT in Ghana's land system. These studies have thoroughly discussed the potentials of BT towards addressing many challenges of Ghana's land sector. Ameyaw & de Vries, (2023) highlighted the importance of socio-cultural elements' consideration in the adaptation of BT in Ghana's land sector. Owusu et al., (2023) also highlighted the importance of institutional factors. Notwithstanding, none of these preliminary studies had considered assessment of the digital status of Ghana's land sector which is an important element in the discussion of possible BT uptake. Understanding the digital maturity status of Ghana's land sector will help assess the sector's readiness, and the extent to which BT can easily be adopted and adapted, or otherwise. That is, whether the land sector is digitally mature and ready for possible BT uptake, especially, given the promising potentials BT presents for addressing the sector challenges. No study has answered this question which leaves a gap in the literature on BT-

Land Administration in Ghana. By investigating this question, this study contributes to filling this gap based on empirical data from three land sector institutions in Ghana; Accra Lands Commission (ALC), Kumasi Lands Commission (KLC), and Otumfuor Customary Land Secretariat (OCLS) also in Kumasi.

7.1 Theoretical View: Digital Maturity, Land Administration, and Blockchain Technology

The concept of Digital Maturity (DM) though not new Chanias & Hess, (2016) has gained much attention in recent times both in academia, and industries (Mahraz, Benabbou, & Berrado, 2019; Vial, 2019; Zaoui & Souissi, 2020). Although DM is more identified in information system, and management science (Mettler, 2011), its use has grown steadily in almost all other sectors ranging from construction, manufacturing, business, to land sector and others (Pirola, Cimini, & Pinto, 2018; Ziyadin, Suieubayeva, & Utegenova, 2020; Levaniuk, Bolsunovskaya, Shirokova, & Gintciak, 2020; Gebrihet & Pillay, 2021; Kusmiarto et al., 2021; Wernicke, Stehn, Sezer, & Thunberg, 2023). This wide application has resulted in several interpretations, and definitions from diverse perspectives as a result of which there is not one single universally accepted definition for DM (Aslanova & Kulichkina, 2020).

Nonetheless, maturity concept connotes the point of completion of a desired transformation, or the state of being ready (Remane, Hanelt, Wiesboeck, & Kolbe, 2017; Pirola et al., 2018). Digital maturity thus relates to a progression towards a target digital status by an institution. DM can be viewed from both the technological, and managerial perspectives (Wernicke et al., 2023). From a technological view, Chanias & Hess, (2016) describe it as the extent to which institutions' tasks are performed, and information flow are handled using digital technologies, while from a managerial perspective, it is seen as the state of an institutions' digital transformation and a description of what these institutions have gained through undertaking transformation efforts. Aslanova & Kulichkina, (2020) also define DM as '*a gradual process of integration and implementation of organization processes, human, and other resources into digital processes and vice versa*'. In this study's context, I define DM as progressive changes from either manual, or a digital state, towards a more emerging novel digital processes and outputs as a result of the integration and implementation of new digital tools or systems in an organizational working practices. To know the DM of an organization however requires a maturity assessment, which is contingent on a framework (Kuusisto, Kääriäinen, Hänninen, & Saarela, 2021; Barry, Assoul, & Souissi, 2022). Assessment framework according to Chekole et al., (2020) is a systematic approach that gives the quality assessment of present activities, and of a system in general.

From a land administration perspective, Ali et al., (2010) recognizes that the growing changes in societal needs, and geo-information communication technologies make it necessary for the development of effective, and reliable assessment frameworks for land administration systems. However, the different purposes, and contexts of land administration assessments make it difficult for a single-fit framework either for evaluation, or comparison at all times (Steudler, 2004; Ali et al., 2010; Showaiter, 2018). Prevailing contextual issues are crucial in the development of a framework, or adaptation of one for assessing either an aspect, or a whole land administration system. Nevertheless, these frameworks are adaptable and lend themselves to modifications.

Although different DM frameworks exist in other disciplines like information systems, and management sciences (Mettler, 2011), DM frameworks specific to land administration are missing. Land sector studies have usually adapted from available assessment frameworks in other disciplines. Kusmiarto et al., (2021) for instance adopted the nine-pillar Digital Governance Readiness Assessment (DGRA) framework of the World Bank (World Bank, 2020). United Nations Development Program (UNDP) also has the six-pillar Digital Maturity Assessment Framework (UNDP, 2022). Other such frameworks include; Digital Maturity Model 5.0 VanBoskirk et al., (2017), Digital Maturity Capability Dimensions Rossmann, (2018), and Digital Maturity Elements Aslanova & Kulichkina, (2020) all of which are for different sectors other than land. To guide the development of a DM framework for a land sector towards a possible BT uptake, I adapt from studies on land administration assessment frameworks, DM assessment frameworks, and BT adoption factors as summarized in Table 13 below. Read (Ameyaw & de Vries, 2020; Ameyaw & de Vries, 2023) for details on the concept of, and guide for BT for land administration.

	Framework	Dimensions	Reference
Digital Maturity Evaluation Frameworks	Digital Governance Readiness Assessment (DGRA)	❖ Leadership and Governance ❖ User-Centered Design ❖ Public Administration and Change Management ❖ Capabilities, Culture, and Skills ❖ Technology Infrastructure ❖ Data Infrastructure, Strategies, and Governance ❖ Cyber security, Privacy, and Resilience ❖ Legislation, and Regulation ❖ Digital Ecosystem	(World Bank, 2020)
	Digital Maturity Assessment (DMA)	❖ Institutional Framework and Collaboration ❖ Service Definition and Delivery ❖ User-Centricity ❖ Skills and Capacity Building ❖ Technology and Solutions	(UNDP, 2022)

		❖ Policy and Regulations	
Land Administration Evaluation Frameworks	Framework for Effective Land Administration (FELA)	❖ Governance, Institutions, and Accountability ❖ Policy, and Legal ❖ Financial ❖ Data ❖ Innovation ❖ Standards ❖ Partnership ❖ Capacity, and Education ❖ Advocacy, and Awareness	(UN-GGIM, 2020)
	Framework for the Evaluation of Land Administration Systems	❖ Policy level ❖ Management level ❖ Operational level ❖ External level ❖ Review	(Steudler, 2004)
Blockchain Technology Adoption Frameworks	Blockchain Technology Adaptation for Land Administration Services: The Importance of Socio-Cultural Elements	❖ Technological ❖ Organizational ❖ External ❖ Socio-cultural elements	(Ameyaw & de Vries, 2023)
	A Systematic Review of the Institutional Success Factors for Blockchain-based Land Administration	❖ Regulatory environment ❖ Organizational environment ❖ Cultural-cognitive environment	(Ansah et al., 2023)

Table 13. Benchmark frameworks for digital maturity, land administration, and Blockchain adoption.

7.2 Methodology

This study adopts two main data gathering strategies. The first involved review of secondary literature, and policy documents on the topic area. The second involved selecting case study areas where primary data were collected through interviews, and survey questionnaire. The literature review focused on identifying related frameworks for assessing land administration, DM, and also factors that influence BT adoption. These were reviewed to guide the development this study's DM assessment framework.

The second research strategy used was the case study approach. Case study allows researchers to deal directly with individual cases in their actual context and the insights generated thereof can

inform decisions in other similar cases (Yin, 2015; Mohajan, 2018). In Ghana, two systems of land administration exist; statutory system under which the various Lands Commissions (LCs) fall, and also the customary system under which we have the Customary Land Secretariats (CLSs). Each system has their own principles, and approaches for land administration. Differentiations exist among these institutions in terms of resource capacity, financial status, years of existence, and experiences among others. These influenced the choice of case study strategy. Case study allowed us to select the most suitable institutions from the two systems taking into considerations factors as; accessibility to the right data for the study, experiences and how well the institutions are developed, language barrier, and functionality level in comparison to other institutions. Premised on these considerations, the ALC, and KLC were selected as cases from the statutory land administration system, while from the customary system, the OCLS in Kumasi was selected. Figure 30 below, is the map of Ghana showing the study regions, and cities of the three selected institutions.

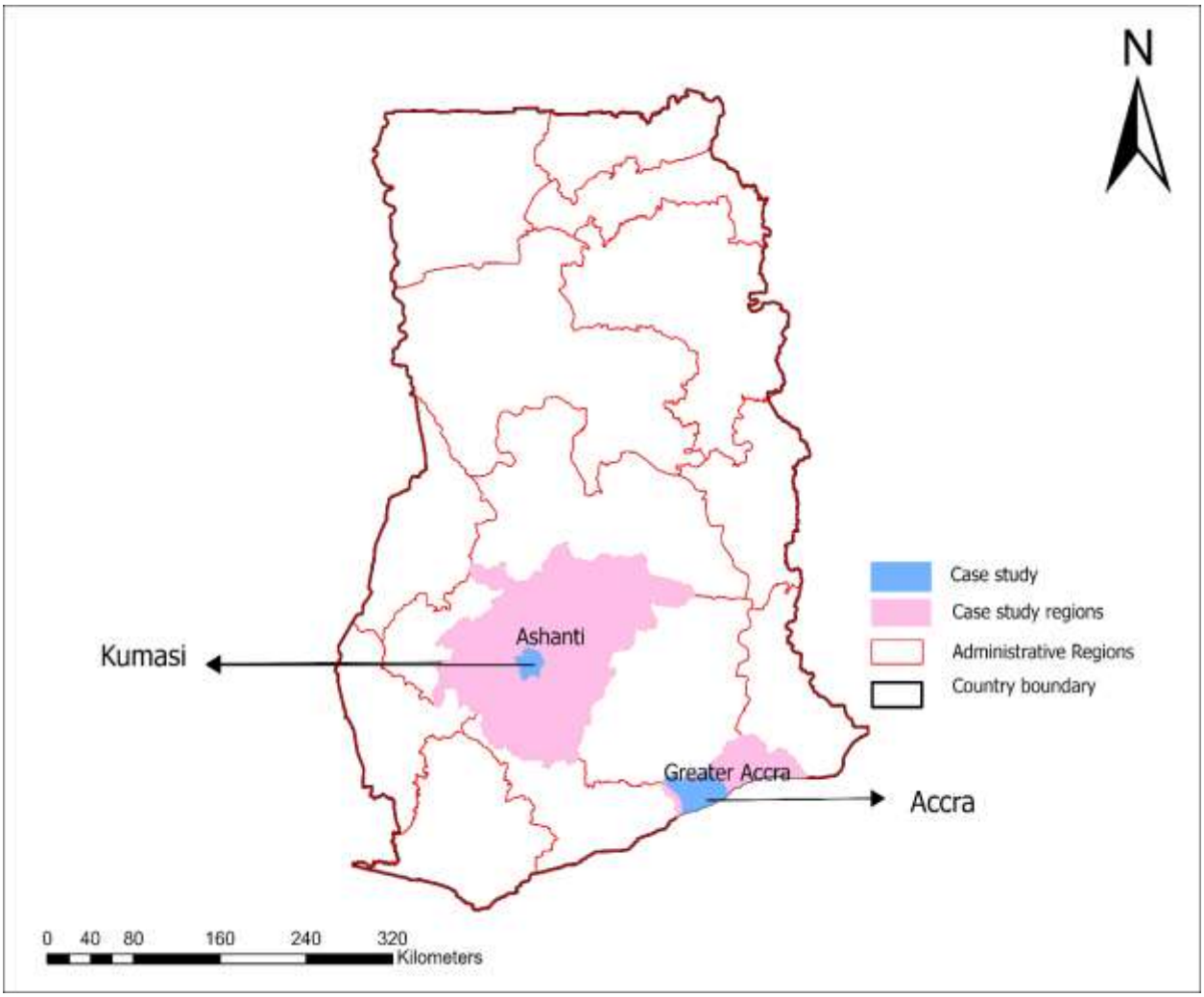


Figure 30. Map of Ghana showing the case study cities

In the selected case study institutions, both interviews, mainly semi-structured and survey questionnaires were administered to respondents which included top level officers and some operational staff. Both interview, and survey questions sought to find out the extent of digitalization in these institutions, the plans and visions on digitalization, availability of resources to support land digitalization, and connectedness of land sector institutions towards digital transformation among other objectives. Respondents were selected purposively, and by snowballing based on their knowledge of the systems and services, and more particularly knowledge relating to digital service initiatives and processes in these institutions. On this basis, partial staff as National Service Personnel were excluded from the respondents as we considered them as not having sufficient information to the line of research questions. In total, I administered 64 interviews, and questionnaire with land professionals; 28 at the ALC, 25 at the KLC, and 11 at the OCLS. Interview, and survey questionnaire were thus the two main data collection tools used in the field. However, for the objective of the study to develop a framework with which I could analyse the DM level, these tools were complemented by further tools; Critical Success Factor (CSF), Video Elicitation (VE), Observation, Field note, and photography.

CSF methodology as adapted from Karikari, Stillwell, & Carver, (2002) was used simultaneously with the interviews, and survey questionnaire. Tsai, Mom, & Hsieh, (2014) define CSF as manageable but crucial factors under important areas of performance that contribute to organization's success, or accomplishment if they are met. Based on the reviewed literature on factors that measure DM, I had pre-defined some factors out of which respondents were asked to identify those factors they considered contextually crucial for Ghana's land administration digitalization vision. Respondents were as well asked to rank these factors in the order of importance on a scale of 3-0 where (3= highly important, 2= important, 1= indifferent, and 0= disregard). This ranking helped us in assigning weights to the different factors identified. That is, factors ranked higher were given higher weighting and vice-versa. Additionally, respondents were asked to indicate the extent to which these factors were present, at the Lands Commission. Where a factor was identified as existing, respondents were to give a rank on a scale of 4-0, to show the extent of existence, where; (4= those factors are present and actually functional, and are also monitored/ measured, 3= factors present and functional, and ways to measure them are implemented but somehow not measured yet, 2= factors are present, and measurable indicators are defined but somewhat not implemented 1= factors are being defined, 0= not applicable/ non-existent). It is important to mention that respondents were free to add, modify, or discard factors they so thought necessary (Karikari et al., 2002). The results of this culminated into our final framework for assessment.

VE tool was also used alongside the interviews, to gather information on BT for land administration. VE tool is used usually alongside interviews to stimulate respondents' reflection

on the phenomenon being investigated (Henry & Fetters, 2012; Zehe & Belz, 2016; Oberdorf, 2017) In this, a video of the phenomenon is shown to the respondents. Visual elicitations have the ability of stimulating memories, thoughts and understanding, better than verbal interviews, especially where respondents are somewhat unfamiliar with the phenomenon being investigated. This was the exact situation in our study institutions regarding BT for land administration. As cited in Oberdorf, (2017) there are three focuses of visual based interview reflections 'reconstructing past-thinking, post-activity narratives, or the construction of reflections on present and future actions'. Since the idea of Blockchain application to land administration is being explored and futuristic in our context, I used the video elicitation based on the last focus, 'construction of reflections on present and future actions' to help evoke in respondents, reflections on the potentials of a Blockchain system, and their view on its adoption for land services. To limit biased opinions being formed based on the video which only showed the use and possibilities BT adds to land administration, I was quick to draw respondents' attention to some of the challenges with possible BT uptake for land administration services.

Finally, observation coupled with field note taking, and photography were used to complement both the interviews, and survey questionnaires. These helped to capture important data which otherwise could have been missed. Study results were analyzed both qualitatively by means of thematic content, and SWOT analysis, and quantitatively by statistical descriptions in excel sheet.

7.3 Findings

7.3.1 Assessment Framework for Digital Land Maturity

Responses from the interviews, survey questionnaire, and CSF methodology, coupled with identified literature on, DM assessment (World Bank, 2020; UNDP, 2022), land administration evaluation (Steudler, 2004; UN-GGIM, 2020), and BT adoption factors (Owusu et al., 2023; Ameyaw & de Vries, 2023) guided us to arrive at the DM assessment framework. The framework consists of focus areas of assessment on the one hand, and performance indicators on the other hand as shown in table 14 below. For each focus area, weightings have been assigned. Similarly, a set of performance indicators, that is, measurable values that show how institutions are achieving their targeted objectives Chekole et al., (2020) have been enumerated for each focus area. These indicators give the variables and proxies measurable, and against which DM status can be described Chekole et al., (2020).

Focus Areas	Weight assigned	Indicators
Policies, legal laws, and political commitment	10%	• Existence of general digital, or e-commerce laws, and which allows for digital signatures, electronic documents, and electronic contract • Existence of policy documents on digital transactions within the land sector

		• Existence of legislative instrument as basis for specific digital transformation initiatives? eg; for GELIS • Are there policies that empower the adoption of digital tools by the land sector agencies as and when it becomes necessary? • Does the government show commitment to accelerating digital transformation of the land sector • Existence of government support avenues for digital system implementations • Existence of a cyber-security strategy and policy document on land? • Existence of land data protection law • Has digital identification legislation been passed • Has a Public-Private-Partnership (PPP) law been enacted? • Existence of legislation to support 'Open Access to Land Information'
Institutional arrangements, and data standards	12%	• Existence of a lateral institutional structure towards digital initiatives, and implementation • Existence of data management strategies, and standardization across the various land sector institutions • Existence of credible, complete, accurate, consistent, and usable data for digital systems • Existence of a defined national spatial data infrastructure • Existence of an administrative reform or modernization strategy to support the digital transformation agenda? • Existence of Data Sharing Agreements or Data Exchange Protocols with other land institutions? • Existence of a contact center to address inquiries on land services or to document complaints from the various user groups? • Existence of guiding principles established to define the design and implementation of digital, or e-Services for each user category • Existence of an outreach/marketing strategy and plan to promote digital or e- Services' uptake across all available channels? • Existence of standard procedures to simplify, digitalize, and optimize land services (e.g. ISO 9000 certification, use of feedback mechanisms, etc.) • Existence of a defined, digitized and shared set of 'basic data registers' across land sector institutions • Existence of a management information systems (such as: e-Business, Land MIS, etc)? • Is cross-land sector referential data (e.g. Personal ID, Business registry, Land database, and Non-Movable assets

		registries) consistently shared electronically across institutions? • Does the land sector invest in change management practices (training, skills, culture, knowledge, HR, etc.) towards digital transformation? • Is there a clear view on the digital capabilities requirements, both business and technical, across land sector institutions to support realization of the digital transformation agenda?
Technical considerations	15%	• Are land institutions adequately resourced with the technological tools necessary to support digital transformation (computers, servers, cloud services, laptops, printers, scanners etc) • Existence of a common digital portal that acts as the front-end interface for all planned digital or e- Services (Online portal, Mobile Apps etc) • Existence of a secure Government-wide digital network that connects all entities (at the national and local levels) to share services and data through a secure Data Center hub • Existence of core services applications • Existence of guidelines for ICT/digital operations' good practices for all user groups • Existence of already underlying software for certain digital services which we can build on to advance land digitalization • Does the land sector use Disruptive technologies such as Cloud services, IoT, Blockchain or AI - or is it open to the idea of doing so? • Have core land service applications been developed? Eg. Document management or correspondence management applications • Existence of a Computer Emergency Response Team (CERT) to offer technical support
Socio-cultural issues	10%	• Societal view and acceptance of digital public services in general • Level of public involvement, and education on digital services' initiative and implementation • Level of acceptance and use (experience) of similar digital services • Extent of customary land custodians, and administrators knowledge of digital services • Recognition, and alignment with customary tenure systems, arrangements, laws, customs etc
Financial considerations	12%	• Existence of sustainable funding schemes for digital land service initiatives

		• Ease of access to funding for digital land initiatives • Presence international development partners' financial support for land digital initiatives • Are national banks and investment institutions supporting land digital agenda in the country?
Collaborations, and partnerships	12%	• Is the land sector open to outsourcing digital services enabling functions to local private firms? • Level of data exchange among different land sector institutions • Extent of collaborative culture around projects amongst civil staff in different land sector institutions • Have partnerships been formalized with local private sector operators in support of digital land services delivery? • Is civil society and/or the private sector regularly engaged in a consultative process to inform the user- centered digital or e-Services design? • Is there an international private sector partner ready and willing to support the commission through partnership arrangements in the digital journey?
Leadership and stakeholder involvement	14%	• Extent of stakeholder consultations on digital initiatives • Extent of operational level staff involvement in digital initiatives decision making • Are users invited to participate in design, test and use of new digital or e- Services? • Is there a process and mechanism to accommodate users' feedback for improving online user-interface if there is such an online portal? • Leadership attitude towards modern digital systems and services • Leadership awareness and knowledge on digital land administration systems
Capacity, and know-how	15%	• Level of land professionals' knowledge of modern digital tools like Blockchain, A.I, IoT etc • Opportunity for digital training of land professionals on new land digital initiatives • Is there targeted internal digital education and training at all levels (managerial, and operation staff)? • Opportunity for continuous professional development (CPD) programs in technical courses • Does the land sector have enough skilled, qualified staff (with business and technical capabilities) to deliver on the digital transformation strategy? • Can the land sector access new specialized talent from local universities or industries for specific projects in the digital transformation plan?

		• Availability of national universities or institutes that offer majors and programs in digital business and technology relevant for digital land services delivery? • Level of land holders' technical know-how on online services • Are there innovation hubs and startup accelerator programs to promote and support innovations? • Awareness of Blockchain technology

Table 14. Assessment Framework for Digital Land Maturity

Source: Authors' construct

7.4 Digital Maturity of ALC, KLC, & OCLS

In this work, the DM level is assessed on a 1-5 graduation scale where, 1 = Digitally Nascent, 2 = Digitally Emerging, 3 = Digitally Agile and Integrated, 4 = Digitally Transformed, and 5 = Digitally Innovative (UNDP, 2022). Find scale implications in appendix 1. Consequently, a digitally transformed, or innovative institution would is more digitally mature, well positioned, and more ready for adoption of new and advanced digital systems compared to a digitally nascent, or emerging institution. Figure 31 below shows the statistical results of the sum of all mean scores for all indicators under each of focus area for each study case. These scores multiplied by the weight of each focus area give the maturity level at each focus area for each study case.

Figure 31. Framework assessment scores

On the average, the ALC performs at higher Mean levels than the other two study areas for; Policies, legal regulations and political commitment, Institutional arrangement and data standards, Technical considerations, Collaborations and partnerships, Leadership and stakeholder involvement, and Capacity and know-how focus areas. The OCLS equally scores higher values at the socio-cultural issues than ALC, and KLC. Figure 32 below consequently shows the digital maturity levels of the three study institutions.

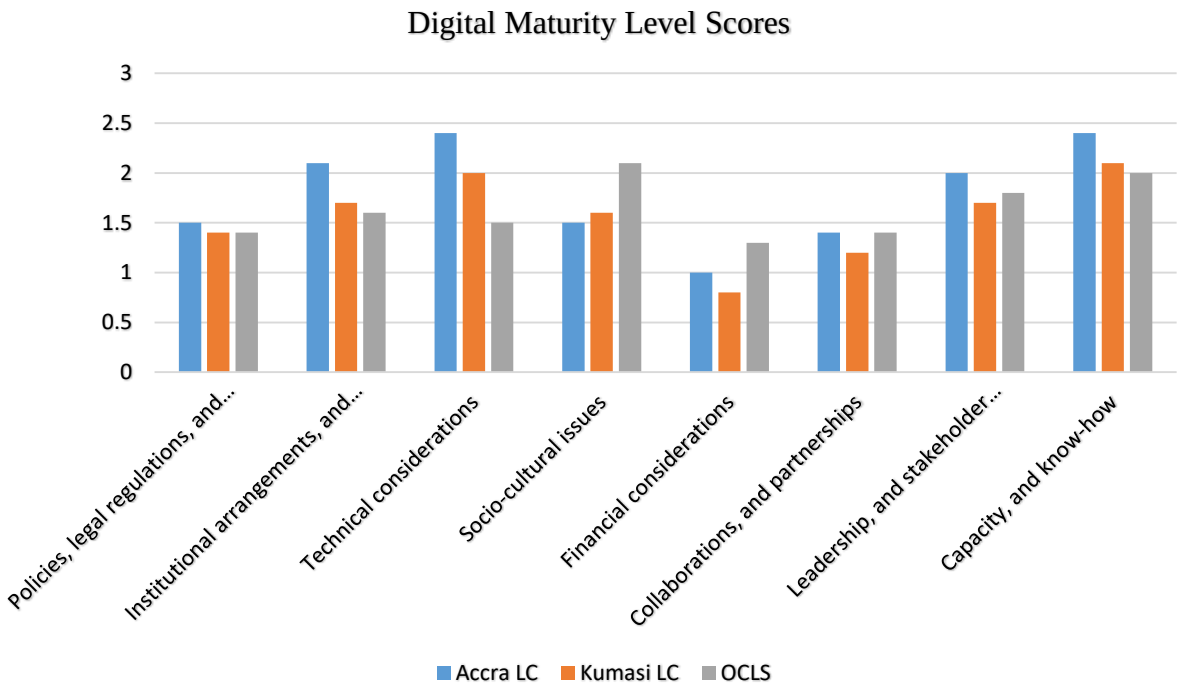


Figure 32. Digital maturity levels of ALC, KLC, and OCLS at the different assessment focus areas

Overall, Ghana is on course on the digital transformation vision. It is however at a generally Emerging level for many of the focus areas. These results are elaborated in the sub-sections below;

7.4.1 Policies, legal regulations, and political commitment

This focus area assessed; policies, regulations, and other legal tools bothering on digital land services delivery, and the extent of governments' commitment to general land administration advancement. This is important because policies, and other legal enactments underline the authority of land institutions to oversee land administration for the regulation of land transactions, and tenure relationship amongst citizens (UN-GGIM, 2020). Chekole et al., (2020) note that without political will and commitment, land institutions cannot deliver. The presence of laws and policies that support and regulate data privacy, protection, and sharing are essential for digital

transformation and the inadequacy of same can hinder digital transformation. In this focus area, all three study areas achieved an Emerging maturity level. Respondents had mixed responses from all three study areas regarding the presence, adequacy, and implementation of policies and other legal tools relating to land digitalization. An official (top management) from ALC indicated that all digital initiatives in the land sector have their underlying legal instruments although some of them are also based on internal policy directives. When asked of whether GELIS, and ELIS were based on any policy framework, he responded '*It was the National Land Policy which provides that there should be a geographic information system to link and integrate all datasets within the land administration setup. GELIS was therefore based on this while ELIS was an internal policy initiative'.* Another respondent indicated that '*There are different policies and laws that support digital services, example is the new Land Act 2020, Act 1036. Even the Electronic Transaction Act can be our basis for digital services. It is not about the laws but how well digital services are designed and implemented'.*

In KLC, and the OCLS, respondents had similar mixed responses. In the KLC for instance, a respondents had this to say;

We have so many land policies, and laws in this country. These all support good land administration and so if digital services delivery is what will help solve land problems, I believe the policies support it. The problem is however how well we can maximize the advantages of digital land services both for the land institutions, and land owners.

These responses are therefore emphasizing how without good commitment to implementation and enforcement, the legal basis for land digitalization alone cannot be enough. Another respondent added *'Even the ACT 1036 provides for digital conveyancing but how many land owners, and the officials have the expertise and experience with solely online land transactions'?* Although respondents admit to the presence of certain legal instruments on digital land services delivery, majority of these respondents from all three study regions are of the view that the mere presence of legal tools are not enough but the actual implementation and effectiveness of the digital services which these legal tools provide for. ALC has in place certain digital services like ELIS, and the LC online portal which respondents consider as direct output of policy directives. In Kumasi however, the ELIS system, and online portal have not been implemented. Although the KLC has internal digital system for records keeping and file tracking, respondents believe that being able to have a digital system that allows clients to communicate, and transact services with the Commission at certain levels without necessary visiting the Commission's premises in person is desirable as this allows for convenient, faster, transparent, and economical services delivery. And they believe this is contingent on policies, or a legal instrument directives as has been done in Accra. At the OCLS, respondents similarly are of the view that policies for digitalization at the secretariat are until recently being implemented thanks to new management leadership. Therefore, not much digital-related policies have been in place. An officer of 10 years work experience remarked;

In about 10 years ago, the leadership was the type that was more used to the book, and manual system, and so when you come up with initiatives of information technology, they were not really in for it because they did not know much about I.T stuff and they thought they might not fit into it.

But when this new Liaison Officer (Boss) came into office since 2017, things have changed because he is an architect, and knows technicalities on land issues. Now we have a software for tracking file movement although it is still a work-in-progress'.

Other responses similarly reveal that the OCLS is recently working on digitizing certain land services, and that the current staff and leadership are all open to this new initiatives and giving their input.

In view of political commitment to digital land services delivery, responses from both ALC and KLC indicated that political governments on their part support land digital initiatives, and policies that contribute to advancing land services delivery. However, despite governments' commitment to supporting digital initiatives, it behooves on L.C's top-management, and the ministry responsible for lands and natural resources to secure such support to implement digital transformation initiatives. A Senior Land Administration Officer made this remark;

Overall, policies and laws exist to certain extent but are disjointed rather than integrated and streamlined to give a clear direction for digital transformation of land services delivery. Government can therefore look into this to streamline all existing legal tools into one single digital land policy document.This observation is necessary to the extent that the prevalence of different laws that partially touch on land digitalization makes it difficult to have a well-documented digital transformation vision plan for the land sector in general.

7.4.2 Institutional arrangements, and data standards

Existence of strong institutional arrangements with clear mandates, and roles provide a direction towards set targets and ensure transparency (Deininger et al., 2012). Land institutional challenges negatively affect all land initiatives including digital transformation (Silva, 2007). In this focus area, assessment was based on indicators as; presence of integrated management information systems, clear vision on digital capability requirements, outreach strategies for promoting digital services, institutional investment into digital training, institutional strategies and or reforms that support digital transformation among others. Also, data represents the core of land administration (UN-GGIM, 2020; Bennett et al., 2023). Data considerations centered on the existence of credible, complete, accurate, consistent, and usable data. Again, the existence of data sharing protocols amongst land institutions, defined national spatial data infrastructure, standard basic data across land institutions, and data accessibility among others. In this area, ALC achieves a maturity score of 2.1 to be at the digitally Agile and Integrated maturity level. KLC, and the OCLS both remain at the Emerging stage at 1.7, and 1.6 respectively. At ALC, consolidated search and search report among all divisions has been integrated which is only possible with standardized data amongst the divisions. This translates into data sharing amongst the divisions. This is not the situation in Kumasi and some other L.C offices.

On outreach strategies for promoting digital systems, there exists public notices, and posts, (see appendices 4, 5 &6) to educate and guide the public on the new lands commission portal. Respondents also indicated the use of radio campaigns and other social media platforms for such public education. To an extent, responses indicated the presence of a direction which the L.C

wishes to go with their digital transformation agenda. Although, there exists no document clearly outlining the digital vision and strategy, respondents, especially top-management revealed how ELIS, and the Lands Commission online portal are going to be scaled up with more functionalities, as well as rolling these out in other regional lands commission branches. Also, within the ELIS software, there is to certain extent, and with restrictions based on a staff's position, access to, and exchange of data amongst the divisions without the complexities of manual contacts. Despite these, data cannot be said to be completely credible, accurate, complete, consistent, and usable as some documents have missing data. Also, some old documents had not been possible to properly capture into digital formats and thus, compromising data quality. Notwithstanding, the head of the scanning office at the ALC indicated that about 60-70% of data is scanned into usable digital formats.

At the KLC, and the OCLS, same situation as identified at the ALC cannot be said in entirety as clients have no digital avenues for accessing any of the services of these institutions. The internal systems used by the staff of the KLC allows for limited functionalities like receiving and lodging applications, and tracking documents' movement. Access to data from amongst the divisions are mainly manual unlike the electronic means within the ELIS. There is no clear vision, and strategy for digital transformation. Responses indicate that converted manual data into usable digital formats is around 50%. No outreach strategies had been detected mainly because there isn't any digital means of clients' interaction with the Commission yet. And finally, many directives come from the ALC headquarters depicting a low institutional hierarchy compared to the ALC. At the OCLS, the digital system in place is still in the development process and so is not completely ready. However, respondents noted possibilities of receiving and lodging documents, and tracking as few of the possibilities. Data exchange amongst staff is mainly manual, and like the KLC, there isn't a clear vision, and strategy for digital transformation. Conversion of paper-based data to usable digital format is also in process with only about 20-30% is complete at the OCLS.

7.4.3 Technical considerations

As noted in Showaiter, (2018), technical framework is one of the three main frameworks of land administration in addition to legal, and organizational. Technical aspect deals with the creation and managing of land administration processes, data, and systems (Showaiter, 2018). In this focus area, I considered; presence of requisite basic hardware and software support tools for digital services, existence of core service applications, digital networks connecting entities, online portals, and computer emergence response teams among others. ALC scores higher mainly for the presence of hardware support tools like computers, scanners, photocopier machines, printers, uninterrupted power supplies, electricity plant among others. However, not all of these are in top functionality conditions and efficiency. For instance, at the LVD, an assistant land administration officer noted *'I was here two years ago but was never assigned a computer until last year. I guess that is because they were not enough then. And even the one that was finally assigned to me doesn't work so I had to make use of my laptop'.*

For the other divisions like PVLMD, SMD, and LTR, almost all staff I talked with confirmed access to computers which they use for their works particularly at LTR, and PVLMD. At the SMD

however, although the computers assigned were functional, most of the respondents noted working more with their personal laptops due to fast processing speed among other things. On the other hand at the I.T department, clients' service access unit (CSAU), and the scanning room, all workers I interviewed had been assigned working computers and actually use these for work. An I.T officer remarked, *'We have been assigned computers and they are functional with very powerful processors even compared to my Laptop. So we work with these computers and not with our personal laptops'*. Respondents noted that the I.T department serves as the Computer Emergency Response Team (CERT) and are readily available to fix both hardware and software issues whenever any officer encountered it. Sometimes, I.T officers voluntarily visit departmental offices to check up with their hardware and software issues and to assist with challenges if there was any. I identified that there is a common WhatsApp platform purposely for reaching the I.T support team which is readily available at all working hours. The existence of computers, and their assignment to staff, as well as the presence of other hardware like; printers, photocopier machines, UPSs, and others is a similar situation for both Accra, and Kumasi. However, the presence and vibrancy of CERT in Kumasi is low compared to Accra.

For electric power, electricity plants are made available for support in times of power outage from the national grid. PVLMD has its plant, LVD has one too that caters for both the CSAU, and the scanning room, while the I.T department has one too for itself. At these divisions, the plants were identified as functional and reliable most of the time. However, at the SMD, and the LTR both of which are situated at a different site, although not far from the other divisions clustered at one side, I identified that the power plant was actually not reliable and in most instances of power outage, the plant does not come on time, and sometimes, does not come on at all. Respondents noted this with displeasure. However, a survey officer noted that there are plans to move both divisions to a new site that is close to where the other divisions are clustered and so that could possibly be the reason why attention hasn't been given to fixing the plant issue. In Kumasi, although there is a power plant, responses showed that this plant barely comes on whenever there is a power outage. It was generally revealed that it is not reliable as an alternate power although it is functional. The problem as revealed is however with fuel for its operation. A Land Administration officer (LAO) noted *'There is an electricity plant; however, getting fuel for its operation is a problem'.* This remark point us to a financial challenge of the Commission.

On already existing software in Accra, ELIS is in use. Also, the SMD makes use of QGIS from open source. There is also the L.C online portal which allows clients such possibilities as; submitting, paying for, and tracking applications on; searches, plan approval, regional numbers, stamp duty assessment, and title registration. The online submission is summarized in figure 33 below. However, just like KLC, no disruptive tool like Blockchain, IoT, or A.I was identified at ALC although the I.T department has a server room with a network management system. There is an internet (Wi-Fi) service available for work purposes which respondents rated as 70-80% reliable in terms of stability and processing speed, indicating that it sometimes have a downtime due to the large number connected devices. The internet connectivity in Kumasi was however rated about 60% reliable. Respondents complained about slow processing speed which forces most workers to switch to personal internet connections most of the times. In Kumasi however, I identified the Lands Commission Management Information System (LCMIS) used mainly for tracking file

movements. Functionalities of the LCMIS compared to the ELIS in Accra is very limited. At the OCLS, most of the things described were absent. There is limited staff to computer ratio, and different divisions share such devices photocopier & scanning machines. No internet service. There is also no power plant to support electricity during power outages. And also, the software for supporting digital services I identified as still in the development process and so does not have full functionalities ready yet.

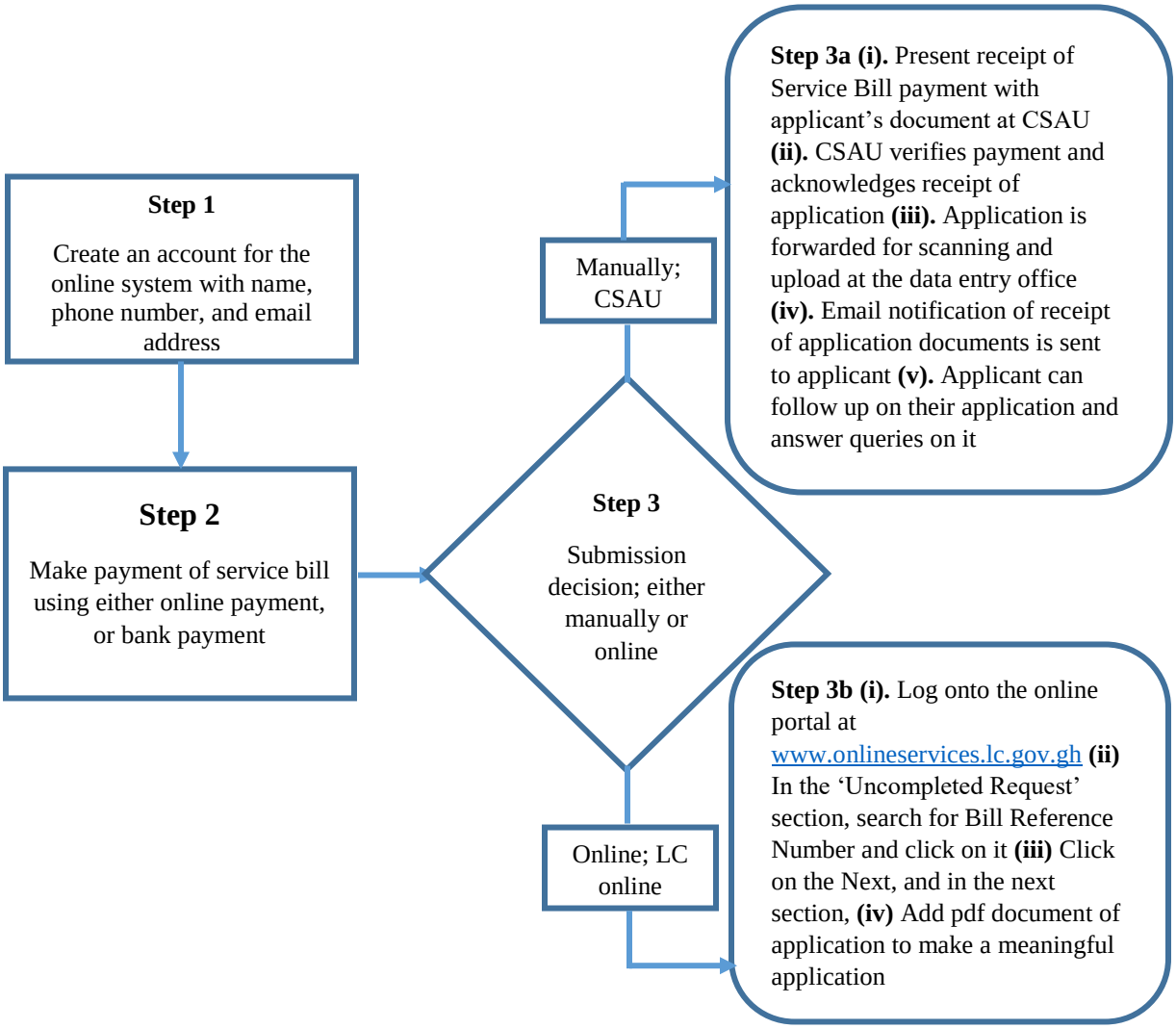


Figure 33. Application submission to the L.C via either the L.C portal, or manually via CSAU

Source: Authors' construct

7.4.4 Socio-cultural issues

Societal readiness, and need must always couple technological transition (UN-GGIM, 2020; Ameyaw & de Vries, 2023). It is therefore crucial to understand the cultural quirks, consumer attitude and preferences, and contextual local market dynamics to help achieve a digital-fit transition (Smidt & Jokonya, 2022). I assessed issues of social acceptance, social experiences with similar systems, incorporation of customary values, tenets, and systems in the development of digital systems, and consideration of customary land custodians in digital systems for land services. In this focus area, the OCLS stands at the Agile and Integrated maturity level with 2.1 while KLC and ALC are both at the Emerging level with 1.6, and 1.5 respectively. This result is attributed to the fact that the OCLS is a customary institution which is built on customary principles and as such, all decisions and initiatives are taken in view of customary factors and considerations. Respondents are of the opinion that given the current trend of advancement in services delivery in various institutions, society is more likely to accept and embrace digital systems that are designed to suit their needs, and address the challenges they face in land transactions like; having to deal with middlemen, and difficulty in accessing land information among others. Respondents noted the need to consult with and take clients views and inputs into the design and implementation of any such land digital system.

In Accra, although there has been the L.C portal for the society, there was actually not an engagement with customary land custodians. No inputs from customary land sector institutions were taken into the design of such digital systems although these institutions are a key stakeholder in statutory lands transactions (Ameyaw & de Vries, 2023). On society acceptance, I observed that there were only public education on the existence, and use of the system through bill posts, radio, and social media advertisements among others. Societal views and inputs in the initial development of the system was missing although there was an avenue for feedback on the system from the public through the CSAU and based on these feedbacks, improvements could be made. In KLC, similar observations were made. However, because KLC has no clients' portal for any land service, not much could be assessed in terms of acceptability, and experiences with similar systems.

7.4.5 Financial considerations

Financial consideration forms an important focus area of assessment for any digital transformation initiative as modern digitalization and technologies could be expensive and particularly for developing countries (Castro et al., 2020; Smidt & Jokonya, 2022). Enemark et al., (2016) in their fit-for-purpose noted that especially in developing countries, such land infrastructure need to be built "within affordable financial resources." This focus area assessed the availability, and ease of access to a sustainable funding source for land digital initiatives, availability of support from development organizations like World Bank and others, commitment of national banks and other financial and investment institutions to support digital land initiatives among other considerations. The ALC, and OCLS study cases scored an Emerging maturity level under this focus area with the OCLS scoring 1.3 and the ALC scoring 1.0. KLC scored 0.8. Reasons accounting for this is that, ALC as the national headquarters just like KLC and the OCLS depends mainly on internally

generated funds (IGF). However, not the entire 100% IGF is for the Commission's use. 67% of the Commission's IGF goes into the government coffers through the consolidated fund while only 33% remains for their use for different purposes. Besides this source, there is no other guaranteed source of finance for the Commission's activities although there are sometimes, and especially development organizations that may show up and invest in land initiatives. In Kumasi, although there is equally IGF, respondents indicated that resources and finances for the KLC are determined from the Accra headquarters.

At the OCLS, I also identified IGF as the main financial source but with limited support from external institutions and bodies in certain cases. However, unlike the ALC and KLC, access to finances according to the respondents is easy and in most cases readily available. They noted that the Management of the secretariat form part of the Kumasi traditional council for which the OCLS represent and operates. There is therefore not much bureaucracies to accessing funds for laudable initiatives which the secretariat comes up with. Additionally, in cases where the percentage of IGF assigned for their use isn't sufficient, the traditional council readily steps in to support, or to help secure the relevant support externally. Therefore, although the secretariats' finances might be on a lower scale compared to the statutory commissions', the availability, and ease of accessibility to finance appears less cumbersome and prompt in comparison with the ALC, and KLC.

7.4.6 Collaborations, and partnerships

Enemark et al., (2016) noted that coordination and collaborations across land sector institutions to integrate land management is key towards fit-for-purpose land administration. The UN-GGIM, (2020) further iterates that networked approaches across the land sector support multi-area collaborations, inclusivity and transparency, and Bennett et al., (2023) note that digital transformation actions can precipitate and sustain partnerships among institutions. In this focus area, I assessed digital networks, collaborations, and partnerships amongst land sector institutions, and other external related institutions in the industry, as well as with private entities. Indicators included; openness to collaboration on digital initiatives, level of data exchange, engagement of the community, civil society organizations and private entities in designing user-centered digital projects, as well as partnership with international institutions or entities. On this front, the study institutions are at an Emerging level of digital maturity. On digital network collaboration, except for the limited data exchange possibility amongst senior lands officers on the ELIS platform in ALC, there exist no digital means of data sharing amongst the different land commissions talk less of with other related institutions like the Land Use Planning and Spatial Authority (LUPSA), Forestry Commission and others despite their close-working relationships. In most cases, clients are burdened and used as the intermediaries for data exchange especially between the L.C and the LUPSA where clients themselves have to pick up planning comments/ reports from the LUPSA and deliver to the L.C as the L.C requests this from LUPSA during land registration. On partnership with other institutions towards digital transformation, responses revealed that the ALC had been in consultations, and partnerships with private experts from companies like the Kofi Annan ICT centre for the design of their platforms like ELIS, and the L.C portal. At the KLC, although the LCMIS exists, responses did not reveal whether it had been developed in partnership

with any private institutions. In the OCLS, respondents indicated the secretariat partnered with a private firm (anonymous) for the development of their portal which is still in progress.

On international partnerships, the LAP project was the biggest one ever but there has not been any other since its completion. However, a top-official at ALC revealed that there are discussions with foreign organization (name withheld until discussion concluded) for partnership towards revamping digital geospatial data infrastructure across the country. No such partnership discussion was however revealed in KLC, and OCLS.

7.4.7 Leadership and stakeholder involvement

Strong leadership coupled with all-stakeholder inclusiveness, and land professionals' willingness to support land initiatives is critical for project successes. UN-GGIM, (2020) advocates for transparency, accountability, inclusiveness, accessibility, and participatory leadership in land sector due to the many stakeholder groups of diverse interests. Stakeholder involvement allows for integration of users' wishes and inputs in the design of digital systems (UNDP, 2022). In this focus area, I assessed; leadership attitude towards digital systems and services, leadership awareness and knowledge of digital land administration systems, the extent of consultations with, and involvement of both operational staff, and other stakeholders in digital initiatives and decision making, design, test, implementation and use, and also consideration of users' inputs and feedbacks for improvement. ALC is digitally Agile and Integrated at level 2.0, while both KLC, and OCLS are at Emerging level with 1.7, and 1.8 respectively. In Accra, I identified that it is the leadership of the L.C that had championed the ELIS, and the L.C online portal into fruition which shows leadership awareness, knowledge and a positive attitude towards digital transformation although general awareness about BT is low. A management official noted '*What we have now is more of proof-of-concept to show that it is possible for us to be able to go high-level digital system which is the way forward for us.*' Regarding stakeholder involvement, there were mixed responses especially with operational staff. Some complained they had no input into the design of the ELIS system, while others noted they only had little involvement in it by means of a short training on its use after the development However, management-officials indicated that the concerns raised by operational staff during the training sessions were taken into consideration and incorporated into the system design. On external stakeholder involvement, a management-official of the ELIS development team from I.T department indicated.

'The public were brought in, in a way at the ELIS stages. Some of the banks, and other institutions are our clients and their processes are a bit different. We receive their bulk applications. So with the bulk application documents, we needed to bring them on-board. Actually, the idea was to create a corporate portal. So for example, if Bank 1 registers as Bank 1 Ghana, all their applications will be under that corporate name or umbrella. So every application they bring, we call that account name and we run their applications. So there was a lot of engagement for those people. Aside that, we held a couple of meetings not for the clients per say but old staff who are running their own institutions. Private firms and all that also came on-board at certain points to give us more information, and to also vent their frustrations with the current system. So basically, it was like a feedback kind of process where they are telling us where we can improve and where they think the

delays are coming from for us to work on. But there wasn't a call out there to the general public for their input in the development of the system.'

In KLC like Accra, responses show leadership awareness and knowledge, as well as positive attitude and openness towards digital land services. Officials believe this will not only facilitate services delivery but ease challenges associated with many land services as well as most of the challenges with clients. However, KLC receives directives from Accra headquarters which makes it complicated in acting independently on their own digital initiatives and this leads to bureaucratic measures with delays and other negative effects on digital-land vision.

At the OCLS, I identified that the current leadership is very much open to digitalization, and has positive attitude towards same. This accounts for why there is a new digital system in development. On stakeholder involvement, operational staff indicated they were involved and gave inputs for the system. However, regarding other stakeholders, respondents noted that the current system in development is meant for internal staff use and as external stakeholders did not have any direct use of it, they were not involved in anyway.

7.4.8 Capacity, and know-how

This focus area relates to both the physical, and human resource requirements necessary for building, and sustaining digital systems. Intensifying digital literacy programs not only improves capabilities for digital transformation but also reduces digital divide as human capital is a key element for digital transformation (Chohan & Hu, 2022; Qureshi, 2023). Assessment indicators included; digital literacy level, opportunities for continuous professional development (CPD) in digital literacy, availability of universities and other training institutions with the relevant land digital programs, availability of innovation hubs and start-up accelerator programs to promote and support land digital innovations, abilities of the land sector to access specialized talents from universities or industries for specific projects in the digital transformation plan, and also, awareness and knowledge of BT relative to land services delivery. All three study areas are at the Agile and Integrated maturity level in this focus area with 2.4, 2.1, and 2.0 scores respectively for ALC, KLC, and OCLS. Reasons for this performance are; all three institutions are able to access specialized I.T talents from the industry, and educational institutions. There are also innovation hubs and startup accelerator programs like BenBen, and Bitland Blockchain that are private firms into BT-land related services which the institutions can benefit from through partnership when necessary.

Again, there are universities and training institutions with I.T programs relevant for land administration. On the other hand, the digital literacy of most staff in all three study institutions, especially those not in the I.T departments, are basic computer knowledge for operating basic computer programs and software. Most of them are unfamiliar with current land related tools like QGIS and others. It is same for advanced I.T tools like Blockchain, Python, IoT, among others. A principal lands officer in ALC indicated;

'Most of the old staff are Kolo (colloquial) and not up to date with digital systems. They say it is for the new generation and so many are not in for the idea of digitalization and do not make any

conscious effort to want to learn and be abreast with things. So it also makes going digital a challenge. Even for ELIS which we have been using for some time now, some of them will call me and be like, 'Hey (name withheld), I want to do this, what and what do I do'?

I was particular to ask respondents' awareness, and knowledge of use of BT particularly as applied in the land sector. At Accra, only 9 respondents out of 28 had actually heard about BT of which, just 5 had heard about its possible application for land administration services. The remaining 4 only knew about it in relation to crypto trading. A similar observation was at the KLC as 8 respondents at the KLC knew about BT, and 4 at the OCLS. No one in all three institutions had use knowledge of BT for any land service. Similarly, on awareness of BenBen, and Bitland Blockchain start-up firms which are into Blockchain for land services, none of the respondents from OCLS knew about either of them. 3 people from KLC knew about the Bitland but just 2 of them knew about both firms. In Accra, 4 respondents, knew about BenBen with just 1 of them knowing of Bitland too.

Regarding targeted internal digital education and training for staff, this initiative is absent in all three study institutions. Although there are CPD programs at the L.C in the form of the Ghana Institute of Surveyors (GhIS) program, respondents indicated it is not mainly targeted at digital education and training. However, staff can on their own pursue a digital education program relevant for the profession by taking a study-leave when they are due for it. A divisional head respondent added that in some instances, the LC can sponsor a staff for specific digital programs if it becomes relevant although this is rare. In both Accra and Kumasi however, I identified that there is very little investment into digital training of staff for digital transformation. A principal officer noted;

'*The digital literacy amongst staff need a big boost. Most staff are graduates and so are open-minded to be able to grasp the new knowledge if we had opportunities to learn these new I.T and software. However, this is absent until a new system is in place and then they organize a day workshop for us. That is not enough. There should be investment in training most staff in I.T as that is the future of all public services'*

On clients' knowledge of use of digital services, I was only able to receive responses from ALC as there are no clients' portals available at KLC, and OCLS. The responses from Accra showed that it is mostly corporate clients like Banks that make use of the online portal on regular basis. For individual clients' many of them are represented by informal intermediary agents that mostly prefer physical contacts with land professionals to the online portal services mainly for the possible reason of being able to fast track their transactions when dealing directly with the officers. However, for 'Search' purposes it is strictly limited to online and as such all clients have that limited possibility.

7.5 Discussions

7.5.1 Existing Situation and the Inherent Opportunities and Challenges

The findings presented above show that although the land sector is on track in the digitalization of land administration functions, it is currently at a generally Emerging and growing stage and rather immature for an instant uptake or consideration BT. Rather, such a consideration will be contingent on a gradual agile and iterative adoption plan based on a clearly defined digital vision policy document, taking into considerations the identified challenges and ways to address these, while capitalizing on the inherent strengths and opportunities within the broader industry, and taking measures to limit both current and potential threats. Figure 34 below summarizes the challenges and opportunities as identified in our results. These provide insights for SWOT outcomes which help us to identify strategies towards improving the land sector to a status, possible for the consideration of BT uptake.

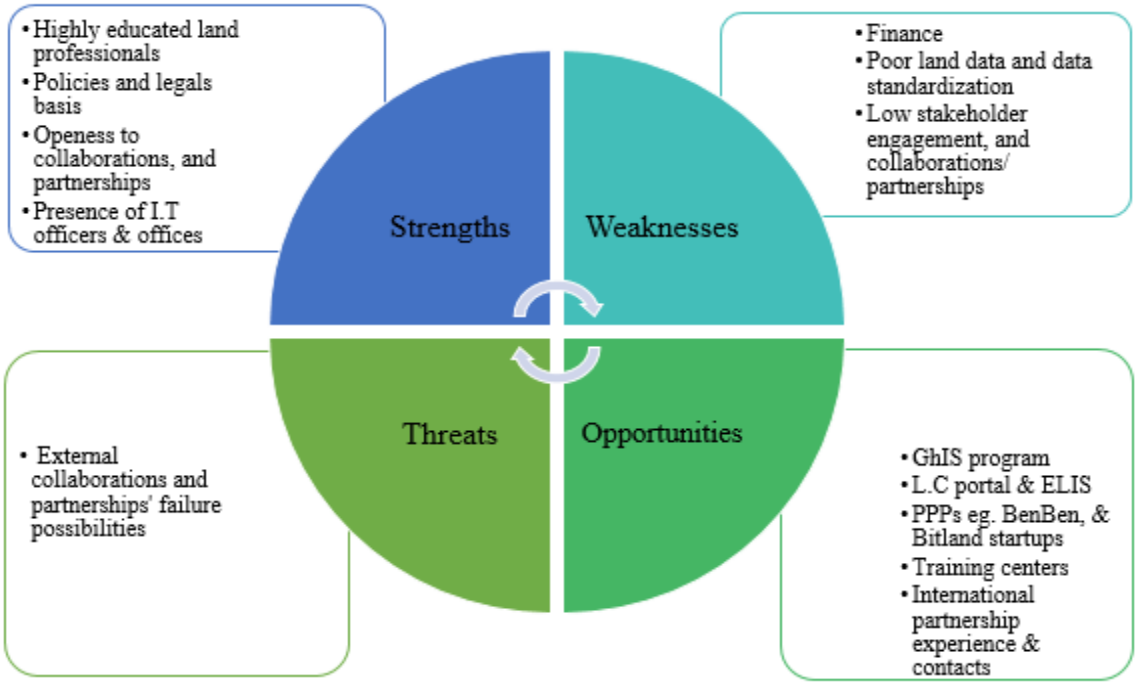


Figure 34. SWOT summary of Ghana's digital land system

7.6 Way Forward

Based on the identified results from the framework focus areas, and the challenges and opportunities, our analysis results in SWOT outcomes is as shown in figure 34 above. As a way forward, SWOT strategies are developed from the SWOT outcomes by linking the different SWOT elements. That is for instance, combining strength and weakness elements to achieve Strength-Weakness Strategies in that logic.

Focus Area	Opportunities and Challenges
Policies, legal regulations, and political commitment	**Harmonizing** the laws and other regulations and their provisions relating to digital land service **Land sector ministry and leadership** must deepen efforts on securing government commitments
Institutional arrangements, and data standards	**Drafting** a clear 5-10 year land digital transformation vision policy document with goals and expected deliverables **Review and prepare** old and incomplete land data (both manual and digital) into standardized usable digital formats to allow for data sharing and collaborative works
Technical considerations	**Revamp** both hardware tools for work services at the various land institutions **Scaling up** ELIS, and the LC portal **Taking measures** to ensure digital service options are mandated as far as possible
Socio-cultural issues	**Incorporating** customary system views and values into digital vision plans **Identifyin**g societal views and inputs into digital solution Taking measures to eliminate digital divide
Financial considerations	Exploring PPP business models on land digitalization **Revision of 33% share IGF** kept by the L.C to help improve funds for digital project **Decentralizing financial autonomy** to allow other land institutions finance their own digitalization initiatives **Exploring international donor organization** options with land digital business models
Collaborations, and partnerships	**Intensify PPPs** on land digitalization **Standardize data** across all land sector institutions to allow for data sharing and collaborations Revisit past and potential partnership options with international organizations in land matters like WB, FAO
Leadership and stakeholder involvement	Periodic stakeholder engagement on land digital initiatives

	Leadership commitment to **continuous learning** to be abreast with modern land digital knowledge **Community education** on digital land initiatives
Capacity, and know-how	**Revise GhIS courses** to encourage more of land digital related courses like GIS and others Revising technical and digital land -related courses in education/ training institutions Intensifying digital land-related courses in internal CPD programs to develop workforce digital literacy **Partner with expert private firms** like BenBen to deliver periodic workshops on new digital tools like BT for staff

Table 15. Opportunities and challenges of Ghana's land digitalization

7.7 SWOT Strategies

At the current maturity level, there is the need for strategies to dealing with the identified areas of shortcomings to improve the land sector digital status for possible BT uptake consideration. The SWOT results guides this to help arrive at these SWOT strategies. It is important to mention that these strategies are not exhaustive but have been limited to these enumerated ones which I consider basic to start with.

Strength-Weakness Strategies: Given the numerous number and high level qualified land professionals, this can be deployed for revision of land data and preparing same into usable digital formats. The predominant manual means of data exchange due to the use of manual paper documents creates dearth of land data, impedes collaborations on projects and initiatives, and presents cumbersome processes for clients navigating these institutions. Deploying the land professionals for such data revision and conversion can also help avail opportunities and to contribute towards possible data standardization at least from within the LC offices across the country. When this is done and is successful, it can give grounds for review and standardization with other related institutions as the LUPSA.

As only 33 % of generated revenue is kept by the L.C for their use, to improve the financial capacity for funding digitalization of land administration, an upward revision of this percentage based on a legal policy document for land digitalization will be necessary. This can support internal financial efforts and thus limit the reliance on external funding sources and their possible failure threats as identified in the SWOT analysis. This will however be based on the continuous government's commitment to land digitalization vision

Establish legal basis for stakeholder consultations and engagements in land digital initiatives. As different stakeholders in land administration have diverse interests, exclusion of some of these stakeholders in land digitalization initiatives can be problematic for program successes. Therefore,

to ensure this situation is resolved, there should be an established legal basis and recognized stakeholder groups that must be involved and consulted on land digitalization initiatives. This can help achieve greater participation and support for successful land digitalization projects.

Strength-Opportunity Strategies: On policies and regulations for digital land services, the fragmented policy documents, and Acts need consolidation and streamlining. Consolidating all the individual pieces into a single Act/ policy document that is holistically focused on digital land administration offers an easily accessible single reference point which can guide the land sector, and related institutions on their digital transformation vision as such an Act will provide clarity and certainty on digital land system. The current Act 1036 is a good and commendable effort in this direction.

Again, an important need to boost digital literacy amongst land service professionals is necessary for sustainability of land digital initiatives (Land Equity International, 2020). Fortunately, opportunities at hand is that most professionals have tertiary level knowledge with at least basic knowledge in ICT. Therefore, incorporation of CPD digital-related courses into the land sector institutional structure can train and equip land professionals with necessary know-how for modern technologies and tools for digital land services delivery.

Also, the openness to collaborations and partnerships must be used to negotiate meaningful partnerships with both educational/ training institutions and private I.T firms. Other alternative can be partnership with BenBen and related Blockchain firms if a BT uptake is to be considered in the future. This will help access resources and personnel to help with improving land professional digital literacy. Also, in this regard, the GhIS course for land professionals can be reviewed to incorporate elements of relevant land-related ICT courses. This can help professionals learn digital tools and their uses for land services as land/ property valuation among others which can enhance preparedness for digital transformation.

Finally, deploy professionals already familiar with ELIS, & the L.C portal for scale up of such digital systems across the country. This is relevant especially given that such professionals are within the same land institution, using them for training other land professionals in other regions on these digital systems can help cut down cost in the digital transformation agenda.

Weakness-Opportunities Strategies: Digital transformation can be expensive and limit digital vision Ameyaw & de Vries, (2023) especially given the financial source and security constraints in the land sector. Therefore, using, or leveraging the LAP experience and contacts with international organizations like the World Bank, as a negotiating point for support with digital transformation vision could yield fruitful outcomes. Also, exploring local partnership deals with investment, and related financial entities through PPP business models can be ideal. Furthermore, systems such as the online payment for services should be well structured and used/ enforced to eliminate all leakages in the revenue base of land institutions.

Strength-Threats Strategies: On PPP business models specific to digitalization of land administration, a consolidated policy document on land digital transformation should provide basis/ clauses that are explicit on both sides' stakes in such partnerships. This will provide better grounds to guide against the threat of external partnership failures.

The presence of I.T offices acting as the Data centres in charge of all digital related issues is a good platform to leverage. These offices need to be well resourced with high-end tools as servers, cloud technologies, among other data centre infrastructures necessary for maintaining and running digital services. This reduces the reliance on external I.T firms bringing in these infrastructures through partnerships and which could be comparatively costly as well.

Opportunities-Threats Strategies: Taking advantage of education/ training institutions to train more land professionals in land-related I.T courses. This can help achieve more professionals with digital competence for land digital transformation to be able to take up digital transformation of the land sector without necessarily relying on external I.T experts. This can help overcome threats of such partnership failures, and also reduce the cost involved.

7.8 Conclusion and Way Forward

The study sought to assess the digital readiness of Ghana's land sector for BT uptake in support of land administration services. Accordingly, I developed a digital maturity assessment framework of eight focus areas; policies, legal regulations and political commitment; institutional arrangements and data standards; technical considerations; socio-cultural issues; financial considerations; collaborations and partnerships; leadership and stakeholder involvement; and capacity and know-how. This framework evolves from field discourse with land professionals, empirical literature on BT-land administration studies, digital maturity assessment frameworks literature, and also from the World Bank's DGRA, UNDP's DMA, UN-GGIM's FELA, and Steudler's framework for evaluating land administration systems. It builds on the works of Ameyaw & de Vries, (2021) who recommended that future works should delve into establishing a framework that could guide in assessing land administrations systems readiness for BT consideration in sub-Saharan Africa, and particularly in Ghana. Using this framework to assess Ghana's land sector readiness for BT-uptake in support of land administration, results show that the sector is currently immature (i.e. at a generally Emerging maturity level) for an immediate uptake consideration. The assessment of this result, based on SWOT framework helped to identify certain challenges and opportunities. Challenges relate to finance, data quality and standardization, and stakeholder involvement and consultations among others. Opportunities equally exist in the presence of legal and policy frameworks, industry partnerships possibilities, and human resources potentials. These guided us to deduce SWOT outcomes to inform SWOT strategies to guide the trajectory of advancing Ghana's land sector digitalization.

This study being the first to make such an assessment of Ghana's digital land status makes it an important reference for land policy makers not only in Ghana, but other developing countries as well, especially in sub-Saharan African countries as similar land administration systems exist. The framework is also useful not just for the land sector but other public administration sectors in other contexts as well given that e-Government initiatives are on the rise.

To extend the discourse set forth in this paper, I recommend future works on the applicability of the developed framework both in Ghana, and other similar contexts. Of particular interest in the Ghanaian context is the SWOT strategies to guide policy makers. And finally, further research

works should also assess the relationship between digital land administration and land tenure security in a two-tenure system situation like Ghana where both statutory and customary land tenures exist.

Chapter 8

General Conclusions, and Recommendations

8.0 Introduction

This section interprets and reflects on the research study. It focuses on re-examining the concepts, and theories that emerged in the study, as well as the empirical findings advanced in chapters 4-7 in view of the main research questions, and objectives the study sought to address. A general conclusion arrived from a synthesis of the findings and the reflections herein is made, and is followed by policy recommendations, and recommendations for further research on the way forward towards operationalization of the study insights generated. The main question that necessitated this research study was, how can Ghana sustainably adopt Blockchain technology in support of land administration services and processes to enhance land administration transparency? Accordingly, my objective was to assess the feasibility of Ghana's land sector for Blockchain technology adoption, or uptake in support of land administration transparency. In line with this main objective, I sought to understand the conceptual relation between land administration functions and transparency, and the role that Blockchain technology can play in achieving transparency in these land administration functions. Having established this, the need to identify which areas of the land administration processes were relevant for Blockchain support, and how this could by adapted and inculcated became necessary. This was thought to help appreciate the areas of land administration challenges and the imports, and possibility of Blochain's application to enhance transparency. I then established a guiding framework to guide the uptake of the technology in these land administration areas to guard against technology uptake failures and pitfalls as had militated against other technology uptakes in the past, as well as possible new challenges. Finally, I sought to assess the digital readiness, and or maturity level of the land sector in view of Blockchain technology adoption feasibility. A synthesis of the findings and the theoretical contributions from the study is presented in the sub-sections below. Figure 35 below shows the synthesized conceptual framework.

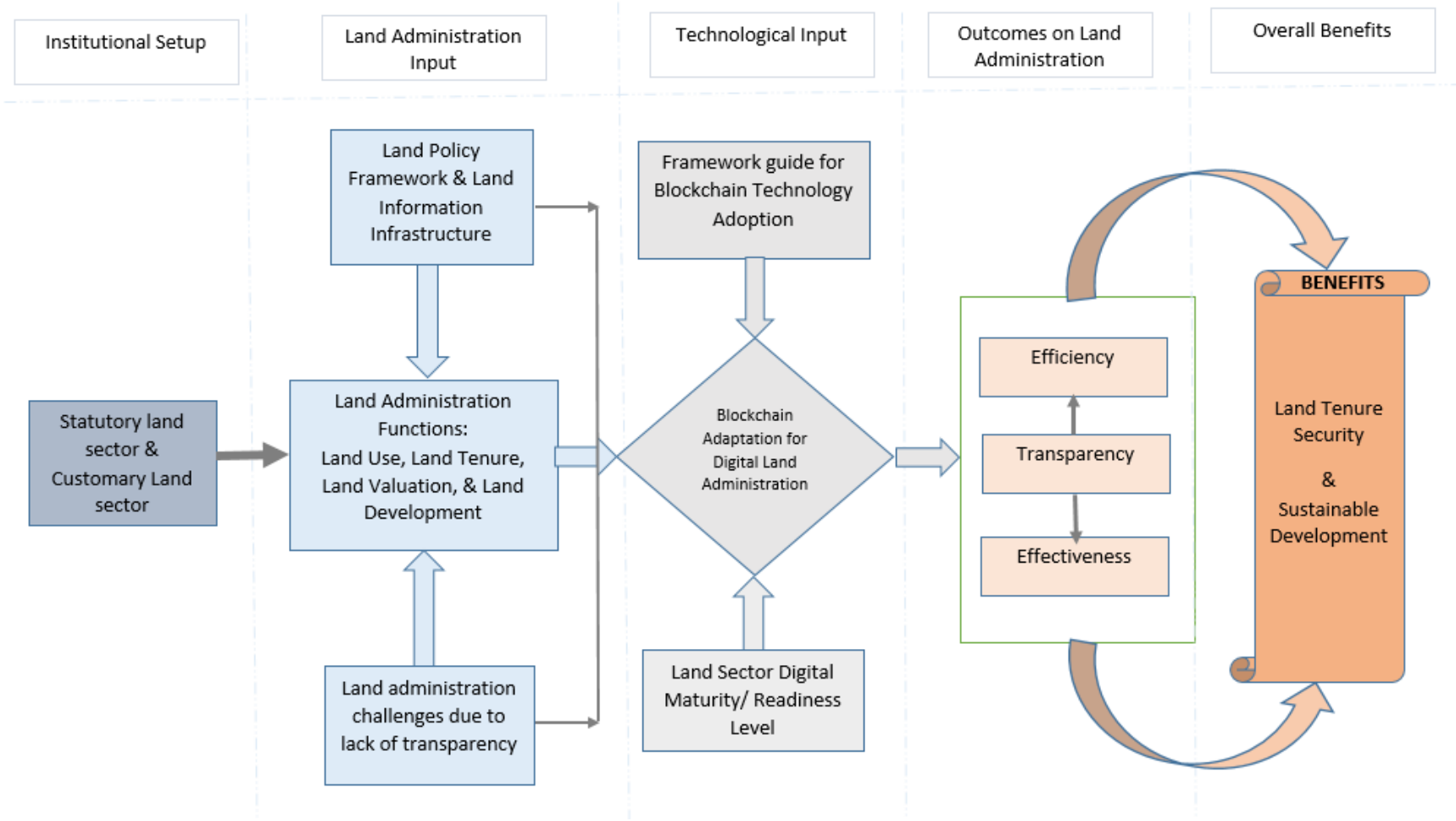


Figure 35. Conceptual framework for Blockchain technology adoption in support of land administration transparency

Source: Author's Construct

8.1 Feasibility of Blockchain Adoption for Land Administration Transparency – Findings and Theoretical Implications

The main issue was that there is a generally low level of transparency in land administration in Ghana and this has paved way for all sorts of related land challenges. Modernization of the land administration system by way of introduction of computerized processes, and or digitization and digitalization has been an approach that has been preached by both researchers, and industry players alike. Towing this line of thought, my interest is in how we can support the achievement of land administration transparency through the support of Blockchain technology. In so doing, I was interested in positioning the discourse on the antecedents to such a decision of Blockchain uptake, and the preparedness of the land sector for a sustainable adoption. The second section of the dissertation (Chapter 4-7) explored these issues.

In chapter 4, I delved into extant literature with the objective to conceptualize Blockchain technology within the land administration transparency discourse. The chapter argues that we can only achieve land administration transparency when there is openness across all land administration processes, and stakeholders alike. Blockchain technology permits openness in processes, enhances inclusion, and participation in land processes by all concerned parties, and allows for easy access to land information. Ease of information accessibility is made possible by the decentralized broadcast of land information, and processes associated with transactions and other documentations. Also, through the verification of processes and validation of same, openness, participation, and awareness of activities associated with each land processing is improved. The potentials of the technology to enhancing land administration transparency is thus well established (Dwivedi et al., 2023; Junaid et al., 2023; Nagpur et al., 2024). Associated with this adoption possibility however, I identified the need to understand the different actors involved in land administration and transactions. Actor Network Theory (ANT) allows us to understand how actors, both human and non-human, acting within the broader view seek to build and maintain networks in the face of a technological change (Heeks & Stanforth, 2015). Mcbride, (2003) on ANT emphasizes that '*technology is as much a product of social construction as of technical innovation and advancement. Hence its success and take-up within an organisation or group will depend on both the technical and social aspects.'* The theory allows for understanding of the working relationship, and connection between various actors within land administration system, which is influenced by the power dynamics, and also the communication technology that connects these actors, and their work processes. In this process of building and maintaining their networks, and to deliver development, the role of the technology in that development process is very keen and as such, the more powerful actors adopt approaches to align the interest of the less powerful actors with their own to effect the change, or adoption of the required technology for the development (Heeks & Stanforth, 2015). This alignment of interest is necessary to ensure that the network of the stakeholders becomes stable, and the technology firmly established (Mcbride, 2003). In the case of the Ghanaian land sector, land services delivery institutions and especially the statutory institution of Lands Commission constitute this group that wields a near-absolute power, which fosters its superior role in land administration technologies adoption. It is however

important to note that the various actors play different roles, and for a technology as Blockchain, the associated features of decentralized verification, and validation requires the need to be careful with how powerful actors reinterpret and displace other actors interests, as this could affect the proper functioning of the technology if subsequently adopted. In the aligning of interest as emphasized in the ANT, rather than coercion from top stakeholders, a negotiation approach is more appropriate to reaching consensus on any decision concerning the adoption. Chhina et al., (2023) identifies that operationalizing the ANT draws on four key stages; problematization, interessement, enrolment, and mobilization. These stages allows for a much deepter uncderstanding of the interaction not only between the human actors, or stakeholders but also of the intricate social, and technical considerations necessary for Blockchain adoption (Chhina et al., 2023). Here, problematization is where the issues of land administration that require the technology to address are established. 'Interessement is about convincing stakeholders of the potential value of Blockchain technology' (Chhina et al., 2023). At enrollment stage, other actors, and or stakeholders like the potential users groups are also encouraged to accept the technology and thus join in the network for the technology. This helps to grow the network involved in the adoption, implementation, and use of the technology. At the mobilisation stage, efforts are made to agree among the stakeholders, and they work collaboratively to overcome any challenges that might emerge to affect the system (Chhina et al., 2023). Hence, I position that given the nature of Blockchain and its functionality requirements, it necessitates a consensus building rather than power plays, and aggressive influence towards a possible adoption. More so, as a communication technology for possible connection of the different land sector institutions, and intra-institutional divisions, as well as connection with the public sector, a permissionless public Blockchain architecture is identified suitable for achieving transparency. This could be integrated with Ethereum Blockchain's smart contract functionality for certain possible processes in land transactions. The need however for standardization of data among others, across institutions becomes important especially in the case of Ghana where land sector institutions like the Lands Commission, and the Land Use and Spatial Planning Authority although have a close working relationship maintain distinct data forms. A revamp of institutional processes and systems therefore will be necessary for possible Blockchain adoption and integration.

Chapter 5 shows how the conceptualized Blockchain-land administration transparency can be operationalized practically. I sought to identify challenges bedeviling land transactions, and especially land acquisition in Ghana, both from the customary, and statutory perspectives, and to find ways and, opportunities to address these through a possible Blockchain-based smart land acquisition system. This chapter took a view from land purchase/ acquisition through to registration of same, taking into account the acquisition from either of the statutory sector, or the customary sector. Findngs showed that the associated challenges are multifaceted and prevalent in both the customary, and the statutory sectors. From the statutory perspective, some of the challenges identified touch on issues of institutional fragmentation, and overlap in functionalities leading to redundancy, and unnecessary bureaucracies. There is also a general lack of proper coordination and consultations, as well as data exchange and synchronization amongst the land services delivery institutions. Also, manual and poor record system, coupled with a distorted sequence of land acquisition sometimes lead to financial cost to prospective buyers although their

applications for the purchase could turn out unsuccessful. This generally adds up to the land transaction costs and in many cases creates skepticisms on the part of prospective buyers thereby making them resort to other informal means of land acquisition. Acquisition from the customary sector also has the challenges of "informality label" and as such making ownerships difficult for any possible legal claims until such ownerships are registered under the statutory laws with the Lands Commission. Also, there is equally a general low transparency in the acquisition processes, allowing for several payments in the process to the same sellers, or sometimes, to different sellers of the same land. This makes the process very costly. It is again fraught with several bureaucracies leading to a prolonged, and frustrating process of dealing with many traditional leaders, each of whom seeks to extract some amount of money from the buyer. In assessing how to circumvent these issues, a SWOT analysis on these systems helped to arrive at SWOT strategies (discussed in chapter 5) which formed the basis for the conceptualization of a Blockchain-based smart land acquisition system. The proposed system, presented in chapter 5 consist of forming an off-chain oracle of stakeholders comprising of the different stakeholder groups in the land sector, and or to land transactions i.e. from the customary sector, the statutory sector, private estate firms, banks, and planning sector amongst others. This oracle will be responsible for the verification of all off-chain land transaction data and issues before it is brought onto the Blockchain system. In this way, there will be a reproduction of the old system, or land transaction pattern around a new technology as the resource. This will equally necessitate a reproduction of the structure and rules within which, or based on which the actors carryout land transaction. This new system stands at the heart of transparency as stakeholders from all the stakeholder groups are integrated both technologically, and manually. With this practical approach to operationalizing Blockchain concept in the Ghanaian land system, the need for a guide towards the technology's adoption becomes necessary.

Chapter 6 highlighted the contextual issues that needed attention, and which can guide a possible adoption of Blockchain technology in support of land transaction within the land administration functions. By relying on expert views on technology adoption experiences, and based on the adoption of the Ghana Enterprise Land Information System (ELIS) by the Accra Lands Commission, I evaluated contextual guidelines based on the tenets of the TOE framework. The TOE framework provides a lens within which to identify the technological, organizational, and external considerations favorable for the uptake, and sustenance of an identified technology taking into account the unique characteristics of the said technology. Based on the statutory, and customary systems of land tenure and administration in the Ghanaian context, elements of socio-cultural influences were found missing within the ambits of the TOE framework. Consequently, I extended the TOE for the purpose of embracing factors of socio-cultural elements that could also influence the adoption of Blockchain technology within the broader scope in support of the general land administration system in Ghana. Thus I came up with a TOES (technological, organizational, external, and socio-cultural) guidelines for Blockchain technology adoption within the Ghanaian sector. This extension of the framework complements the recognition of customary stakeholders in the off-chain oracle in chapter 5 as part of the Blockchain-based smart land acquisition. Consequently, the GELIS adoption case-study evaluated within the TOES framework, and based on expert responses from their experiences guided to deductively arrive at the suggestions/ guidelines for Blockchain adaptation for land administration services as seen in table 12 in chapter

5. This framework comes in at an opportune time as it can guide the uptake such a Technology as Blockchain as is in consonance with the provision for electronic land transactions stipulated in the new Lands Act (1036).

To operationalize the guidelines in view of a possible Blockchain uptake within the land administration system, an assessment of the digital readiness of the system was necessary as Blockchain technology builds on existing digital systems. In chapter 7 of the study, I employed the Digital Maturity concept/ frameworks from the Word Bank, and UNDP, together with land administration evaluations frameworks, and also Blockchain adoption frameworks, to assess the digital readiness of Ghana's land sector in support of Blockchain technology adoption. Primary data were collected from land professionals in the field within the provisions of the various frameworks, and based on personal contextual experiences of the professionals in the land sector. Subsequently, I arrived at an assessment framework for digital land maturity with eight focus areas of different weights, and sixty-six indicators. The focus areas, overarching in nature included: policies, legal regulations and political commitment; institutional arrangements and data standards; technical considerations; socio-cultural issues; financial considerations; collaborations and partnerships; leadership and stakeholder involvement; and capacity and know-how. Three land sector institutions, namely; Accra Lands Commission, Kumasi Lands Commission, and the Otumfuor Customary Land Secretariat also in Kumasi were evaluated for their digital maturity in view of the focus areas identified. Results, although were varied for all three generally showed the Accra Lands Commission comparatively performing well than the other two. However, the insititutions are generally performing at an Emerging maturity although the ALC performs well at digitally Agile and Integrated maturity level at certain areas as institutional, technical, leadership and capacity. A SWOT analysis on the results identified SWOT strategies (discussed in chapter 7) for improving the digital status of Ghana's land sector towards possible Blockchain technology adoption. These indicate that although the uptake of Blockchain within the Ghanaian land sector in support of land administration transparency is feasible, it is currently immature for an outright consideration and needs to build on the digital readiness of the general land sector to allow for sound foundational structures for a possible Blockchain uptake.

8.2 Reflections and Conclusions

The research questions shown below formed the basis for the study as identified in chapter 1.

1. How does Blockchain technology relates to land administration transparency?
2. How can Blockchain technology potentially enhance the land acquisition, and registration processes in Ghana?
3. How can we develop a contextual reference guide for use by the land sector in the possible consideration of Blockchain technology uptake?
4. To what extent is Ghana's land administration system digitally ready towards a possible Blockchain technology uptake for a transparent system?

In answering these questions, a case-study approach was employed to study the land administration system of Ghana in its hybrid nature of manual system on the one hand, and a quasi-digital system

on the other hand. This approach helped to evaluate the problem into the indepth to uncover important and crucial data on the challenges that have hindered progression of land digitalization in the country. In retrospective assessment, this approach is still considered the most appropriate for this study as it allowed for collecting the relevant and detailed data within the timeframe of the research fieldwork through close interaction with the research participants in their original contexts of the selected institutions. Case study is time bound and effective for evaluative research which allows for on-time evaluative results to guide solution-oriented actions as done in this study. Other strategies like ethonography could have helped to gain the needed detailed data within the contexts as well. However, ethnography requires the researcher to study the the subject matter in the setting over a very prolonged period of time which makes it less effective for the study given the limited teimeframe (Creswell, 2014). This prolonged period of study often could also lead to results which might be outdated and have less effect for developing appropriate solutions. The sub-sections reflects on the main findings and conclusions.

8.2.1 Blockchain's Relation to Land Administration Transparency in Ghana as a Collective Role of Institutional Stakeholders' Acceptance and Recognition

In chapter 4, the main argument advanced is that it is possible to employ Blockchain technology by way of adaptation in support of land administration transparency in Ghana. The technology allows for transactions over a digital platform in a decentralized approach without a central authority. Land data in textual form can be captured on Blockchain, and spatial data as maps, and plans can equally be captured as tokens by way of minting on the system (Agbesi & Tahiru, 2020; Dwivedi et al., 2023; Zein & Twinomurinzi, 2024). Land administration functions within the Ghanaian land sector is a hybrid system between the State on the one side, and the customary sector on the other. The main land administration functions; land tenure, land valuation, land use, and land development processes are undertaken mainly within the institutional frameworks of the Lands Commission, and the Land Use and Spatial Planning Authority (LUSPA) on the statutory spectrum, and the customary land secretariats (CLSs) also on the customary side. In the land sector of Ghana like many other African countries, Akaateba, (2018) identifies that these statutory (formal) land institutions, and the customary (informal) land institutions are neither strictly oppositional, nor strictly collaborative but caught up in reciprocal relationship in land services delivery based on their interdependent mandates. There is also the Office of the Administrator of Stool Lands (OASL) as a State institution in charge of the collection and disbursement of Stool lands (customary lands) revenue. Hitherto to the coming into force of the Lands Act 2020 (Act 1036), which directs the CLSs to submit records of their recorded transactions to the L.C and the OASL on quarterly basis for assessment, the CLSs operated independent of the L.C. A registration of land from the customary sector connected both sectors at certain stages. The relationship of the two sectors however still remains dormant than would have been expected with the coming of the Act 1036. Akaateba, (2018) describes this as fuzzy. Despite the possibility to introduce Blockchain technology in the processes of land registration, valuation, taxation, and land use planning and development, the processes of the identified sector institutions have been identified as a potential challenge. There is a general lack of standardization in their data, and work processes, poor coordination even between L.C., and the LUSPA, and a large percentage of paper-based land

documents. There exists also, no communication technology system connecting the institutions despite the overlap in their functions.

Although the above are institutional, technical, and administrative challenges, the thesis identifies some challenges in relation to responsibilities in the relationship between the LUSPA, and the L.C. That is, normally, the LUSPA is to furnish the Lands Commission with their plaaning comments during land processing. This is to help the Commission to be sure that the proposed use of the land conforms to the designated use of the area. Therefore, the comments report must be formally submitted either through postal services, or through professional courier delivery. Unfortunately, this is not the case. The Commission complains that it takes unnecessarily longer time, to the extent that they sometimes end up not receiving such comments if they wait on the LUSPA to submit them. Conversely, the Commission will also not pick up these comments by themselves simply because it is not their professional responsibility. And although this situation negatively affects land processing, no resolved efforts were identified to address the situation. Rahter, at best, the clients are used as the channel between these two instituions for the delivery of planning comments. This sometimes leaves land processing hanging, which contributes to longer processing times. There is also the risk of clients' losing these comments by accident among other numerous risks. To address the possible working together and integration of the work processes of these institutions in land administration will demand a way to circumvent this by way of charging land land institutions to live up their designated responsibilities. This can also be resolved if the two institutions are digitally integrated, with well established and functional data sharing platforms as is being recommendeded within Blockchain technology. In following through however, there is first the need for acceptance of roles, and responsibilities, and the commitment to these by the institutions concerned in the interest of enhancing land services delivery in the country. Additionally, there should be clear superior government authorities to oversee these. The creation of the supervisory role for the Lands Commission, and the OASL over the CLSs as stipulated under section 14 of the Act 1036, provides an entry point towards proper coordination, and possible integration of these institutions, and the respective supervisory roles. It is however important that all the concerned institutions recognize their individual unique contributions towards the holistic goal of an effective and efficient land administration system for sustainable development. This is important for the uptake of a technology such as Blockchain, based on the fact that the technology in itself has an inherent consensus mechanism required for functionality. Thus, where there isn't that mutual recognition, and consensusness amongst the institutions to fully commit to the Blockchain-uptake and implementation for land digitalization, it can poorly affect the effectiveness and success of the initiative.

Accordingly, Stakeholder salience theory identifies three types of stakeholders, namely; latent, expectant, and definitive stakeholders (Slabá, 2018). These stakeholders are defined by the attributes of power, legitimacy, and urgency (Mitchell et al., 1997). And these attributes determine how each stakeholder can influence an organization, and as such, the extent to which managers of pay attention to them (Mitchell et al., 1997). The Stakeholder theory contends that the more attibutes a stakeholder group possesses, the more influence they exert on an organization's decisions, and outcomes. Thus, where a stakeholder possesses power, legitimacy, and urgency, they tend to highly influence the organizational decisions more than stakholders that possess just

one, or two of the three attributes. It is important however to note that an adoption decision for Blockchain technology which in itself operates on mutual consensus, must be one that minimizes the emphasis on the number of attributes a stakeholder group possess, and rather consider all stakeholders, especially from an institutional perspective as having equal stakes in the decision making, implementation, and the subsequent functionality of the system (Thapa, Devinder; Sæbø, 2013). That is, the broader Stakeholder theory's normative perspective recognizes the legitimacy of interest of all stakeholders regardless of the number of attibutes possessed and as such promotes that these stakeholders should be treated on equal grounds of opportunities, and considerations (Thapa, Devinder; Sæbø, 2013). This goes to enhance stakeholders' contribution, and support towards adoption success. However, where the more powerful stakeholders by virtue of possessing all three attributes dominate, and influence a Blockchain-based digital land system initiative decision, the consensus mechanism feature/ requirement in Blockchain working process can be negatively affected if the less powerful stakeholders do not fully support the system, or decisions. Therefore, from the institutional perspective, mutual recognition of all involved institutional actors as well as the technical artefacts available and impactful on the new technology are essential to reach a consensus on the best possible way towards; insitutional data digitization, standardization of data, and work processes to effect smart coordination. To this end, the Actor Network Theory (ANT) was indicated in chapter 4 to better supports this mutual relationship of both human/ institutional actors, and non-human actors towards Blockchain technology uptake as already noted in the preceeding sub-section. Therefore, to circumvent self-seeking attitudes, and conflicting interests, the different land sector instituions must first form an alliance, negotiate their individual positions and roles, and perform these accordingly. This way, future conflicting situations like currently happening between the LUSPA, and L.C with respect to the delivery of planning comments can be forestalled.

8.2.2 Blockchain-Based Smart Land Transactions

The approach to inculcating Blockchain into the Ghanaian land administration system is addressed in both Chapter 4, and Chapter 5. As already indicated in the preceding sub-section, Blockchain allows for the capture and storage of data both in textual form, and in the spatial form for maps, and plans among others. Different design architectures are identified for Blockchain uptake based on the accessibility possibilities. Generally, there are the public, and also private Blockchain architectures with a third categorization being the consortium (Junaid et al., 2023; Zein & Twinomurinzi, 2024). The public Blockchain is fully decentralized and allows for anyone to join the system without restrictions. A private Blockchain on the other hand is a controlled Blockchain system where participants need authorization to join, and also to data accessibility, transaction initiation, and validation. However, private Blockchains are used on small scale for small platforms which makes them perform faster compared to public ones which need more computer power for transactions' approval and are usually deployed on larger scales comapratively (Zaman et al., 2022). Private Blockchains may therefore not be ideal for a land administration system with several stakeholder groups made up of large number of people. A consortium Blockchain on the other hand equally has an extent of authorization as new participants of the system need pre-authorization. However, the consortium Blockchain is a form of hybrid; public, and private

Blockchains and is semi-decentralized. A consortium Blockchain is usually formed by different institutions (consortium). That is a consortium of institutions come together on a single Blockchain platform allowing them to share data, and also to possibly undertake transactions, which allows them to benefit from their unique features. A consortium Blockchain allows the participating institutions equal stake in the consensus, and decision making process (Khalid et al., 2022). Table 16 below details the characteristics of the different forms of Blockchain architecture as adapted from (Dib et al., 2018)

Properties	Blockchain Governance		
	Public	Consortium	Private
Governance Type	Consensus is public	Consensus is managed by a set of participants	Consensus is managed by a single owner
Transactions Validation	Any node (or miner)	A list of authorized nodes (or validators)	
Consensus Algorithm	Without permission (PoW, PoS, etc.)	With permission (PBFT, Tendermint, PoA, etc.)	
Transactions Reading	Any node	Any node (without permission) or A list of predefined nodes (with permission)	
Data Immutability	Yes, Blockchain rollback is almost impossible	Yes, but Blockchain rollback is possible	
Transactions throughput	Low (a few dozen of transactions validated per second)	High (a few hundred/thousand transactions validated per second)	
Network scalability	High	Low to medium (a few dozen/hundreds of nodes)	
Infrastructure	Highly-Decentralized	Decentralized	Distributed
Features	Censorship resistance Unregulated and cross-borders Support of native assets Anonymous identities Scalable network architecture	Applicable to highly regulated business (known identities, legal standards, etc.) Efficient transactions throughput. Transactions without fees Infrastructure rules are easier to manage. Better protection against external disturbances	
Examples of technologies	Bitcoin, Ethereum, Ripple, etc.	MultiChain, Quorum, HyperLedger, Ethermint, Tendermint, etc.	

Table 16. Blockchain Architecture Types and Characteristics

Source: Dib et al., (2018)

The Ghanaian land sector is characterized by diverse stakeholder groups of high mistrust amongst themselves. Aside the institutional stakeholders as the L.C., LUSPA, CLSs, Real Estate Firms, and Investment Banks among others, individuals from the general public participating in the land market also forms a powerful stakeholder that cannot be downplayed in the event of Blockchain technology uptake. Based on the objective to enhance transparency, and access to land data amongst these stakeholders while checking against unscrupulous acts of corruption and other related challenges in the land sector, the Public Blockchain architecture is proposed. This is mainly for the reason that both the private, and Consortium Blockchain architectures have diverse limitations ranging from the access permission, possible number of participant, to scalability difficulties which makes these extremely difficult for the numerous amount of land data, and the large number of land market participants/ stakeholders. It is important to note that this architecture comes with high cost implications by way of high-end computational power and electric energy requirements (Ooi et al., 2022; Junaid et al., 2023). This makes it rather expensive and if Ghana can move towards Blockchain uptake for land administration, there is the greater need for funding sources. International donor support as the GIZ, World Bank, Transparency International and other organizations involved in promoting land administration, and transparency may consider supporting the sector in this direction.

The identified public Blockchain architecture can be deployed in support of land acquisition, and land registration in the country. This public Blockchain can be built on the Ethereum platform due to its features of possible tokenization and also smart contracts. Tokenization as already noted allows possibility to represent assets in a form of token on the Blockchain platform. Tokens are in two forms; fungible, and non-fungible tokens (NFT). Tokens generally act as digital representations of objects of value. Fungible tokens are of the same value at every point in time and as such exchangeable and can also be broken down into smaller units. Example is Bitcoin, or Ether. 1 Ether in possession of an individual is the same as another 1 Ether in possession of another individual. The same applies to Bitcoin. On the other hand, non-fungible tokens represents assets of different unique features. These are therefore traded in that, a particular NFT in possession of one individual will be different from what which another individual has and so both can be transacted at different values (Agbesi & Tahiru, 2020). A piece of land can be represented as a non-fungible token. Representing these assets on the Blockchain system is minting (Agbesi & Tahiru, 2020). Consequently, An Application Programming Interface (API) based on the Ethereum Blockchain will be created as a public Blockchain system. Participants, based on their service requirements can then access the system in a transparent and decentralized way. Land, and landed properties can be tokenized, and participants can access these to enter into possible transactions. What will be required of participants is to create accounts which will enable them participate on the system. It is important to state that the validation of these transactions will be reserved for the land professional stakeholders. Thus, these validators will possess the full nodes in the system while the general public participants can use the light nodes. I argue that to prevent false land data from entering into the Blockchain system, an off-chain oracle made of representatives of the different stakeholder groups as far as possible should be formed to ensure the authenticity, and genuineness of the data before brought on chain for transaction purposes.

On land registration, I propose the smart contract feature of the same Public Ethereum Blockchain platform. Here, authorities need to define the rules governing each stage of the registration process and where these are met, the documents can move onto the next stages of registration. This will not completely eliminate human-involvement as manual processes as site inspections, surveying, and sometimes personal verifications of certain documents may still stand. It will however expedite the process, as well as enhance transparency even in those stages not captured in the smart processes as these stages will now be made known to all involved participants in the registration process. This transparency in the land sector, and potential elimination of land corruption also goes to enhance the sense of land tenure security for individuals (Uwayezu, 2020). And where land market participants have high sense of land tenure security, this translates into higher investment in land and subsequent impact on the country's sustainable goals.

The proposed system of Blockchain and its possible uptake as identified in the previous sub-section depends on stakeholders' acceptance and recognition of individuals' roles towards its success. On the other hand, due to the possible elimination of corruption, and intermediaries in land transactions, there is the high tendency of sabotage both within, and outside the land professionals. Strict measures thus need to be instituted against such behaviors. Example, intermediary agents that parade themselves at the Lands Commission premises to lure innocent clients of the Commission can be sent away even if it demands the use of the police personnel. On the part of professionals, strict use of the system as against manual approaches must be instituted and all those that cannot use the system due to lack of know-how even after training must be replaced and changed to different roles of only manual nature if possible.

8.2.3 Emphasizing Socio-Cultural Elements within the Guiding Considerations for Blockchain Uptake

As established already, Ghana's land sector is both statutory, and customary with the customary sector making up about 80% of all lands in the country. This makes the influence of the customary land sector in land decision making very crucial in the country. In chapter 6, I examined a land technology (GELIS) uptake at the Accra Lands Commission and identified that socio-cultural elements and their adaptations were to a large extent overlooked in this uptake. This largely contributed as a factor to the subsequent unsustainability of the GELIS system when the Land Administration Project ended. I identify that the uptake of a land technology in a customary dominated country like Ghana needs to be adapted to the socio-cultural elements that resonates well with the people, and which enhances their sense of ownership of the system. Subsequently, in addition to the technological, organizational, and external/ environmental factors which we consider are very instrumental for consideration in the uptake of any technology for the land sector, I contended that for a normative society as Ghana that is highly customarily dominated, there is the need to consider socio-cultural elements and the influence they exert on both the technology uptake, and subsequent sustainability. Through socio-cultural recognition, land sector institutions championing land technology uptakes lend the system to a practical local adaptability which has both practical and theoretical implications on the scholarly debates on hybrid land administration, and the resurgence of traditional principles and roles therein. It also reflects a creation of

contextually fitting, and unique systems that are practical, and workable for the country. That is it allows for creative adaptations to modernity Akaateba, (2018) which is the desired vision of all developing land administration systems especially, those with duality of land tenure systems across Africa. Due cognizance must be taken of such elements as the tenure types, customary values which could be impacted by the introduction of these technologies, cost implications for the local people, modern and traditional channels for creating local awareness, local attitudinal approach to change and to technologies, and also social capital to enable the society fully utilize the system amongst others. These issues will provide grounds to creating a socio-political land administration system of complementarity from both the state, and customary land sectors which can allow for a creative adaptation to modernity (Akaateba, 2018).

8.2.4 Digital Basis as a Stepping Stone towards a Blockchain-Based Transparent Land Administration System

The foregoing establishes that Blockchain consideration for the purpose of enhancing land administration transparency in Ghana is possible. This is however based on a careful guide that incorporates technological, organizational, external/ environmental, as well as socio-cultural factors within the Ghanaian land sector. However, Blockchain technology cannot operate in a vacuum. The technology operates in a digital avenue. Without a proper digital basis and ecosystem, the uptake only stands a trial and error approach without sound grounds for success and sustainability outlook. The thesis identified that although there have been some sporadic efforts towards digitalization initiative in some of the study cases, there has not been any resolute digitalization plan for the land sector, making digitalization efforts faced with unclear visions, action plans, and roadmaps. This thesis identified eight key focus areas to assess the digital basis of the Ghanaian land sector in lieu of a possible Blockchain uptake. That is how these areas support digital processes, and or are digitally synched to allow for a build-upon digitalization of the land sector. The thesis finds a generally Emerging digital status across the study institutions although the Accra Lands Commission is comparatively on a good pedestal than the Kumasi Lands Commission, and the Otumfour Customary Land Secretariat. These findings reflect the results found in Ansah et al., (2024) who looked at the transition into a digital land information system at the Accra Lands Commission and found it to be at the beginning stages of a comprehensive transition curve. I reflect on these areas in the subsequent paragraphs;

Policies, legal laws, and political commitment: Diverse policies, laws and legal documents on land administration directly, or indirectly support a digital transformation of the sector. So have the different political regimes demonstrated willingness, and support for a digital land sector through various measures, and initiatives. What I identify in this study is that presence of policies and laws, and also the promised commitments from political leaders towards land digitalization does not directly translate into working digital systems. There is a big gap between actual action implementation, and the provisions in the policy documents. For every little digital effort made, findings showed underlying legal policy support. This points to the existence of policy documents. However, the extent of the policy documents and the details borering on digitalization, and its implications are very limited. This makes it complex and difficult to discuss in-depth digitalization

systems and processes that have policy implications. For instance, the security and exchange commission of Ghana (SEC) has warned the public to be careful of, and desist from crypto-currency trading, and their platforms since these are not regularized by the commission, nor licensed under them (Security and Exchange Commission Ghana, 2019). With Ethereum Blockchain being one of such platforms which is identified as a solution platform for a transparent land administration system, there will be the need for a thorough review with the SEC, and possible comprehensive policy document on the operation and use of such a solution. Political supports and commitments will be instrumental in these processes as a way forward. A well-structured and comprehensive digital land policy document is thus a necessity at this point, commitment to the provisions of this policy and their translation into actions must be enforced through the combined efforts of political champions, and land sector institutions.

Institutional arrangements, and data standards: As identified in sub-section 8.2.1, institutional acceptance, and recognition towards integration and coordination acts as a bedrock in achieving land administration transparency. Data sharing forms the basic step towards integration. This is however challenging where different data forms are used within these different institutions. Thus data standardization amongst the land sector institutions, both statutory, and customary is identified key. Land related data from across the land sector institutions in manual format must be carefully reviewed for completeness, accuracy, and authenticity, and digitized. Although digitization is already on course in all the study institutions, review of the process, and their capacity needs to be done to help accelerate the pace. This is due to the fact that it's been over two decades since the digitization of manual data began at the Lands Commission, and to date, there is a backlog of old data. In digitizing these data, there need to be an adaptation to standardizing these across the institutions to facilitate use, and exchange amongst them. This can improve work processes amongst them over Blockchain technology. The thesis identified that some other public institutions usually withhold data. This attitude often leads to the other institutions incuring huge costs to get the same data from the public source. Hence, this attitude amongst public institutions needs strong political intervention to resolve and to foster free release, and exchange of data amongst them since it goes to not only facilitate public institutions services to the country, but also saves the national purse from double spending on the same data.

Technical considerations: The technical systems in terms of hardware and software tools to support possible digital processes, and services are also identified at varying degree. The Accra Lands Commission is well on course in this consideration with the presence of systems like the ELIS, the Lands Commission Portal, and other divisional software as the Topcon tool for the survey department are a big step. Same cannot however be said of the Kumasi Lands Commission, and the OCLS which are lagging behind in these areas. However, there is a general need for hardware technical boost across all the institutions. From imbalanced computer to staff ratio, to other tools like printers, scanners, photocopiers, and uninterrupted power supplies (UPSs) among others. Other necessities to boost work service efficiency include Electricity Power Plants, and High Speed Internet Services. The limited supply of these, and the fact that most of them are dysfunctional, or performing relatively low hinders work efficiency. They lead to drastic loss of productive working hours especially where working computers are slow, or where electricity from the national grid goes off and there is no standby electric power plant, or where there is, and it

does not power on for different reasons. These challenges significantly cut down production efficiency, and subsequently affect digital land processes and services. Efforts to improving the digital system of the land sector towards transparency thus largely is contingent on the collective efforts of both state and non-state actors like NGOs, CSOs, private partners, and donor partners to help boost the hardware and logistical assets of land institutions. Such efforts must however not be centralized at the Accra Headquarters as is the case in most instances but must be decentralized to all other regions, and to the CLSs as well, and be kept under strict monitor and supervision to ensure they are diligently used and cared for, for sustainability. This is because, there is a general apathy towards government properties in the Ghanaian sector which is a major contributory factor for the unsustainability of public sector projects. On the software systems in support of land services delivery, as Accra Lands Commission is already pioneering most of these systems, efforts must be put in place to scale up the systems across the others institutions, and must be integrated and synchronized to foster coordinated efforts, and a transparent land delivery system.

Socio-cultural issues: This is well discussed in chapter 6, and thoroughly reflected in sub-section 8.2.3, socio-cultural consideration in view of land digitalization must be equally well incorporated. These aspects relating mainly to the social values of the people, their customs, belief systems, and attitudes amongst others affect the use, and sustainability of any digital system in the land sector, and more particularly, if there will be a frontend interface for the people to use. Thus, proper consultations with the public through education in various forms, and languages, and involving opinion leaders in communities in such outreach campaigns and education is highly recommended. This is because, the ordinary Ghanaian takes such campaigns more serious and feel part of the decision making where these are brought to them within their communities than in the media. Such door-step campaigns and education allows them to freely raise their concerns, ask their questions, and express their thoughts in a way that makes them feel as part of the whole process of the digital decision making. This way, when such digital changes are effected in the land sector, there is a high possibility of acceptance, and use by the public.

Financial considerations: Land administration across the world is highly capital intensive. This is same with the uptake of a technology as Blockchain for land administration transparency. With the need for high computational power for mining purposes, and large electricity power among others, the uptake, maintenance, and sustainability of Blockchain for the land sector will be dependent on a sound plan for budgets and financial sources. Across many African countries, different projects and especially in the land sector have faced challenges like; drastic cutting down of initial scope, abrupt ending/ terminations, or unsustainability due to financial support withdrawals, or end of donor sponsors' project timeframes (Deane et al., 2017). Currently, the main source of finance for the land sector institutions is a certain percentage of their internally generated funds (IGFs). For instance, only 33% of the annual income of the Accra Lands Commission is retained for the Commission's use for its projects (Ansah et al., 2024). Thus, dependent of the income in a particular year, this retained amount could be less, or high. As such, where this is the only source to rely on for funding, and sustaining a project as Blockchain uptake for land transparency, there is highly likely to be challenges for maintenance and sustainability during years of low annual income accruals. At the CLSs, it is a similar situation of internally generated funds acting as the main financial source for their activities and projects. I find these

financial base for the institutions not only inadequate but also unreliable for long term projects that are capital intensive as there is no guarantee of sufficient income at the end of each year. It is therefore important that other avenues of guaranteed finance be explored especially for specific capital intensive projects of long term effects on the trajectory of the land sector. Political governments as part of their commitments to fostering an efficient land sector can therefore allocate an annual sum of money committed to supporting such long term capital intensive projects which can be justified within certain parameters. Such a support can help in the adoption, maintenance, and sustainability of Blockchain technology for land administration transparency in Ghana. In addition to this, the land sector institutions are equally called up to be innovative in their approaches to services provision to boost their annual revenues by way of breaking revenue leakage points in the system, boosting public interest in land processing through introduction of attractive, and easy land processing approaches among others.

Collaborations, and partnerships: This is very crucial for building a modern land administration system. Collaborations and partnerships provide avenues for achieving economies of scale within institutions. For instance, collaboration among the land sector institutions can help cut down the cost implications on individual institutions where they decide to collaboratively undertake a project. Also, it will help to draw expertise from all the involved institutions for the different aspects of the project and thus eliminate the need for hiring external experts as would have been the case for a single institution. Again, partnerships, and especially public-private partnerships offer very fruitful gain-gain results for the partner institutions. In the case of Blockchain uptake in the land sector, the land sector institutions like the Lands Commission, and LUSPA can come together, and possibly with some customary land secretariats to form a consortium to adopt a Consortium Blockchain technology for their activities. This will not only facilitate their work processes, and enhance transparency but also cut down the cost of adoption on the individual institutions. These institutions can equally partner with private sector Blockchain firms like BenBen in Ghana which can provide the expertise for the adoption. Collaborations and partnerships should therefore be streamlined in the land sector in Ghana, and be well guided. Critical reviews, and formulation of policies that foster healthy and beneficial partnerships within and amongst both state, and non-state actor institutions or firms must be looked into at the government level. This can boost the interest in institutions, and especially in private sector firms to come together, and to work with government institutions for the overall good and sustainable development of the country and not just in the land sector.

Leadership and stakeholder involvement: Institutions and their leadership are faced with daunting challenges resulting from digital transformation and the disruptions that new digital technologies introduce into work processes, and environments (Weber et al., 2022). Institutional leadership must know when, and how to adopt and to implement successfully emerging and disruptive technologies, and also demonstrate competence in the lead and navigation of the challenges within the digital space (van Wart et al., 2017). Leadership in this position of digital technologies adoption can be referred to as e-leadership and this is defined as the ability to effectively select, and use digital technologies for both personal, and institutional purposes (van Wart et al., 2017). In the study areas, leadership show the openness to digital technology adoption in support of land administration transparency. Leaders have the necessary land administration experiences in the

sector and embrace the idea for digital advancement/ transformation. It is however not enough to be willing and open to the idea of land digitalization but the actual competence on the part of the leaders in the selection and use of the right technologies based on the identified challenges needing redress. And Blockchain promises a higher potential for enhancing transparency in transaction in the recent years. However, the knowledge-base of leadership of the study institutions on Blockchain technology, its potential and use in the land sector, and possible adoption is very limited. I found that although many of these leadership have heard of Blockchain technology, they have little to no knowledge of its use in the land sector. To many of these, it is mainly a financial tool associated with Bitcoin trading. The implication is that attempts to adopt the technology without the right expertise especially from within the land sector stakeholder group can only lead to mimetic isomorphism without sound basis. Stakeholder involvement in Blockchain technology adoption in the Ghanaian land sector is thus as important as the leadership role. This is because, the broader stakeholder group presents some form of expertise and other instrumental human resources that can support leadership efforts for possible adoption. For instance, the BenBen private Blockchain firm focused on employing the technology for land services on small scale private basis can greatly support leadership with the expertise knowledge needed to guide the decision, and adoption process of the technology. Again, the involvement of other stakeholders as the public-user groups, and operational staff will provide better ideas for how the system can be designed to suit the practical needs and challenges. Ensuring such a balanced leadership role and stakeholder involvement will provide for an enabling environment for achieving a fit-for-purpose digital adoption and sustainability for the land sector while advancing leadership competence, and know-how.

Capacity, and know-how: Related to the leadership role defined in the preceding sub-section, the overall land sector capacity, and know-how plays a significant role in the possible adoption, and sustainability of Blockchain technology for land administration transparency. General digital literacy, capacity, and know-how within the land sector is skewed. The thesis identified that aside from the professionals in the I.T departments, the majority of the actual land administration officers have low digital literacy level limited mainly to the basics of the Microsoft Office programs as; Word, Excel, and PowerPoint among others. Technical knowledge of related software are very low. However, the Survey department makes use of some software as ArcGIS, QGIS, and others for their work and so can be said to be comparatively better than those at the LVD, LTR, and the PVLMD of the Lands Commission. At the CLSs, there is equally a general low capacity level and technical know-how just as within the statutory sector. The implication of this is that although the sector is experienced in the core mandates of land administration functions; land tenure, land use, land valuation, and land development, the complementary skillsets, and knowledge necessary to modernize these experiences by way of digital transformation of their services, and work processes is limited. As they have for a long period been used to manual processes, and face-to-face services delivery, the sector appears seemingly comfortable with their rudimentary and manual approaches to land services delivery. This also has a negative repercussion on digital transformation as people generally are reluctant to move out of their comfort zones (manual services delivery approaches). On the other hand, where digital literacy and capacity is well developed, and high, it creates cravings in professionals for new digital

approaches to services delivery. This does not only make professionals, and the system efficient and smart, it also helps them stay abreast with current, and new trends to land services delivery and to better serve society. In this regard, and to enhance capacity and technical know-how, there is the need for policy to inculcate digital literacy programs into the land administration profession especially for staff engaged in the core land administration functions. This policy could be made part of the necessary requirements for professional promotions. That is, each professional level should come with some form of digital competence and literacy needed for technical processes and services delivery. Such a policy can help grow a workforce of high digital literates and competence in addition to their knowledge and experiences of the main land administration functions. And this will greatly drive the necessary digital transformation of the land sector at every point in time. This has implication on the education of the general public clients as well as on new digital systems that might be introduced as the professional are knowledgeable enough to educate the customers that they deal with on daily basis.

8.3 Contribution to Scientific Knowledge

In an age of digital innovation across every sphere of human activity, and where digitalization has become so relevant that countries are ranked on their digital maturation (van Wart et al., 2017), the successes of good governance is heavily bounded to the a country's level of digital governance (Demuyakor, 2021). In the land sector, digitalization is ever important due to the high level of corruption in the sector and especially in most developing countries in the global south. This study's focus on a feasibility assessment for Blockchain technology uptake in the Ghanaian sector is considered timely. The findings have diverse relevance to the body of knowledge in various domains:

First, similar to research works on Blockchain consideration in the land sector (Njoroge, 2019; Mintah et al., 2020; Seun et al., 2020; Biswas et al., 2021; Khalid et al., 2022) this study has demonstrated that Blockchain technology can be adapted for land administration purposes. However, different from these other research works which have mainly focused on Blockchain for land record keeping, and or land registration, this thesis in chapter 4 has advanced the Blockchain in land administration discourse to demonstrate its uptake in a holistic view in support of the land administration functions of land tenure, land value, land use, and land development. Specifically, this study contributes to the knowledge of deploying Blockchain as an underlying communication tool connecting the four land administration functional areas and in a dual land administration system of statutory, and customary. The study has shown that the processes in the different functions of land tenure (registration), land valuation, land use, and land development can be integrated and facilitated by means of a Blockchain system. Also, by identifying the different process of land administration functions and the stakeholders involved in these processes both from the statutory, and customary perspectives, and their various roles, the study reveals the various power dynamics amongst these stakeholders and the implications this has on land administration, specifically technology adoption. That is, by interrogating the extent of applicability of such theories as the stakeholder salience, and the actor network theory, the study provides for a much better understanding of the socio-political nature in a dual land administration

system from the African perspective. This contributes to strengthening the debate on the fit-for-purpose land administration (Enemark et al., 2016; Chigbu et al., 2021) and illustrates the imports of contextual specificities, and local actors in defining the outcomes of land administration policies and reforms. This will go to enrich the African narrative of evolving land administration systems based on contextual ideas, and practice-based experiences gained from the challenges and successes of such a unique system of both state, and non-state actors engaged in land administration processes (Akaateba, 2018). Also, by employing the SWOT analysis which helped to reach relevant SWOT strategies to guide technology adoption in the sector, this thesis provides practical insights to inform future policies on technology adoption for land administration in Africa.

Secondly, this thesis expands the literature on land administration assessment frameworks by employing frameworks from information science (digital maturity framework), and public administration disciplines (technology adoption framework) and combining these with land administration frameworks to develop a guiding framework for assessing digital maturity of a land administration system. Recent studies assessing digitalization, and land administration have mostly relied mainly on land administration evaluation frameworks like LGAF, and FELA among others (Bennett et al., 2022; Joannides, 2023; Ansah et al., 2024). This has led to little commentary on the multidisciplinary nature of land administration in contemporary literature. This situation has the tendency of narrowing future knowledge scope, and the potential leaarning from other disciplines to enrich land administration as a whole. Thus, this study specifically contributes not only to land administration, but also information science, and public administration by raising the awareness on the linkages within the three sectors particularly in assessing digitalization and possible uptake of innovative technologies. Again, through contextual specificities, and empirical findings, I have advanced the scope of the TOE framework within the context of land administration to include socio-cultural elements which are key in many land administration systems in sub-Saharan Africa (Dieterle, 2022). I show the impacts and implications of these socio-cultural elements on any land management decision within an African perspective. This presents a theoretical extension to the TOE framework different from as applied in other works (Vergouwen et al., 2020; Singeh et al., 2020; Badi et al., 2021).

Furthermore, the study contributes to practical awareness of the digital maturity of Ghana's land sector based on two leading statutory lands commissions, and a leading customary land secretariat in the country. Hitherto, no study has undertaken such a view of Ghana's land sector digital status assessment which made knowledge of the extent of digitalization in the sector, and its preparedness for innovative land tools absent both for practitioners, and for researchers in academia. This thesis thus informs practical insights to guide the discourse on land digitalization and the way forward in Ghana from both the academic, and professional standpoints. Specifically, it contributes a developed framework guide for possible Blockchain technology uptake based on contextual factors and experiences. It develops a Blockchain-based smart land transaction model based on lessons from a practical Blockchain-land pilot activities from BenBen. Finally, it develops a digital maturity assessment framework tool based on empirical professional knowledge, and experiences for the Ghanaian, and similar land administrations systems across sub-Saharan Africa. These practical findings and outcomes of the thesis offer rich local knowledge, and experiences as

alternative ideas for expanding the scope of debate, theories, and concepts around digital transformation within land sector reforms in Africa.

8.4 Limitations

Like every research work, this study has some limitations emanating mainly from the methodological process. Given the research design and methodology chosen, not all relevant land sector institutions, and stakeholders in Ghana could be included due to limited time for fieldwork, funds, and also access to data possibilities. Consequent to this, the results from the three case study institutions, and the stakeholders represented cannot be said to be a conclusive general situation of the Ghanaian land administration system. Thus a conclusive generalization of the study result cannot be made. However, due to the richness of data from the carefully selected critical cases from amongst the land administration institutions in the country, the findings and the interpretations therein offer a reasonable idea into the situation as exist in other parts of the country, and also offer sound basis for exploring the situation in these other part, and other land institutions in Ghana to evaluate their applicability. Also, access to data from the two private Blockchain firms, BenBen, and Bitland had proven to be difficult. With the exception of the CEO of BenBen, all attempts to reach other staff proved futile. With Bitland on the other hand, no interview had been possible with any staff, and also a visit to their address as picked from their LinkedIn website led us to no specific office. This challenges skewed the empirical data.

8.5 Recommendations:

8.5.1 Recommendations for Policy Makers and Practitioners

The findings, and outcomes of this thesis has vast implication for especially the Ghanaian land sector as a whole. It has revealed that digital transformation of Ghana's land sector is currently at the Emerging stage, and has diverse possibilities for achieving a more transparent modern digital land administration system based on Blockchain technology. The extent of realization of this is however contingent of certain policy directives discussed below;

Frist, there is the need for a National Land Digitalization Delta Plan. That is, there should be a formulated national grand digital land agenda document that encapsulates the visions, goals, and deliverables for the land sector within a specified timeframe. Digital transformation of the Ghanaian land sector which began over two decades ago has been ad-hoc in nature. There is simply no concrete land sector digital agenda/ document outlining the visions, and missions for land digitalization. This distorts the possibility of a single direction for land digitalization resulting in unstructured, and blurry digitalization journey of the Ghanaian land sector. There is therefore need for a holistic national land digitalization vision document. At the current maturity state, it is recommended that just like the LAP vision, a longterm 25 year Digital Land Vision/ Plan be drawn up for the land sector. The formulation of such a document must incorporate all land sector institutions and expertise, as well as relevant private partner expertise. The result of such a digital

agenda document must state the direction of the digital transformation, the deliverables expected within each five year interval, the action plan for digital transformation journey, the institutions involved and their roles, and also provide for a national coordinating body that will oversee that concrete actions are taken and not just discourses.

Secondly, there is the need for a National Digital Land Policy Document: By this, I mean there should be a comprehensive and holistic policy document which consolidates all the laws on digitalization of land administration and will provide basis for all innovative land digitalization projects in the sector. Such a legal policy document should for instance define, and provide lawful basis for digital signatures, electronic documents, and contracts, public-private partnerships, data protection and privacy, data accessibility, cyber-security, and digital identification among others for land administration purposes. Where such a legal document exists, it provides better grounds for land digital transformation especially as it helps to justify the need for an innovative tool which might be considered ideal for purposes of land administration but which the SEC might not have approved, or given permission yet for legal adoption and use. That is, the National Digital Land Policy can offer legal basis for negotiating the uptake of innovative land technologies like Blockchain technology in Ghana within the digital space.

Furthermore, the need for Budget Allocation for Digital Land Initiatives: Funding is an indispensable element in every project. Current digitalization innovations are capital intensive and as such require secure funding to ensure total deployment and functionality. This is particularly important because lack of secure funding led to cutting down in the proposed functionalities of the GELIS project birthed from LAP. That is, due to limited funding from the partners of the project, the commission was unable to deploy all the proposed functionalities of the system which led to removing certain core aspects from the system as identified in chapter 6. Such dependencies on funding sources that are not guaranteed can always lead to disappointments, and or projects being forced to end, or abandoned even after initial commitments. It is therefore recommended that aside the internally generated funds of the land institutions, political governments must endeavor to enshrine a cap for land digitalization initiatives in the national budget and this must be supported and guaranteed by legislative approval. It is however important to state that any proposed land digital initiative that seeks to access such a fund must be justified before parliament, and a selected independent expert group. And where the budget is approved, the independent expert group must supervise, and monitor the use of the funds for the proposed project, submitting project progress report quarterly to parliament, and the government until complete project delivery. This policy will not only provide funds for land digital initiatives but also ensures that institutions actually work to give value for money for sustainable development of the country as a whole.

Again, boost in Digital Leadership and Governance: Across all institutions of the world in the current age, digitalization has become an integral aspect to remain competitive and to better serve the growing demands of clients, while still addressing new challenges in a smart manner. This places great challenge on leadership to keep up with the continuously evolving innovations. The leadership structure of land institutions in Ghana must be revised for digital competence since modern land administration systems are contingent on digitalization. In addition to the professional qualification, and experiences in the core functions of land administration, leadership must equally

be competent, and 'effective in dealing and navigating the challenges of leading within the digital space' (van Wart et al., 2017). This can help land sector leadership make sound decisions on the digital transformation vision of the sector based on in-depth knowledge, and understanding of such innovative land tools like Blockchain technology. Two ways to achieve this leadership for the land sector are proposed; first, the core land administration experts who might not have expertise in computer science, or related fields to be experts in the digitalization in the sector can take further courses, and training in these related fields to acquire the necessary digital knowledge and expertise to complement their land administration expertise for the leadership of the land sector. Secondly, experts from computer science, or related fields who have the expertise knowledge and experience in digitalization, and innovative technologies can also be employed in the land sector to support the leadership in such areas digital transformation decisions. It is however important that such leaders learn on the job, and understand the core land administration functions and processes to better guide their expert advice on land digitalization.

Finally, land administration practitioners must acknowledge, and accept that modern land administration has gone beyond the basic manual processes to innovative digital systems. Thus, leadership must create learning opportunities for continuous professional development of the practitioners' digital literacy, and competence, and must ensure that all practitioners take advantage of this initiative. Staff that are unable to upgrade themselves for the new digital systems must be relieved of critical roles and be replaced with digitally literate land experts that can deliver on the digital transformation vision.

8.5.2 Recommendations for Future Research – In the Broader Scope of the Thesis Idea

Given the scope of the thesis, the results and conclusions made, there are still some areas I deem need to be covered within the broader scope of digital land administration in Ghana.

First, the scope of the study was limited to land professionals at the Accra, and Kumasi Lands Commission, and at the Otumfuor Customary Land Secretariat. Although this was aimed at helping to gain in-depth details on the issue at hand, the narrowed scope to one land sector professionals as done in similar studies (Oberdorf, 2017; Ansah et al., 2024) does not allow for a better comparison of the issues on their digitalization journey, their current statuses, and possibility to integrate them for effective coordination, and for general land sector transparency. It is therefore recommended that future scholars should consider extending the study scope by looking at it from the perspective of other land instituions like the LUSPA. This can help give a broader understanding of readiness, and feasibility for possible adoption of Blockchain technology for these land sector institutions for land administration transparency. In so doing, scholars should also consider the possibility of including the public clients of the institutions as a stakeholder group, and also consider other cities other than Accra, and Kumasi which have mostly been the focus of studies due to their status as the biggest, and busiest administratively in the country. Also, the dual land tenure system in Ghana as is prevalent in many other sub-Saharan African countries offers a better opportunity for extending the research on Blockchain consideration for land administration transparency in the African hybrid land administration system. The dynamics of the different customary land tenure practices, and the relationships with the state-land sector across

these African countries will help to elucidate more contextual factors that affect land sector digitalization in Africa and in lieu of the potentials, and possible consideration of Blockchain technology for land transparency across African cities. This can effect a bigger pan-African discourse on Blockchain for land administration in the long run, to learn from individual country experiences and possible partnerships. New ideas, and understandings from such local partnerships are relevant for pragmatic land administration forms Akaateba, (2018) and can allude more empirical evidences to support calls on 'local-knowledge for local solution' adaptations in land administration.

Secondly, the study demonstrated how a Blockchain-based smart land transaction can effect integration of all involved stakeholders for land transparency. This however has an implication on the various stakeholder theories like the Actor Network Theories, and the Stakeholder Salience Theory. Although the study provides a reflection on an extent to which the findings interrogate the truism, and reflexivity of these theories from the Ghanaian perspective in a possible Blockchain technology uptake, I recommend further studies on these theories within the land sector technology uptake in the hybrid tenure system to identify how the customary, and statutory land administration, and the prevalent power dynamics challenge these from an institutional point of view. Such research works can provide empirical knowledge towards a positive rethinking and extension of these theories in the land administration across sub-Saharan Africa. Also, as part of the Digitalization initiative of the current (2024) vice President of the Republic of Ghana, H.E. Mahamudu Bawumia, diverse digital initiatives have been implemented across various ministries and the respective institutions under these ministries, see https://www.govgh.org/search/?filterBy=ministry. I recommend that further studies into these digital services be carried out by scholars to identify the successes, the challenges, and the experiences with the platforms. This will contribute towards identifying approaches to improve these digital initiatives to better serve the public in a sustainable way.

Finally, as this research focused on the feasibility of Blockchain technology uptake, an extensive look into the works of BenBen, Bitland, and Landano which are private Blockchain firms dealing in land services would have been very ideal. However, due to the limitation as noted already, this had not been possible. Therefore, future researchers can consider focusing extensively on the works of these Blockchain firms if possible and accessible. They should explore their activities, which areas of land services they are into, how they are delivering these services, and for which group or category of people. Researchers should also investigate how the services of these firms are being received, and contributing towards land transparency, and tenure security in general. Such comprehensive investigations will offer rich experiences and evidences, or insights on Blockchain's possible consideration at the broader land sector of Ghana.

8.5.3 Recommendations for Future Research – Outside Thesis Scope but in Related Views

Generally, this study's findings, and the reflections therein make relevance for further research works not only from the view of digitalization, and Blockchain in the land sector but for similar areas outside of this study's broader purview as well;

First, several new innovative tools have emerged with different capabilities and applicability. This broadens the scope and discourse on e-governance, and or e-administration in various public sector institutions. Adoption of all such new technology ideas as Digital twin and others are dependent on the issues identified in the developed digital maturity assessment framework in this thesis. Therefore further research works in other areas like Digital twin for public services delivery should consider the issues raised in framework. This can help in the validation and extension of the framework across domains.

Again, in political studies, and especially in many developing countries where national elections are still fraught with grievous malpractices, this study has demonstrated the potential of Blockchain to enhance transparency. Therefore, I recommend that this potential of Blockchain be explored further by researchers in the area of national voting in Ghana, and other African countries. Findings can be a starting point of reformation for politics and the many scandalous issues associated with it, which are responsible for political tensions and rifts in these parts of the world.

References

Abolade, A. O., Dugeri, T., & Adama, J. U. (2018). Challenges of Digitalizing Land Administration System in Nigeria : The Kaduna State Experience. *18th African Real Estate Society (AfRES) Annual Conference*, 67–82.

Abubakari, Z., Richter, C., & Zevenbergen, J. (2018). Exploring the "implementation gap" in land registration: How it happens that Ghana's official registry contains mainly leaseholds. *Land Use Policy*, *78*, 539–554. https://doi.org/10.1016/j.landusepol.2018.07.011

Adams, J., Khan, H. T., Raeside, R., & White, D. (2007). *Research mthods for graduate business and social science students*. Response books.

Adeyinka, R. B. (2020). Transparency in Land Title Registration : Strategies to Eradicate Corruption in Africa Land Sector. *African Journal on Land Policy and Geospatial Sciences*.

Adiaba, S. Y. (2014). *A Framework for Land Information Management in Ghana*. University of Wolverhampton.

Agbesi, S., & Tahiru, F. (2020). Application of Blockchain Technology in Land Administration in Ghana. *In Cross-Industry Use of Blockchain Technology and Opportunities for the Future*, 103–116. https://doi.org/10.4018/978-1-7998-3632-2.ch006

Agyemang, F. S., & Morrison, N. (2017). Recognising the barriers to securing affordable housing through the land use planning system in Sub-Saharan Africa : A perspective from Ghana. *Urban Studies*, *55*(12), 2640–2659. https://doi.org/10.1177/0042098017724092

Aha, B., & Ayitey, J. Z. (2017). Biofuels and the hazards of land grabbing: Tenure (in)security and indigenous farmers' investment decisions in Ghana. *Land Use Policy*, *60*, 48–59. https://doi.org/10.1016/j.landusepol.2016.10.012

Akaateba, M. A. (2018). *Urban Planning Practice under Neo-customary Land Tenure : The interface between Government Agencies and Traditional Authorities in Peri-Urban Ghana*. Technische Universitaet Berlin (Germany).

Akram, S. V., Malik, P. K., Singh, R., Anita, G., & Tanwar, S. (2020). Adoption of blockchain technology in various realms: Opportunities and challenges. *Security and Privacy*, *3*(5), 1–17. https://doi.org/10.1002/spy2.109

Alam, K. M., Rahman, J. M. A., Tasnim, A., & Akther, A. (2020). A Blockchain-based Land Title Management System for Bangladesh. *Journal of King Saud University - Computer and Information Sciences*. https://doi.org/10.1016/j.jksuci.2020.10.011

Ali, D. A., Deininger, K., & Duponchel, M. (2017). New Ways to Assess and Enhance Land Registry Sustainability : Evidence from Rwanda. *World Development*, *99*, 377–394. https://doi.org/10.1016/j.worlddev.2017.05.016

Ali, S. H., & Tahir, H. (2020). A Survey on Blockchain and Online Land Registration. *International Journal of Scientific & Engineering Research*, *11*(7). https://doi.org/10.13140/RG.2.2.22552.01289

Ali, T., Nadeem, A., Alzahrani, A., & Jan, S. (2020). A Transparent and Trusted Property

Registration System on Permissioned Blockchain. *International Conference on Avances in the Emerging Computing Technologies (AECT)*, 1–6. https://doi.org/10.1109/aect47998.2020.9194222

Amanor, K. S. (2022). Land Administration, Chiefs, and Governance in Ghana. In *African Land Reform Under Economic Liberalisation* (pp. 21–39).

Ameyaw, P. D., & de Vries, W. T. (2020). Transparency of Land Administration and the Role of Blockchain Technology, a Four-Dimensional Framework Analysis from the Ghanaian Land Perspective. *Land*, *9*(12), 491.

Ameyaw, P. D., & de Vries, W. T. (2021). Toward Smart Land Management : Land Acquisition and the Associated Challenges in Ghana. A Look into a Blockchain Digital Land Registry for Prospects. *Land*, *10*(3), 239.

Ameyaw, P. D., & de Vries, W. T. (2023). Blockchain technology adaptation for land administration services : The importance of socio-cultural elements. *Land Use Policy*, *125*, 106485. https://doi.org/10.1016/j.landusepol.2022.106485

Amone, C., & Lakwo, C. (2014). Customary Land Ownership and Underdevelopment in Northern Uganda. *International Journal of Social Science and Humanities Research*, *2*(3), 117–125.

Anand, A., McKibbin, M., & Pichel, F. (2015). Colored Coins: Bitcoin, Blockchain, and Land Administration. *In Annual World Bank Conference on Land and Poverty*. https://www.ubitquity.io/home/resources/worldbank_land_paper_ubitquity_march_2016.pdf

Ansah, B. O., Voss, W., Asiamah, K. O., & Wuni, I. Y. (2023). A systematic review of the institutional success factors for blockchain-based land administration. *Land Use Policy*, *125*, 106473. https://doi.org/10.1016/j.landusepol.2022.106473

Ansah, R. O. (2022). *Assessment of Land Information System for Land Administration: A Case Study of Ghana*. University of Twente.

Ansah, R. O., Abubakari, Z., Quaye, B., Todorovski, D., Malumbo, C., & Lemmen, C. (2024). Navigating the Terrain of Digital Transition : Ghana ' s Journey of Developing a Digital Land Information System. *Land*, *13*(4).

Antwi, A. Y., & Adams, J. (2003). Rent-seeking Behaviour and its Economic Costs in Urban Land Transactions in Accra , Ghana. *Urban Studies*, *40*(10), 2083–2098. https://doi.org/10.1080/0042098032000116121

Aquib, M., Dhomeja, L. Das, Dahri, K., & Malkani, Y. A. (2020). Blockchain-based Land Record Management in Pakistan. *2020 3rd International Conference on Computing, Mathematics and Engineering Technologies (ICoMET)*, 1–5. https://doi.org/10.1109/iCoMET48670.2020.9073927

Arthur, B. (2022). Digitalization of Land Administration in Ghana: Transforming Lands Commission. *National Land Conference*.

Asante, L. A. (2020). *The Politics and Activism of Urban Governance in Ghana: Analyzing the Processes of Market Redevelopment in Kumasi and Cape Coast*. Humboldt-Universitat.

Asiama, K. O., Bennett, R., & Zevenbergen, J. (2018). Land valuation in support of responsible land consolidation on Ghana ' s rural customary lands Land valuation in support of responsible land consolidation on Ghana ' s rural customary lands. *Survey Review*, *50*(361), 288–300. https://doi.org/10.1080/00396265.2018.1467672

Aslanova, I. V, & Kulichkina, A. I. (2020). Digital Maturity : Definition and Model. *2nd International Scientific and Practical Conference "Modern Management Trends and the Digital Economy: From Regional Development to Global Economic Growth" (MTDE 2020)*, 443–449.

Awuah, K. G. B., & Hammond, F. N. (2014). Determinants of low land use planning regulation compliance rate in Ghana. *Habitat International*, *41*, 17–23. https://doi.org/10.1016/j.habitatint.2013.06.002

Awuah, K. G. B., Hammond, F. N., Lamond, J. E., & Booth, C. (2014). Benefits of urban land use planning in Ghana. *Geoforum*, *51*, 37–46. https://doi.org/10.1016/j.geoforum.2013.09.019

Babalola, S. O., & Uyi, I. O. (2019). A Web-Based Land Information System, Tool for Online Land Administration in Akure Nigeria. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*. https://doi.org/10.5194/isprs-archives-xlii-4-w16-137-2019

Badi, S., Ochieng, E., Nasaj, M., & Papadaki, M. (2021). Technological, organisational and environmental determinants of smart contracts adoption: UK construction sector viewpoint. *Construction Management and Economics*, *39*(1), 36–54. https://doi.org/10.1080/01446193.2020.1819549

Bagdai, N., van der Molen, P., & Tuladhar, A. (2012). Does uncertainty exist where transparency is missing? Land privatisation in Mongolia. *Land Use Policy*, *29*(4), 798–804. https://doi.org/10.1016/j.landusepol.2011.12.006

Bagdai, N., van der Veen, A., van der Molen, P., & Tuladhar, A. (2009). Transparency as a Solution for Uncertainty in Land Privatization - A Pilot Study for Mongolia. *Surveyors Key Role in Accelerated Development*, *3-8 May 2009*.

Bagla, A., & Gupta, V. (2011). Information Technology and the Structuring of Organizations. *Journal of Cmmerce and Trade*, *VI*(2), 36–39.

Baker, J. (2012). The technology-organization-environment framework. *Information Systems Theory*, 231–245. https://doi.org/10.1007/978-1-4419-6108-2

Bal, M. (2017). Securing Property Rights in India through Distributed Ledger Technology. *Observer Research Foundation*.

Barbieri, M., & Gassen, D. (2017). Blockchain - can this new technology really revolutionize the land registry system? *Responsible Land Governance: Towards an Evidence Based Approach: Proceedings of the Annual World Bank Conference on Land and Property*, 1–13. http://www.forbes.com/sites/laurashin/#1143578f655d

Barnes, I., Bruce, W., & Xiao, B. (2019). Organizational Adoption of Blockchain Technology : An Ecosystem Perspective. *Diffusion Interest Group In Information Technology*.

Barry, A. S., Assoul, S., & Souissi, N. (2022). Benchmarking of digital maturity models according to the dimension component. *2022 2nd International Conference on Innovative Research in Applied Science, Engineering and Technology (IRASET), IEEE*, 1–8. https://doi.org/10.1109/IRASET52964.2022.9737781

Batubara, F. R., Ubacht, J., & Janssen, M. (2018). Challenges of Blockchain Technology Adoption for e-Government : A Systematic Literature Review. *19th Annual International Conference on Digital Government Research: Governance in the Data Age*, 1–9.

Bell, K. C. (2007). *Good Governance in Land Administration*.

Benbunan-Fich, R., & Castellanos, A. (2018). Digitalization of land records: From paper to blockchain. *International Conference on Information Systems 2018*.

Bennett, R. M., Hutabarat, I. R., Unger, E.-M., Ginting, C. P., van der Vegt, H., & Latif, A. (2023). Digital Transformation in Indonesian Land Administration Further Developments and Directions. In W. T. de Vries, I. Rudiarto, & M. N. M. . Piyasena (Eds.), *Geospatial Science For Smart Land Management. An Asian Context* (pp. 43–67). CRC Press Taylor & Francis Group.

Bennett, R., Unger, E., Verheij, V., der Vegt, H. V, Tovmasyan, S., Hutabarat, I., Gugarats, A., Latif, A., & Trdat, C. (2022). Digital Transformation of Land Administration: Stages, Status, and Solutions. *FIG Congress 2022: Volunteering for the Future - Geospatial Excellence for a Better Living*, 11–15.

Bennett, R., Wallace, J., & Williamson, I. (2005). Integrated Land Administration in Australia-The Need to Align ICT Strategies and Operations. *In Proceedings of Spatial Science Institute Conference*.

Biitir, S. B., Miller, A. W., & Musah, C. I. (2021). Land Administration Reforms : Institutional Design for Land Registration System in Ghana. *Journal of Land and Rural Studies*, *9*(1), 7–34. https://doi.org/10.1177/2321024920968326

Biitir, S. B., Nara, B. B., & Ameyaw, S. (2017). Integrating decentralised land administration systems with traditional land governance institutions in Ghana : Policy and praxis. *Land Use Policy*, *68*, 402–414. https://doi.org/10.1016/j.landusepol.2017.08.007

Biscaye, P., Callaway, K., Chen, K., Mcdonald, M., Morton, E., Reynolds, T., & Anderson, C. L. (2017). Land Tenure Technologies Summary of Services and Implementation. In *Evans School Policy Analysis and Research (EPAR)*.

Biswas, M., Faysal, J. Al, & Ahmed, K. A. (2021). LandChain : A Blockchain Based Secured Land Registration System. *International Conference on Science & Contemporary Technologies*. https://doi.org/10.1109/ICSCT53883.2021.9642505

Bludnik, I. (2022). Digitalisation as a driving force for land grabbing in the Global South. *Procedia Computer Science*, *207*, 265–271. https://doi.org/10.1016/j.procs.2022.09.059

Boamah, E. F., & Amoako, C. (2020). Planning by (mis)rule of laws: The idiom and dilemma of planning within Ghana's dual legal land systems. *Environment and Planning C: Politics and Space*, *38*(1), 97–115. https://doi.org/10.1177/2399654419855400

Boamah, N. A. (2013). *Constraints on Property Rating in the Offinso South Municipality of Ghana*. *13*, 77–89.

Boeije, H. (2002). A Purposeful Approach to the Constant Comparative Method in the Analysis of Qualitative Interviews. *Quality and Quantity*, *36*(4), 391–409.

Brandful, P., Osei, M., & Gyedu-pensang, Y. A. (2020). Urban land use planning in Ghana : Navigating complex coalescence of land ownership and administration. *Land Use Policy*, *99*(August), 105054. https://doi.org/10.1016/j.landusepol.2020.105054

Broni, F. E. J. (2019). *Blockchain Technology Readiness in Firms: Idustry Experts' Perspectives from a Developing Economy*. University of Ghana.

Brown, A. E., & Grant, G. G. (2010). Highlighting the Duality of the ICT and Development Research Agenda. *Information Technology for Development*, *16*(2), 96–111. https://doi.org/10.1080/02681101003687793

Bryman, A. (2016). *Social research methods*. Oxford University Press.

Bugri, J. T. (2012). *Final Report: Improving Land Sector Governance in Ghana. Implemetation of the Land Governance Assessment Framework*.

Chanias, S., & Hess, T. (2016). company ' s status in the digital transformation. *In Management Report / Institut Für Wirtschaftsinformatik Und Neue Medien*, 1–14.

Chavez-Dreyfuss, G. (2016). Sweden tests blockchain smart contracts for land registry. *URL: Http://Www. Coindesk. Com/Sweden-Blockchain …*.

Chekole, S. D., de Vries, W. T., & Shibeshi, G. B. (2020). An Evaluation Framework for Urban Cadastral System Policy in Ethiopia. *Land*, *9*(60).

Cheremshynskyi, M., & Byamugisha, F. F. K. (2014). Developing Land Information Systems in Sub-Saharan Africa: Experiences and Lessons from Uganda and Ghana. In *Agricultural Land Redistribution and Land Administration in Sub-Saharan Africa* (pp. 103–116).

Chhina, S., Chadhar, M., Firmin, S., & Tatnall, A. (2023). The Role of Actors in Blockchain Adoption Decisions – An Innovation Translation Perspective. *Australasian Journal of Information Studies*, *27*, 1–26.

Chigbu, U. E., Bendzko, T., Mabakeng, M. R., Kuusaana, E. D., & Tutu, D. O. (2021). Fit-for-Purpose Land Administration from Theory to Practice : Three Demonstrative Case Studies of Local Land Administration Initiatives in Africa. *Land*, *10*(5), 476.

Chigbu, U. E., de Vries, W. T., Duran, P. D., Schopf, A., & Bendzko, T. (2018). Advancing collaborative research in responsible and smart land management in and for Africa: The Adland Model. *World Bank Conference on Land and Poverty*, 19–23.

Chigbu, U. E., Schopf, A., de Vries, W. T., Masum, F., Mabikke, S., Antonio, D., & Espinoza, J. (2017). Combining land-use planning and tenure security : a tenure responsive land-use planning approach for developing countries. *Journal of Environmental Planning and Management*, *60*(9), 1622–1639. https://doi.org/10.1080/09640568.2016.1245655

Chiiweshe, M. K., Mutopo, P., Ncube, M. J., & Mutondoro, F. (2013). *An analysis of Transparency*

and Accountability in Land sector Governance in Zimbabwe. Transparency International.

Chimhowu, A. (2019). The ‘ new ’ African customary land tenure . Characteristic , features and policy implications of a new paradigm. *Land Use Policy*, *81*, 897–903. https://doi.org/10.1016/j.landusepol.2018.04.014

Chitonge, H., Mfune, O., Umar, B. B., Kajoba, G. M., Banda, D., & Ntsebeza, L. (2017). Silent privatisation of customary land in Zambia : opportunities for a few , challenges for many. *Social Dynamics*, *43*(1), 82–102. https://doi.org/10.1080/02533952.2017.1356049

Chiu, C.-Y., Chen, S., & Chen, C.-L. (2017). An Integrated Perspective of TOE Framework and Innovation Diffusion in Broadband Mobile Applications Adoption by Enterprises. *International Journal of Management, Economics and Social Sciences (IJMESS)*, *6*(1), 14–39.

Chohan, S. R., & Hu, G. (2022). Strengthening digital inclusion through e- government : cohesive ICT training programs to intensify digital competency. *Information Technology for Development*, *28*(1), 16–38. https://doi.org/10.1080/02681102.2020.1841713

Chun, S. A., Kim, D., Cho, J., Chuang, M., Shin, S., & Jun, D. (2021). Framework for Smart City Model Composition: Choice of Component Design Models and Risks. *International Journal of E-Planning Research*, *10*(3), 50–69. https://doi.org/10.4018/IJEPR.20210701.oa4

Clark, V. L. P., Schumacher, K., West, C., Edrington, J., Dunn, L. B., Harzstark, A., Melisko, M., Rabow, M. W., Swift, P. S., & Miaskowski, C. (2013). Practices for Embedding an Interpretive Qualitative Approach Within a Randomized Clinical Trial. *Journal of Mixed Methods Research*, *7*(3), 219–242. https://doi.org/10.1177/1558689812474372

Clohessy, T., & Acton, T. (2019). Investigating the influence of organizational factors on blockchain adoption An innovation theory perspective. *Industrial Management & Data Systems*. https://doi.org/10.1108/IMDS-08-2018-0365

Clohessy, T., Acton, T., & Rogers, N. (2019). Blockchain Adoption : Technological , Organisational, and Environmental Considerations. In *Business transformation through blockchain* (pp. 47–76). Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-319-98911-2

Clohessy, T., Treiblmaier, H., Acton, T., & Rogers, N. (2020). Antecedents of blockchain adoption : An integrative framework. *Strategic Change*, *29*(5), 501–515. https://doi.org/10.1002/jsc.2360

Collindres, J., Regan, M., & Panting, G. (2016). Using Blockchain to Secure Honduran Land Titles. *Fundacion Eleutra*.

Cordella, A., & Tempini, N. (2015). E - government and organizational change : reappraising the role of ICT and bureaucracy in public service delivery. *Government Information Quarterly*, *32*(3), 279–286. https://doi.org/10.1016/j.giq.2015.03.005

Creswell, J. W. (2012). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (Fourth Ed). Pearson.

Creswell, J. W. (2014). *Research Design: Qualitative, Quantitative, and Mixed Methods*

Approaches (Fourth Edi). SAGE Publications.

Creswell, J. W. (2015). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (Fifth Ed). Pearson.

Creswell, J. W., & Guetterman, T. C. (2019). *Eduacational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (Sixth Ed). Pearson.

Creswell, J. W., & Poth, C. N. (2016). Qualitative Inquiry and Research Design: Choosing Among Five Approaches. In *Sage publications* (Vol. 16, Issue 4, pp. 473–475). https://doi.org/10.1177/1524839915580941

Crosby, M., Nachiappan, Pattanayak, P., Verma, S., & Kalyanaraman, V. (2016). BlockChain Technology: Beyond Bitcoin. *Applied Innovation Review*, *2*, 5–20.

Crotty, M. J. (1998). The foundations of social research: Meaning and perspective in the research process. In *The foundations of social research* (pp. 1–256).

Daluwathumullagamage, D. J., & Sims, A. (2020). *Blockchain-Enabled Corporate Governance and Regulation*. https://doi.org/10.3390/ijfs8020036

Daniel, D., & Speranza, C. I. (2020). The Role of Blockchain in Documenting Land Users ' Rights : The Canonical Case of Farmers in the Vernacular Land Market. *Frontiers in Blockchain*, *3*. https://doi.org/10.3389/fbloc.2020.00019

Danso, H., & Manu, D. (2013). High Cost of Materials and Land Acquisition Problems in the Construction Industry in Ghana. *International Journal of Research in Engineering & Applied Sciences*, *3*(3), 18–33.

Dawidowicz, A., & Źróbek, R. (2017). Land Administration System for Sustainable Development - Case Study of Poland. *Real Estate Management and Valuation*, *25*(1), 112–122.

De Castro, P., Tanner, M., & Johnston, K. (2020). Perceived Factors Influencing Blockchain Adoption in the Asset and Wealth Management Industry in the Western Cape, South Africa. In *Evolving Perspectives on ICTs in Global Souths* (pp. 48–61).

de Vries, W. T., Bugri, J., & Mandhu, F. (2020). Advancing Responsible and Smart Land Management. In *Responsible and Smart Land Management Interventions: An African Context* (pp. 279–285). CRC Press.

Deane, G., Owen, R., & Quaye, B. A. (2017). The Ghana Enterprise Land Information System (GELIS) as a Component of National Geospatial Policy. *World Bank Conference on Land and Poverty, 2017*.

Deininger, K., & Castagnini, R. (2006). Incidence and impact of land conflict in Uganda. *Journal of Economic Behavior & Organization*, *60*(3), 321–345.

Deininger, K., Selod, H., & Burns, A. (2012). *The Land Governance Assessment Framework: Idnetifying and monitoring good practice in the land sector.* World Bank Publications.

Demah, E. (2018). Psychological and Socio-Cultural Factors Influencing Blockchain Technology Adoption in Resolving Land Insecurity in Ghana. *Scholars Journal of Arts, Humanities and Social Sciences*. https://doi.org/10.21276/sjahss.2018.6.9.4

Demuyakor, J. (2021). Ghana's Digitization Initiatives : A Survey of Citizens Perceptions on the Benefits and Challenges to the Utilization of Digital Governance Services. *International Journal of Publication and Social Studies*, *6*(1), 42–55. https://doi.org/10.18488/journal.135.2021.61.42.55

Dib, O., Brousmiche, K., Durand, A., Thea, E., & Hamida, E. Ben. (2018). Consortium Blockchains : Overview , Applications and Challenges. *International Journal on Advances in Telecommunications*, *11*(1), 51–64.

Dieterle, C. (2022). Global Governance Meets Local Land Tenure : International Codes of Conduct for Responsible Land Investments in Uganda Global Governance Meets Local Land Tenure : International Codes of Conduct for Responsible Land Investments in Uganda. *The Journal of Development Studies*, *58*(3), 582–598. https://doi.org/10.1080/00220388.2021.1983165

Djursén, L., & Björk, T. (2022). *Blockchain Adoption is an Evolution – not a Revolution : Advantages and Challenges of Blockchain in Real Estate Transaction in Sweden*. KTH Royal Institute of Technology.

Duminy, J., Odendaal, N., & Watson, V. (2014). Case Study Research in Africa: Methodological Dimensions. In *Planning and the case study method in Africa : The Planner in Dirty Shoes* (pp. 21–47). Palgrave Macmillan UK.

Dwivedi, R., Patel, S., & Shukla, S. (2023). Blockchain-Based Transferable Digital Rights of Land. *ArXiv Preprint*, *arXiv:2308.05950*.

Eder, G. (2019). Digital Transformation: Blockchain and Land Titles. *OECD Global Anti-Corruption & Intergrity Forum, Paris, France*, 20–21.

Edrees, Z. (2019). An Overview of Blockchain Technology in Government Sectors Use Cases, Benefits and Challenges. *Global Scientific Journals*, *7*(11). www.globalscientificjournal.com

Ehwi, R. J., & Asante, L. A. (2016). Ex-Post Analysis of Land Title Registration in Ghana Since 2008 Merger: Accra Lands Commission in Perspective. *SAGE Open*, *6*(2). https://doi.org/10.1177/2158244016643351

Ehwi, R. J., & Mawuli, D. A. (2021). 'Landguardism' in Ghana: Examining public perceptions about the driving factors. *Land Use Policy*, *109*, 105630. https://doi.org/10.1016/j.landusepol.2021.105630

Ekemode, B. G., Olapade, D., & Shiyanbola, E. (2019). Resolving the Land Title Registration Debacle : The Blockchain Technology Option. *Environmental Design and Management Internation Conference*, 739–747.

Elong, S., Muhwezi, L., & Acai, J. (2019). Assessment of the Challenges and Effects of Delays in Compulsory Land Acquisition on the Performance of Road Construction Projects in Uganda. *International Journal of Scientific and Engineering Research*, *10*(9).

Enemark, S. (2004). Building land information policies. *Special Forum on Building Land Information Policies in the Americas, Aguascalientes, Mexico, 26 October*.

Enemark, S. (2005). Understanding the Land Management Paradigm. *In Proceedings of the FIG*

Commission 7, Symposium on Innovative Technologies for Land Administration, 19-25 June.

Enemark, S., McLaren, R., & Lemmen, C. (2016). *Fit-For-Purpose Land Administration Guiding Principles for Country Implementation*. UN-Habitat, Global Land Tool Network.

Enemark, S., Williamson, I., & Wallace, J. (2005). Building Modern Land Administration Systems in. *Spatial Science*, *50*(2), 51–68.

Fateye, T. B., Ibuoye, A. A., Wahab, B. M., & Odunfa, V. O. (2020). *Technological Innovations in Land Administration System (LAS): Concern on Level of Awareness in Nigeria*.

Fateye, T. B., Ibuoye, A. A., Wahab, B. M., & Odunfa, V. O. (2021). *Technological Innovations in Land Administration System (LAS): Concern on International Journal of Real Estate Studies INTREST Technological Innovations in Land Administration System (LAS): Concern on Level of Awareness in Nigeria*. *January*.

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, *12*(2), 219–245. https://doi.org/10.1177/1077800405284363

Forkuo, E. K., & Asiedu, S. B. (2009). Developing a One Stop Shop Model for Integrated Land Information Management. *Journal of Sciencen and Technology*, *29*(3), 114–125.

Forkuor, D., Kyei, P. O., & Wusu-adjei, P. O. (2013). Enhancing land administration in Ghana through the decentralized local government system. *International Society for Development and Sustainability (ISDS)*, *2*(2), 1127–1141.

Fuseini, I., & Kemp, J. (2015). A review of spatial planning in Ghana ' s socio-economic development trajectory : A sustainable development perspective. *Land Use Policy*, *47*, 309–320. https://doi.org/10.1016/j.landusepol.2015.04.020

Fusilier, M., & Durlabhji, S. (2001). Cultural Values of Indian Managers : An Exploration through Unstructured Interviews. *International Journal of Value-Based Management*, *14*(3), 223–236.

Gale, N. k., Heath, G., Cameron, E., Sabina, R., & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMS Medical Research Methodology*, *4*, 1–8.

Gavu, E. K. (2020). *Understanding location and neighbourhood effects : An analysis of the housing submarkets in Accra – Ghana*.

Gebrihet, H. G., & Pillay, P. (2021). Emerging Challenges and Prospects of Digital Transformation and Stakeholders Integration in Urban Land Administration in Ethiopia. *Global Journal of Emerging Market Economies*, *13*(3), 341–356. https://doi.org/10.1177/09749101211034097

Ghana Statistical Service. (2013). *Population & housing census*.

Ghana Statistical Service. (2021). *Population and Housing Census*.

Gillpatrick, T., Boğa, S., & Aldanmaz, O. (2022). How Can Blockchain Contribute to Developing Country Economies? A Literature Review on Application Areas. *Economics-Innovative and Research Journal*, *10*(1), 105–128. https://doi.org/10.2478/eoik-2022-0009

Gobal Land Tool Network. (2015). *Land Tenure Security in Selected Countries: Global Report* (Issue December).

Göbel, J., Keeler, H. ., Krzesinski, A. ., & Taylor, P. . (2016). Bitcoin Blockchain Dynamics : the Selfish-Mine Strategy in the Presence of Propagation Delay. *Performance Evaluation*, *104*, 23–41.

Goderdzishvili, N., Gordadze, E., & Gagnidze, N. (2018). Georgia's blockchain-powered property registration: Never blocked, always secured - Ownership data kept best! *In Proceedings of the 11th International on Theory and Practice of Electronic Governance*, 673–675. https://doi.org/10.1145/3209415.3209437

Government of Ghana. (1993). *Constitution of the Fourth Republic of Ghana*.

National Land Policy, (1999).

Lands Commission Act, 2008 (Act 767), (2008).

Government of Ghana. (2016a). *Land Use and Spatial Planning Act, 2016. Act 925*.

Government of Ghana. (2016b). *Local Government Act , 2016. Act 936*.

Land Act,2020. Act 1036, (2020).

Greiner, C. (2017). Pastoralism and Land-Tenure Change in Kenya : The Failure of Customary Institutions. *Development and Change*, *48*(1), 78–97. https://doi.org/10.1111/dech.12284

Gyamera, E. (2018). Land Acquisition in Ghana; Dealing with the Challenges and the Way Forward. *Journal of Agricultural Economics*, *6*(1), 664–672.

Habib, G., Sharma, S., Ibrahim, S., Ahmad, I., Qureshi, S., & Ishfaq, M. (2022). Blockchain Technology: Benefits, Challenges, Applications, and Integration of Blockchain Technology with Cloud Computing. *Future Internet*, *14*(11), 1–22. https://doi.org/10.3390/fi14110341

Habib, M. N., & Shah, A. (2013). Business Process Reengineering : Literature Review of Approaches and Applications. *In Proceedings of 3rd Asia-Pacific Business Research Conference*, 25–26.

Hancock, D. R., & Algozzine, B. (2006). *Doing case study research: A practical guide to begining researchers*. Teachers College Press.

Heeks, R., & Stanforth, C. (2015). Technological change in developing countries: Opening the black box of process using actor-network theory. *Development Studies Research*, *2*(1), 33–50. https://doi.org/10.1080/21665095.2015.1026610

Henry, S. G., & Fetters, M. D. (2012). Video elicitation interviews: A qualitative research method for investigating physician-patient interactions. *Annals of Family Medicine*, *10*(2), 118–125. https://doi.org/10.1370/afm.1339

Hughes, A. K., Nishimwe, M. G., Rutabayiro, S. N., Mizero, R., Akumuntu, A., Muyombano, S., Jones, J., Mcgowan, K., & Tagliarino, N. (2022). Harnessing Technology to Advance Citizen-Centric Land Administration in Rwanda. *African Journal Ofn Land Policy and Geospatial Sciences*, *5*(2).

Humdullah, S., Othman, S. H., Razali, M. N., Mammi, H. K., & Javed, R. (2021). An Improved Blockchain Technique for Secure Land Registration Data Records. *International Journal of Innovative Computing*. https://doi.org/10.11113/ijic.v11n2.291

Hunt, D. (2004). Unintended Consequences of Land Rights Reform : The Case of the 1998 Uganda Land Act. *Development Policy Review*, *22*(2), 173–191.

Ibrahim, I., Daud, D., Azmi, F. A. M., Noor, N. A. M., & Yusoff, N. S. M. (2021). Improvement Of Land Administration System In Nigeria : A Blockchain Technology Review . *International Journal of Scientific & Technology Research*, *10*(8).

Jaitner, A., Caldeira, R., & Koynova, S. (2017). Transparency International - Land Corruption in Africa Finding Evidence, Triggering Change. *Working Paper Presented at the 2017 Annual World Bank Conference on Land and Poverty*, *20-24 Marc*.

Janssen, M., Weerakkody, V., Ismagilova, E., Sivarajah, U., & Irani, Z. (2020). A framework for analysing blockchain technology adoption: Integrating institutional, market and technical factors. *International Journal of Information Management*, *50*, 302–309. https://doi.org/10.1016/j.ijinfomgt.2019.08.012

JLD & MB Legal Consultancy. (2021). *Land Act, 2020 (Act 1036)*.

Joannides, R. (2023). *Towards Improved Land Administration Services: A Model to Support Spatial Data Interoperability Among Land Agencies in Accra, Ghana*. University of Twente.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, *33*(7), 14–26.

Junaid, L., Bilal, K., Khalid, O., & Erbad, A. (2023). Blockchain-Enabled land management systems. *Telecommunication Systems*, *84*(3), 421–442. https://doi.org/10.1007/s11235-023-01032-2

Kaczorowska, M. (2019). Blockchain-based land registration: Possibilities and challenges. *Masaryk University Journal of Law and Technology*, *13*(2), 339–360. https://doi.org/10.5817/MUJLT2019-2-8

Karamitsos, I., Papadaki, M., & Barghuthi, N. B. Al. (2018). Design of the Blockchain Smart Contract: A Use Case for Real Estate. *Journal of Information Security*, *4*, 177–190. https://doi.org/10.4236/jis.2018.93013

Karikari, I. B., Stillwell, J., & Carver, S. (2002). *GIS Application to Support Land Administration Services in Ghana : Institutional Factors and Software Developments*.

Karikari, I., & Stillwell, J. (2004). The implementation of geographical information systems for land administration in Ghana. *International Development Planning Review*, *26*(2), 209–229. https://doi.org/10.3828/idpr.26.2.5

Karikari, I., & Stillwell, J. (2005). *Applying Cost / Benefit Analysis to Evaluate Investment in GIS : The Case of Ghana ' s Lands Commission Secretariat , Accra*. *9*(October 2004), 489–505.

Karikari, I., Stillwell, J., & Carver, S. (2003). Land administration and GIS: The case of Ghana. *Progress in Development Studies*, *3*(3), 223–242.

https://doi.org/10.1191/1464993403ps050ra

Keilitz, I., & Wiipongwii, T. (2017). Blockchain and international development: Can blockchain technology be the solution to effective land registration systems in developing nations? *Wm. & Mary Pol'y Rev.*, *9*, 52.

Khalid, M. I., Iqbal, J., Alturki, A., Hussain, S., Alabrah, A., & Ullah, S. S. (2022). Blockchain-Based Land Registration System : A Conceptual Framework. *Applied Bionics and Biomechanics*.

Khan, R., Ansari, S., Jain, S., & Sachdeva, S. (2020). Blockchain based land registry system using Ethereum Blockchain. *Researchgate.Net*, *XII*(April), 3640–3648. https://www.researchgate.net/profile/Rizwan_Khan12/publication/340830321_Blockchain_based_land_registry_system_using_Ethereum_Blockchain/links/5ea02a3a92851ca3eb52b500/Blockchain-based-land-registry-system-using-Ethereum-Blockchain.pdf

Khan, S., Shael, M., Majdalawieh, M., Nizamuddin, N., & Nicho, M. (2022). Blockchain for Governments: The Case of the Dubai Government. *Sustainability*, *14*(11), 6576. https://doi.org/10.3390/su14116576

Kleemann, J., Inkoom, N. J., Thiel, M., Shankar, S., Lautenbach, S., & Fürst, C. (2017). Peri-urban land use pattern and its relation to land use planning in Ghana, West Africa. *Landscape and Urban Planning*, *165*, 280–294. https://doi.org/10.1016/j.landurbplan.2017.02.004

Konashevych, O. (2021). "GoLand Registry" Case Study: Blockchain/DLT Adoption in Land Administration in Afghanistan. *ACM International Conference Proceeding Series*, 489–494. https://doi.org/10.1145/3463677.3463720

Koster, F., & Borgman, H. P. (2020). New Kid On The Block ! Understanding Blockchain Adoption in the Public Sector. *53rd Hawaii International Conference on System Science | 2020*, *3*, 1770–1779.

Kouhizadeh, M., Saberi, S., & Sarkis, J. (2020). Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers. *International Journal of Production Economics*, *231*(107831). https://doi.org/10.1016/j.ijpe.2020.107831

Krigsholm, P., Ridanpää, K., & Riekkinen, K. (2019). Blockchain as a Technological Solution in Land Administration-What are Current Barriers to Implementation? *Geospatial Information for a Smarter Life and Environmental Resilience*, 22–26. https://doi.org/ISSN: 0973-2136

Krishnapriya, S., & Sarath, G. (2020). Securing Land Land Registration Registration using Blockchain. *Procedia Computer Science*, *4*, 1708–1715. https://doi.org/10.1016/j.procs.2020.04.183

Kusmiarto, K., Aditya, T., Djurdjani, D., & Subaryono, S. (2021). Digital Transformation of Land Services in Indonesia : A Readiness Assessment. *Land*, *10*(120).

Kuusaana, E. D. (2015). Property rating potentials and hurdles: what can be done to boost property rating in Ghana? *Commonwealth Journal of Local Governance*, *June*, 204–223. https://doi.org/10.5130/cjlg.v0i0.4495

Kuusaana, E. D., & Eledi, J. A. (2015). Customary land allocation , urbanization and land use

planning in Ghana : Implications for food systems in the Wa Municipality. *Land Use Policy*, *48*, 454–466. https://doi.org/10.1016/j.landusepol.2015.06.030

Kuusisto, O., Kääriäinen, J., Hänninen, K., & Saarela, M. (2021). Towards a Micro-enterprise – focused Digital Maturity Framework. *International Journal of Innovation in Digital Economy (IJIDE)*, *12*(1), 72–85.

Kwofie, T. E., & Afranie, I. (2013). Land Acquisition Challenges for Urban Housing Development in Ghana. *6th Annual Applied Research Conference by Koforidua Polytechnic*, 2–5.

Land Equity International. (2020). *Land Administration Information and Transaction Systems: State of Practice and Decision Tools for Futre Investment*.

Kenyan National Land Policy, (2009).

Lazuashvili, N., Norta, A., & Draheim, D. (2019). Integration of Blockchain Technology into a Land Registration System for Immutable Traceability: A Casestudy of Georgia. In *In International Conference on Business Process Management* (Vol. 361, pp. 219–233). https://doi.org/10.1007/978-3-030-30429-4_15

Leedy, P. D., & Ormrod, J. E. (2014). *Practical Research: Planning and Design*. Pearson education.

Lemieux, V. L. (2017a). A Typology of Blockchain Recordkeeping Solutions and Some Reflections on their Implications for the Future of Archival Preservation. *2017 IEEE International Conference on Big Data (BIGDATA) A*, *1*, 2271–2278.

Lemieux, V. L. (2017b). Evaluating the Use of Blockchain in Land Transactions : An Archival Science Perspective. *European Property Law Journal*, *6*(3), 392–440.

Lemmen, C. (2020). *BENEFITING FROM TECHNOLOGICAL INNOVATIONS ICT and Land Administration*. *July 2006*.

Lemmen, C., Vos, J., & Beentjes, B. (2017). Ongoing Development of Land Administration Standards: Blockchain in Transaction Management. *European Property Law Journal*, *6*(3), 478–502. https://doi.org/10.1515/eplj-2017-0016

Leung, D., Lo, A., Fong, L. H. N., & Law, R. (2015). Applying the technology-organization-environment framework to explore ICT initial and continued adoption: An exploratory study of an independent hotel in Hong Kong. *Tourism Recreation Research*, *40*(3), 391–406. https://doi.org/10.1080/02508281.2015.1090152

Levack, W. M. M. (2012). The role of qualitative metasynthesis in evidence-based physical therapy. *Physical Therapy Reviews*, *4*, 390–397. https://doi.org/10.1179/1743288X12Y.0000000020

Levaniuk, D. ., Bolsunovskaya, M. ., Shirokova, S. ., & Gintciak, A. . (2020). Assessment of digital maturity of enterprises. *IOP Conference Series: Materials Science and Engineering*. https://doi.org/10.1088/1757-899X/986/1/012019

Locke, A., & Henley, G. (2013). The possible shape of a land transparency initiative: lessons from other transparency initiatives. In *The Possible Shape of a Land Transparency Initiative:*

Lessons from Other Transparency Initiatives. http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20133405582&site=ehost-live%5Cnhttp://www.odi.org.uk/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8599.pdf%5Cnemail: a.locke@odi.org.uk

Lü, D., Gao, G., Lü, Y., Xiao, F., & Fu, B. (2019). Detailed land use transition quanti fi cation matters for smart land management in drylands : An in-depth analysis in Northwest China. *Land Use Policy*, *90*, 104356. https://doi.org/10.1016/j.landusepol.2019.104356

Mabe, F. N., Nashiru, S., Mummuni, E., & Boateng, V. F. (2019). The nexus between land acquisition and household livelihoods in the Northern region of Ghana. *Land Use Policy*, *85*, 357–367. https://doi.org/10.1016/j.landusepol.2019.03.043

Mabe, J. B., & Kuusaana, E. D. (2016). Property taxation and its revenue utilisation for urban infrastructure and services in Ghana : Evidence from Sekondi-Takoradi metropolis. *Property Management*, *34*(4), 297–315. https://doi.org/10.1108/PM-07-2015-0033

Maha-Atma, S. P. (2014). *Customary Land Tenure Practices and Land Markets in Ghana: A Case Study of Odupong Ofaakor*. Kwame Nkrumah University of Science and Technology.

Mahraz, M.-I., Benabbou, L., & Berrado, A. (2019). A systematic literature review of digital transformation. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 917–931.

Makala, B., & Anand, A. (2018). Blockchain and Land Administration. *UNOPS*, 1–34.

Mantey, S., & Tagoe, N. D. (2012). Geo-Property Tax Information System- A Case Study of the Tarkwa Geo-Property Tax Information System- A Case Study of the Tarkwa Nsuaem Municipality , Ghana. *In Proceedings of the FIG Working Week*, *6-10 May*, 6–10. https://www.fig.net/resources/proceedings/fig_proceedings/fig2012/papers/ts05g/TS05G_mantey_tagoe_5882.pdf

Mark, R., Pickering, M., Sargent, J., Bennett, R. M., Pickering, M., & Sargent, J. (2019). Transformations, transitions, or tall tales? A global review of the uptake and impact of NoSQL, blockchain, and big data analytics on the land administration sector. *Land Use Policy*, *83*(February), 435–448. https://doi.org/10.1016/j.landusepol.2019.02.016

Martens, D. M. (2014). *Research and Evaluation in Education and Psychology* (Fourth Ed).

Mcbride, N. (2003). Actor-Network Theory and the Adoption of Mobile Communications. *Geography*, 266–276.

Mccallin, A. M. (2003). Designing a grounded theory study : some practicalities. *Nursing in Critical Care*, *8*(5), 203–208.

Mclaren, R., & Stanley, V. (2017). ICT for Land Administration and Management. In *ICT in Agriculture: Connecting Smallholders to Knowledge, Networks, and Institutions* (pp. 343–372). The World Bank. https://doi.org/10.1596/978-1-4648-1002-2

Mcmurren, J., Young, A., & Verhulst, S. (2018). Addressing Transaction Costs Through Blockchain and Identity in Swedish Land Transfers. *Blockchain Technologies for Social Change, GovLab*.

Mcphee, R. D., Poole, M. S., & Iverson, J. (2020). Structuration Theory. In 3rd ed (Ed.), *The SAGE Handbook of Organizational Communication* (pp. 75–100). SAGE.

Merriam, S. B., & Tisdell, E. J. (2015). *Qualitative research: A guide to design and implementation* (Fourth Ed.). John Wiley & Sons.

Mettler, T. (2011). Maturity assessment models : a design science research approach. *International Journal of Society Systems Science*, *3*(1–2), 81–98.

Tanzania National Land Policy, (1997).

Republic of Rwanda, National Land Policy, (2004).

Uganda National Land Policy, (2013).

Mintah, K., Baako, K. T., Kavaarpuo, G., & Otchere, G. K. (2020). Skin lands in Ghana and application of blockchain technology for acquisition and title registration. *Journal of Property, Planning and Environmental Law*, *12*(2), 147–169. https://doi.org/10.1108/JPPEL-12-2019-0062

Mintah, K., Godwin, F., Tetteh, K., Gaisie, E., & Kwame, G. (2021). Blockchain on stool land acquisition : Lessons from Ghana for strengthening land tenure security other than titling. *Land Use Policy*, *109*, 105635. https://doi.org/10.1016/j.landusepol.2021.105635

Mireku, K. O., Kuusaana, D. E., & Kidido, K. J. (2016). Legal implications of allocation papers in land transactions in Ghana — A case study of the Kumasi traditional area. *Land Use Policy*, *50*, 148–155.

Miscione, G., Richter, C., & Ziolkowski, R. (2020). Authenticating Deeds/ Organizing Society Considerations for Blockchain- Based Land Registries. In *Responsible and Smart Land Management Interventions: An African Context* (pp. 133–147). CRC Press.

Mitchell, R. K., Agle, B. R., & Wood, D. J. (1997). Toward a Theory of Stakeholder Identification and Salience: Defining the Principle of Who and What Really Counts. *Academy of Management Review*, *22*(4), 853–886.

Moeller, G. H., Mescher, M. A., More, T. A., & Shafer, E. L. (2018). The Informal Interview as a Technique for Recreation Research. *Journal of Leisure Research*, *12*(2). https://doi.org/10.1080/00222216.1980.11969436

Mohajan, H. K. (2018). Qualitative Research Methodology in Social Sciences and Related Subjects. *Journal of Economic Development, Environment and People*, *7*(1), 28–28.

Mohammed, A., Potdar, V., & Yang, L. (2020). Key Factors Affecting Blockchain Adoption in Organizations. In *Big Data and Security* (Vol. 1). Springer Singapore. https://doi.org/10.1007/978-981-15-7530-3

Mueller, A. E., & Segal, D. L. (2014). Structured versus Semistructured versus Unstructured Interviews. *The Encyclopedia of Clinical Psychology*, 1–7. https://doi.org/10.1002/9781118625392.wbecp069

Mukne, H., Pai, P., Raut, S., & Ambawade, D. (2019). Land Record Management using Hyperledger Fabric and IPFS. *2019 10th International Conference on Computing,*

Communication and Network Technologies (ICCCNT).

Müller, H., & Seifert, M. (2019). Blockchain , a Feasible Technology for Land Administration? *FIG Working Week 2019*, *22-24 April*.

Nagpur, M., Nagpur, M., & Nagpur, M. (2024). Blockchain in Land Registry forTransorming Land Administration. *Journal of Theoretical and Applied Information Technology*, *102*(3), 1014–1022.

Nakamoto, S. (2008). *Bitcoin: A Peer-to-Peer Electronic Cash System*. https://doi.org/10.1108/TG-06-2020-0114

Nara, B. B., Mwingyine, D. T., Boamah, N. A., & Biitir, S. B. (2014). Enhancing Efficiency in Land Management through the Customary Land Secretariats (CLSs) in Upper West Region, Ghana. *Developing Country Studies*, *4*(1), 24–31.

Natarajan, H., Krause, S. K., & Gradstein, H. L. (2019). Distributed Ledger Technology (DLT) and Blockchain. *Fin Tec Note; No. 1*.

Ngoga, T. H. (2019). A quick , cost-effective approach to land tenure regularisation : the case of Rwanda. In *International Growth Centre*.

Niloy, F. A., Dowla, N. U., Alam, S., Hossain, J., Muntasir, F., Hossain, S., & Hasan, M. (2021). LANDCHAIN: A Blockchain-Based Lightweight Land Administration System for Bangladesh. *Proceedings of International Conference on Fourth Industrial Revolution and Beyond*, 345–356.

Njoroge, T. G. (2019). *Use of Blockchain to Digitize Land Records and Track Land Transfer Transactions in Kenya*. University of Nairobi.

Nkurunziza, E. (2007). Informal mechanisms for accessing and securing urban land rights : the case of Kampala , Uganda. *Environmental and Urbanization*, *19*(2), 509–526. https://doi.org/10.1177/0956247807082833

Ntihinyurwa, P. D., & de Vries, W. T. (2020a). Farmland fragmentation and defragmentation nexus : Scoping the causes , impacts , and the conditions determining its management decisions. *Ecological Indicators*, *119*, 106828. https://doi.org/10.1016/j.ecolind.2020.106828

Ntihinyurwa, P. D., & de Vries, W. T. (2020b). Farmland fragmentation concourse : Analysis of scenarios and research gaps. *Land Use Policy*, *100*, 104936. https://doi.org/10.1016/j.landusepol.2020.104936

Nwuba, C. C., & Nuhu, S. R. (2018). Challenges to Land Registration in Kaduna State , Nigeria. *Journal of African Real Estate*, *3*(1), 141–172. https://doi.org/10.15641/jarer.v1i1.566.Abstract

Obeng-odoom, F. (2013). Urban Land Policies in Ghana : A Case of the Emperor ' s New Clothes? *The Review of Black Political Economy*, *41*(2), 119–143. https://doi.org/10.1007/s12114-013-9175-5

Obeng-odoom, F. (2014). Urban property taxation , revenue generation and redistribution in a

frontier oil city. *Cities*, *4*, 58–64. https://doi.org/10.1016/j.cities.2013.10.003

Obeng-odoom, F. (2016). Understanding Land Reform in Ghana : A Critical Postcolonial Institutional Approach. *Review of Radical Political Economics*, *48*(4), 661–680. https://doi.org/10.1177/0486613415603161

Oberdorf, V. (2017). Building Blocks for land administration: The potential impact of Blockchain-based land administration platforms in Ghana. In *MSc. Thesis*. Utrecht University.

Ogwang, T., & Vanclay, F. (2019). Social Impacts of Land Acquisition for Oil and Gas Development in Uganda. *Land*, *8*(7), 109.

Okembo, C., Lemmen, C., Kuria, D., & Zevenbergen, J. (2022). Developing an adapted land administration domain model profile for Kenya. *Land Use Policy*, *117*(September 2021), 106087. https://doi.org/10.1016/j.landusepol.2022.106087

Okyere, M., & Bedu, V. (2022). Customary land administration in Ghana ; the challenges of Bolgatanga Customary Land Secretariat. *African Geographical Review*, *00*(00), 1–10. https://doi.org/10.1080/19376812.2022.2152844

Ølnes, S., Ubacht, J., & Janssen, M. (2017). Blockchain in government : Benefits and implications of distributed ledger technology for information sharing. *Government Information Quarterly*, *34*(3), 355–364. https://doi.org/10.1016/j.giq.2017.09.007

Ooi, V., SOH, K. P., & SOH, J. (2022). Blockchain land transfers : Technology , promises , and perils. *Computer Law & Security Review*, *45*, 105672.

Orji, I. J., Kusi-sarpong, S., Huang, S., & Vazquez-brust, D. (2020). Evaluating the factors that influence blockchain adoption in the freight logistics industry. *Transportation Research Part E: Logistics and Transportation Review*, *141*, 102025. https://doi.org/10.1016/j.tre.2020.102025

Owusu, G. (2004). Small towns and decentralized development in Ghana : theory and practice. *Africa Spectrum*, 165–195.

Paaga, D. T., & Dandeebo, G. (2013). Customary Land Tenure and Its Implications for Land Disputes in Ghana : Cases from Wa , Wechau And Lambussie. *International Journal of Humanities and Social Science*, *3*(18), 263–270.

Patten, M. L. (2013). *Understanding Research Methods* (Fifth Ed).

Peiró, N. N., & García, E. J. M. (2017). Blockchain and Land Registration Systems. *European Property Law Journal*, *6*(3), 296–320.

Perera, S., Nanayakkara, S., Rodrigo, M. N. N., Senaratne, S., & Weinand, R. (2020). Blockchain technology: Is it hype or real in the construction industry? *Journal of Industrial Information Integration*, *17*. https://doi.org/10.1016/j.jii.2020.100125

Petio, M. K. (2013). Role of the Land Valuation Division in Property Rating by District Assemblies in Ghana's Upper East Region. *Commonwealth Journal of Local Governance*, *12*, 69–89.

Petkova, P., & Jekov, B. (2018). Blockchain in e-Governance. *In Selected and Extended Papers*

from X-Th International Scientific Conference 'E-Governance and e-Communication, 149.

Phadermrod, B., Crowder, R. M., & Wills, G. B. (2016). Importance-Performance Analysis based SWOT analysis. *International Journal of Information Management*, 1–10. https://doi.org/10.1016/j.ijinfomgt.2016.03.009

Phuong, T. H. (2012). Enhancing Transparency in Land Transaction Process by Reference Architecture for Workflow Management System. *In Proceedings of the PACIS, Ho Chi Minh City, Vietnam*, 69.

Pirola, F., Cimini, C., & Pinto, R. (2018). Digital readiness assessment of Italian SMEs : a case-study. *Journal of Manufacturing Technology Management*. https://doi.org/10.1108/JMTM-09-2018-0305

Pirotti, A., & Roknifard, A. (2020). Trustless Technology within Trust-Based Systems ; A Comparative Study of the Big Four 's Approach to Blockchain Adoption and its Future Prospects. *Macrothink Institute, Business Management and Strategy*, *11*(1). https://doi.org/10.5296/bms.v11i1.17095

Quaye, B. A. (2014). *Formal and Informal Land Institutions , Land Information Deficiencies , and the Development of Urban Land Markets in Ghana*. University of Otago, Dunedin, New Zealand.

Quaye, B. A. (2021). Impacts of Socio-political Organisational Structures Underpinning Indigenous Land Tenure Systems: Evidence from Ghana. *African Journal Ofn Land Policy and Geospatial Sciences*, *4*(4).

Qureshi, S. (2023). Digital transformation for development : a human capital key or system of oppression ? *Information Technology for Development*, *29*(4), 423–434. https://doi.org/10.1080/02681102.2023.2282269

Ramya, U. M., Sindhuja, P., Atsaya, R. A., & Dharani, B. B. (2019). *Reducing Forgery in Land Registry System Using Blockchain Technology*. Springer Singapore. https://doi.org/10.1007/978-981-13-3140-4

Reddick, C. G., Cid, P. G., & Ganapati, S. (2019). Determinants of blockchain adoption in the public sector : An empirical examination. *Information Policy*, *24*(4), 379–396. https://doi.org/10.3233/IP-190150

Remane, G., Hanelt, A., Wiesboeck, F., & Kolbe, L. M. (2017). Digital Maturity in Traditional Industries – An Exploratory Analysis. In *In ECIS* (p. 10).

Ritchie, B. W., Burns, P., & Palmer, C. A. (2005). *Tourism Research Methods. Integrating Theory with Practice*. Cabi.

Rizal Batubara, F., Ubacht, J., & Janssen, M. (2019). Unraveling transparency and accountability in blockchain. *20th Annual International Conference on Digital Government Research, 18-20 Ju*, 204–213. https://doi.org/10.1145/3325112.3325262

Rodima-Taylor, D. (2021). Digitalizing land administration: The geographies and temporalities of infrastructural promise. *Geoforum*, *122*(August 2020), 140–151. https://doi.org/10.1016/j.geoforum.2021.04.003

Rossmann, A. (2018). Digital Maturity : Conceptualization and Measurement Model. *Thirty Ninth International Conference on Information Systems*.

Sahoo, S., Jha, S., Sarkar, S., & Halder, R. (2022). BLRS: An Automated Land Records Management System Using Blockchain Technology. *Applied Computing for Software and Smart Systems*, 113–130.

Salmeling, M., & Fransson, C. (2017). *The Land Registry in the blockchain - testbed. A development project with Lantmäteriet, Landshypotek Bank, SBAB, Telia company, ChromaWay and Kairos Future*. https://doi.org/10.1016/s1569-9056(18)31707-x

Sanka, A. I., Irfan, M., Huang, I., & Cheung, R. C. C. (2021). A survey of breakthrough in blockchain technology: Adoptions, applications, challenges and future research. *Computer Communications*, *169*, 179–201. https://doi.org/10.1016/j.comcom.2020.12.028

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students* (fifth ed). Pearson education.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research methods for business students* (Seventh Ed). Pearson education.

Saunders, M. N., Lewis, P., Thornhill, A., & Bristow, A. (2015). Understanding research philosophy and approaches to theory development. In *Research methods for business students* (Seventh Ed, pp. 122–161). https://www.researchgate.net/publication/309102603_Understanding_research_philosophies_and_approaches

Schinckus, C. (2020). The good, the bad and the ugly: An overview of the sustainability of blockchain technology. *Energy Research and Social Science*, *69*(May), 101614. https://doi.org/10.1016/j.erss.2020.101614

Schuetz, S., & Venkatesh, V. (2019). Blockchain, adoption, and financial inclusion in India: Research opportunities. *International Journal of Information Management*, *52*, 101936. https://doi.org/10.1016/j.ijinfomgt.2019.04.009

Security and Exchange Commission Ghana. (2019). *Public Warning on Investment and Trading in Crypto-Currencies and their Digital Platforms*.

Selase, A. E., & Jiang, L. F. (2015). Land Tenure System in the Pre-Colonial Era . Ghana as the Insight. *International Journal of African and Asian Studies*, *14*.

Seun, O. A., Khodadadi, T., & Palaniappan, S. (2020). Blockchain Technology for Managing land Titles in Nigeria. *International Journal of Advanced Trends in Computer Science and Engineering*.

Shahriyer, M. M., & Monim, M. (2019). *Blockchain based Land Registry with Delegated Proof of Stake (DPoS) Consensus in Bangladesh* [BRAC University]. https://doi.org/10.1109/TENSYMP50017.2020.9230612

Shang, Q., & Price, A. (2019). A Blockchain-Based Land Titling Project in the Republic of Georgia: Rebuilding Public Trust and Lessons for Future Pilot Projects. *Innovations: Technology, Governance, Globalization*, *12*(3–4), 72–78.

https://doi.org/10.1162/inov_a_00276

Shapiro, E., Mackmin, D., & Sams, G. (2012). *Modern Methods of Valuation*. Taylor & Francis.

Showaiter, A. (2018). *Assessment of Land Administration System : A Case Study of the Survey and Land Registration Bureau in Bahrain*.

Shuaib, M., Daud, S. M., Alam, S., & Khan, W. Z. (2020). Blockchain-based framework for secure and reliable land registry system. *Telkomnika*, 2560–2571. https://doi.org/10.12928/Telekominika.v18i5.15787

Sifuna, N. (2009). Public regulation of the use of private land: opportunities and challenges in kenya. *Law Env't & Dev*, *5*(38).

Siiba, A., Adjei, E., & Brandful, P. (2017). Chieftaincy and sustainable urban land use planning in Yendi , Ghana : Towards congruence. *Cities*, *October*, 0–1. https://doi.org/10.1016/j.cities.2017.10.015

Silva, L. (2007). Institutionalization does not occur by decree : Institutional obstacles in implementing a land administration system in a developing country. *Information Technology for Development*, *13*(1), 27–48.

Singeh, F. W., Abrizah, A., & Kiran, K. (2020). Bringing the digital library success factors into the realm of the technology-organization-environment framework. *Electronic Library*, *38*(3), 659–675. https://doi.org/10.1108/EL-08-2019-0187

Singh, H., Gupta, H., Singh, A., & Litoria, P. K. (2018). Applications of Blockchain for Land Record Management. *National Conference on Role of Geospatial Technologies to Bridge the Rural and Uraban Divide*, *22-23 February*.

Siriba, D. N., & Dalyot, S. (2017). Adoption of volunteered geographic information into the formal land administration system in Kenya. *Land Use Policy*, *63*, 279–287. https://doi.org/10.1016/j.landusepol.2017.01.036

Sittie, R. (2006). Land Title Registration . The Ghanaian Experience. *In 23rd FIG Congress, Munich, Germany*.

Slabá, M. (2018). Stakeholder Salience Theory in Management of Small and Medium Enterprises. *The 12th International Days of Statistics and Economics. Prague*, 6–8.

Sladi´c, G., Milosavljevi´c, B., Nikoli´c, S., Sladi´c, D., & Radulovi´c, A. (2021). A Blockchain Solution for Securing Real Property Transactions : A Case Study for Serbia. *ISPRS International Journal of Geo-Information*, *10*(1), 35.

Smidt, H. J., & Jokonya, O. (2022). Factors affecting digital technology adoption by small-scale farmers in agriculture value chains (AVCs) in South Africa. *Information Technology for Development*, *28*(3), 558–584. https://doi.org/10.1080/02681102.2021.1975256

Snyder, H. (2019). Literature review as a research methodology : An overview and guidelines. *Journal of Business Research*, *104*(August), 333–339. https://doi.org/10.1016/j.jbusres.2019.07.039

Spielman, A. (2016). *Blockchain: Digitally Rebuilding the Real Estate Industry*. Massachusetts

Institute of Technology.

Stahl, J., Sikor, T., & Dorondel, S. (2008). Transparency in Albanian and Romanian Land Administration. *Paper Forthcoming in the Next Issue of Cahiers Options Méditerranéennes Entitled "La Question Foncière Dans Les Balkans*.

Stefanović, M., Pržulj, Đ., Ristić, S., Stefanović, D., & Vukmanović, M. (2018). Blockchain and Land Administration: Possible Applications and Limitations. *Proceedings of the 5th International Scientific Conference on Contemporary Issues in Economics, Business and Management*.

Steudler, D. (2004). *A Framework for the Evaluation of Land Administration Systems*. University of Melbourne.

Sullivan, T., Solovov, A., Mushaija, G., Msigwa, M., & Issa, M. (2019). An Innovative, Affordable, and Decentralized Model for Land Registration and Administration at A National Scale in Tanzania. *Annual World Bank Conference on Land and Poverty*, 1–29.

Supriyadi, Y., Sensuse, D. I., & Sucahyo, Y. G. (2021). Influential Factors In Adopting Blockchain Technology for eGovernment : A Systematic Review of Empirical Research. *2021 4th International Conference on Information and Communications Technology (ICOIACT)*, 17–22. https://doi.org/10.1109/ICOIACT53268.2021.9564017

Taherdoost, H. (2021). Data Collection Methods and Tools for Research ; A Step-by-Step Guide to Choose Data Collection Technique for Academic and Business Research Projects. *International Journal of Academic Research in Management (IJARM)*, *10*(1), 10–38.

Thakur, V., Doja, M. N., Dwivedi, Y. K., Ahmad, T., & Khadanga, G. (2019). Land records on Blockchain for implementation of Land Titling in India. *International Journal of Information Management*, *52*, 101940. https://doi.org/10.1016/j.ijinfomgt.2019.04.013

Thamrin, R. M., Harahap, E. P., Khoirunisa, A., Faturahman, A., & Zelina, K. (2021). Blockchain-based Land Certificate Management in Indonesia. *ADI Journal on Recent Innovation (AJRI)*, *2*(2), 232–252. https://doi.org/10.34306/ajri.v2i2.339

Thapa, Devinder; Sæbø, Ø. (2013). How To Scale Ict4D Projects : a Salience Stakeholder Perspective. *International Conference on Social Implications of Computers in Developing Countries, May 2013*, 741–752.

Themistocleous, M. (2018). Blockchain Technology and Land Registry. *Cyprus Review*, *4*, 195–202.

Thontteh, E. O., & Omirin, M. M. (2016). Land registration within the framework of land administration reform in Lagos state. *Pacific Rim Property Research Journal*, *12*(2), 161–177. https://doi.org/10.1080/14445921.2015.1058033

Thurman, K. G. (2010). Land Use Regulations and Urban Planning Initiatives in Accra , Ghana. In *PLAN A6211*.

Tilbury, J. L., de la Rey, E., & vab der Schyff, K. (2019). Business Process Models of Blockchain and South African Real Estate Transactions. *2019 International Conference on Advances in Big Data, Computing and Data Communication Systems (IcABCD)*, 1–7.

Torraco, R. J. (2005). Writing Integrative Literature Reviews: Guidelines and Examples. *Human Resource Development Review*, *4*(3), 356–367. https://doi.org/10.1177/1534484305278283

Torraco, R. J. (2016). Writing Integrative Literature Reviews : Using the Past and Present to Explore the Future. *Human Resource Development Review*, *15*(4), 404–428. https://doi.org/10.1177/1534484316671606

Torun, A. (2017). Hierarchical Blockchain Architecture for a Relaxed Hegemony on Cadastre Data Management and Update: A Case Study for Turkey. *Proceedings of the UCTEA International Geographical Information Systems Congress*, 15–18.

Tsai, M. H., Mom, M., & Hsieh, S. H. (2014). Developing critical success factors for the assessment of BIM technology adoption : part I . Methodology and survey. *Chinese Institute of Engineers*, *37*(7), 845–858. https://doi.org/10.1080/02533839.2014.888811

Tsankova, R., & Marinov, O. (2018). Stimulating the Creative Thinking of Students in Administration and Management Specialities in Context of European TeSLA Project. *Selected and Extended Papers from X-Th International Scientific Conference*, 57.

Tuladhar, A. M., Zevenbergen, J. A., Ali, Z., Tuladhar, A. M., & Zevenbergen, J. A. (2010). Developing a framework for improving the quality of a deteriorated land administration system based on an exploratory case study in Pakistan. *Nordic Journal of Surveying and Real Estate Research*, *7*(1), 30–57.

Udoka, I. S. (2017). Effect of Land Titles Registration on Property Investment in Nigeria. *International Journal of Advanced Studies in Economics and Public Sector Management*, *5*(2), 81–94.

Umapathy, K. (2009). The Influences and Impacts of Societal Factors on the Adoption of Web Services. In *In Handbook of research on social dimensions of semantic technologies and web services* (pp. 568–587). IGI Global.

Umrao, L. S., Patel, S. C., & Kumar, S. (2022). Blockchain-based Reliable Framework for Land Registration Information System. *International Journal of Technology Diffusion*, *13*(1). https://doi.org/10.4018/ijtd.300743

UN-GGIM. (2020). *Framework for Effective Land Administration*.

UN-Habitat. (2016). *Tenure Responsive Land Use Planning: A Guide for Country Level Implementation*. www.unhabitat.org

UNDP. (2022). *Digital Maturity Assessment – Lao PDR*.

Uwayezu, E. (2020). *Spatial Justice and Land Tenure Security. Insights from Urabn Re-development in Kigali, Rwanda*. Technical University of Munich.

Uwayezu, E., & de Vries, W. T. (2018). Indicators for Measuring Spatial Justice and Land Tenure Security for Poor and Low Income Urban Dwellers. *Land*, *7*(3), 84. https://doi.org/10.3390/land7030084

Uwayezu, E., & de Vries, W. T. (2019). Scoping land tenure security for the poor and low-income urban dwellers from a spatial justice lens. *Habitat International*, *91*, 102016.

https://doi.org/10.1016/j.habitatint.2019.102016

Van der Molen, P. (2007). *Some Measures to Improve Transparency in Land Administration*.

van Wart, M., Roman, A., Wang, X., & Liu, C. (2017). Integrating ICT adoption issues into (e-)leadership theory. *Telematics and Informatics*, *34*(5), 527–537. https://doi.org/10.1016/j.tele.2016.11.003

VanBoskirk, S., Gill, M., Green, D., Berman, A., Swire, J., & Birrell, R. (2017). *The Digital Maturity Model 5 . 0*.

Vaux, A., Phillips, J., Holly, L., Thomson, B., Williams, D., & Stewart, D. (1986). The Social Support Appraisals (SS-A) Scale : Studies of Reliability and Validity. *American Journal of Community Psychology*, *14*(2), 195–218.

Veeramani, K., & Jaganathan, S. (2020). Land Registration : Use-case of e-Governance using Blockchain Technology. *KSII Transactions on Internet & Information Systems*, *14*(9), 3693–3711.

Vergouwen, M., Koens, T., & Poll, E. (2020). Drivers and Impediments : Experts Opinions on Blockchain Adoption in the Netherlands. *In 2020 Second International Conference on Blockchain Computing and Applications (BCCA)*, 86–91.

Veuger, J. (2018). Trust in a viable real estate economy with disruption and blockchain. *Facilities*, *36*(1–2), 103–120. https://doi.org/10.1108/F-11-2017-0106

Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, *28*(2), 118–144. https://doi.org/10.4324/9781003008637-4

Visvaldis, V., Ainhoa, G., & Ralfs, P. (2013). Selecting indicators for sustainable development of small towns : The case of Valmiera municipality. *Procedia Computer Science*, *26*, 21–32. https://doi.org/10.1016/j.procs.2013.12.004

Vos, J. (2016). Blockchain-based land registry: Panacea illusion or something in between? *In Proceedings of the IPRA/CINDER Congress*, 1–26.

Vos, J., Lemmen, C., & Beentjes, B. (2017). Blockchain-Based Land Administration Feasible, Illusory or a Panacea? *Responsible Land Governance: Towards an Evidence Based Approach*, 1–27. https://doi.org/10.1088/0953-8984/19/29/295202

Wanyama, G. I., & Qin, Z. (2010). Organizational Culture and Information Systems Implementation : A Structuration Theory Perspective. *Sprouts*.

Weber, E., Krehl, E.-H., & Büttgen, M. (2022). The Digital Transformation Leadership Framework: Conceptual and Empirical Insights into Leadership Roles in Technology-Driven Business Environments. *Journal of Leadership Studies*, *16*(1), 6–22. https://doi.org/10.1002/jls.21810

Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. *MIS Quarterly*, *26*(2), xiii–xxiii. https://doi.org/10.1.1.104.6570

Wernicke, B., Stehn, L., Sezer, A. A., & Thunberg, M. (2023). Introduction of a digital maturity

assessment framework for construction site operations. *International Journal of Construction Management*, *23*(5), 898–908. https://doi.org/10.1080/15623599.2021.1943629

Williams, C. (2007). Research Methods. *Journal of Business & Economic Research*, *5*(3), 65–72.

Williamson, I., Enemark, S., Wallace, J., & Rajabifard, A. (2010). Land Administration for sustainable development. In *FIG Congress 2010 Facing the Challenges – Building the Capacity* (p. 487). Redlands, CA:ESRI Press Academic.

Williamson, I. P., & Grant, D. M. (2002). United Nations-FIG Bathurst Declaration on Land Administration for Sustainable Development : Development and Impact. *In Proceedings of the XXII FIG International Congres*, 1–13.

Williamson, I., & Wallace, J. (2007). New Roles of Land Administration Systems. *In Proceedings of International Workshop, Ulaanbaatar, Mongolia, June*, 27–29.

Wily, L. A. (2018). The Community Land Act in Kenya Opportunities. *Land*, *7*(1), 12. https://doi.org/10.3390/land7010012

World Bank. (2008). *Restructuring of the Ghana - Land Administration Project*.

World Bank. (2011). *Implementation Completion and Results Report*.

World Bank. (2013). *Project Performance Assessment Report, Ghana- Land Administration Project*.

World Bank. (2015). How Innovations in Land Administration Reform Improve on Doing Business: Cases from Lithuania, the Republic of Korea, Rwanda and the United Kingdom. In *How innovations in land administration reform improve on doing business : cases from Lithuania, the Republic of Korea, Rwanda and the United Kingdom*. http://documents.worldbank.org/curated/en/450041467995100809/How-innovations-in-land-administration-reform-improve-on-doing-business-cases-from-Lithuania-the-Republic-of-Korea-Rwanda-and-the-United-Kingdom

World Bank. (2020). *Digital Government Readiness Assessment: The Fiundation of Digital Development (DGRA) Toolkit V. 31; Guidelines for Task Teams*. World Bank.

Xu, M., Chen, X., & Kou, G. (2019). A systematic review of blockchain. *Financial Innovation*, *5*(1). https://doi.org/10.1186/s40854-019-0147-z

Yan, J., Xia, F., & Bao, H. X. H. (2015). Strategic planning framework for land consolidation in China : A top-level design based on SWOT analysis. *Habitat International*, *48*, 46–54. https://doi.org/10.1016/j.habitatint.2015.03.001

Yapicioglu, B., & Leshinsky, R. (2020). Blockchain as a tool for land rights : ownership of land in Cyprus. *Journal of Property, Planning and Environmental Law*, *12*(2), 171–182. https://doi.org/10.1108/JPPEL-02-2020-0010

Yeboah, E., & Shaw, D. P. (2013). Customary land tenure practices in Ghana : examining the relationship with land-use planning delivery. *International Development Planning Review*, *35*(1), 21–39. https://doi.org/10.3828/idpr.2013.3

Yildiz, U., Zevenbergen, J., & Todorovski, D. (2020). Exploring the Relation Between

Transparency of Land Administration and Land Markets : Case Study of Turkey. FIG Working Week 2020 Smart surveyors for land and water management Amsterdam , the Netherlands , 10 – 14 May 2020. *In Proceedings of the FIG Working Week 2020 Smart Surveyors for Land and Water Management, May 2020*, 10–14.

Yin, R. (2016). Case Study Research and Applications. Design and Methods. In *Theory and Methods of Metallurgical Process Integration*. https://doi.org/10.1016/b978-0-12-809568-3.00016-4

Yin, R. K. (2003). *Case Study Research: Design and Methods* (3rd Editio).

Yin, R. K. (2016). *Qualitative research from start to finish* (Second Ed). Guilford publications.

Zaman, Q., Idrees, M., Ashraf, A., & Ahmad, A. (2022). A Smart Contract Approach in Pakistan Using Blockchain for Land Management. *International Journal of Innovations in Science & Technology*, *4*(2), 425–435. https://journal.50sea.com/index.php/IJIST/article/view/252

Zaoui, F., & Souissi, N. (2020). Roadmap for digital transformation: A literature review. *Procedia Computer Science*, *175*. https://doi.org/10.1016/j.procs.2020.07.090

Zehe, A. K., & Belz, F.-M. (2016). Video Elicitation Interviews in Organizational and Management Research: Application in a Field Study. *European Academy of Management (EURAM), June*. https://doi.org/10.2139/ssrn.2892534

Zein, R. M., & Twinomurinzi, H. (2024). Information Sharing in Land Registration Using Hyperledger Fabric Blockchain. *Blockchains*, *2*(2), 107–133.

Zevenbergen, J. (2004). A Systems Approach to Land Registration and Cadastre. *Nordic Journal of Surveying and Real Estate Research*, *1*.

Zevenbergen, J., de Vries, W. T., & Bennett, R. M. (2015). Future Directions in Responsible Land Administration. In *Advances in Responsible Land Administration* (pp. 271–277). CRC Press.

Zhang, Y., & Wildemuth, B. M. (2009). Unstructured Interviews. *Application of Social Research Methods to Questions in Information and Library Science*, 222–231.

Ziyadin, S., Suieubayeva, S., & Utegenova, A. (2020). Digital Transformation in Business. In *In Digital Age: Chances, Challenges and Future* (Vol. 7, pp. 408–415). Springer International Publishing. https://doi.org/10.1007/978-3-030-27015-5_49

Appendixes

Appendix 1.

Implications of the five digital maturity levels

Maturity	Digitally	Digitallv	Digitally Agile &	Digitally	Digitally
Implications	• Undefined focus areas and sub-areas • Low level of digital literacy, skillsets among the workforce • Processes are not citizen centric and do not capture feedback from the end users • Policies and regulation not defined for the digital	• Somewhat defined focus areas and sub-areas • Emerging level of digital literacy among the workforce • Processes capture user feedback to some extent for improving functionality • Policies and regulations defined in silos for the digital services and standards	• Defined and connected focus areas and sub-areas • High level of digital literacy and skillsets among the workforce • Processes are citizen centric to some extent with improved user experience	• Focus areas are completely aligned with digital strategies • High level of digital literacy and skillsets among the workforce • Widespread adoption of digital services by citizens and businesses due to the highly engaging user experience • Evolved set of policies and regulations resulting from multiple amendments	• Vision and goals align with innovative new systems and solutions • Very high level of digital literacy and skillsets among the workforce • Citizen-driven service design with highly engaging user experience and inclusivity • Policies and regulations

	services and standards • Institutions not yet enabled • Digital vision and implementation strategies are unclear • Processes are manual and require intervention for decision-making • Lack of technology infrastructure in place	for specific functionalities • Digitally enabled governance in place with digital services offered in silos • Defined implementation and monitoring strategies in place • Digital projects exist under some focus areas and sub-areas • Processes are being digitized to execute digital initiatives but in functional silos • Emerging technological infrastructure leading to development of digital	• Common policies and regulation established across ministries for the digital services and standards • Digital services are fully integrated with other systems, standards and application • Clear vision/ strategy and roadmap defined • Strong digital mindset and agile culture • Digital initiatives are built in a streamlined manner and	• Digital processes and systems have been embedded throughout the functionalities of Governments • Processes are fully optimized through an evolved transformation roadmap • Well-defined technological ecosystem enabling development of world-class digital services	support continuous digital innovation • Fully automated integrated functionalities across ministries • Openness to evolving technologies and their implementation • Optimized development for rapid innovation • Ecosystem fostering continuous technology innovation for faster adaptability to a changing external environment

		functionalities	launched successfully • Technological ecosystem contributing to rapid development of digital services established		

Source: (UNDP, 2022)

Appendix 2

SECTION A. Interview Guide for All Case Study Land Professionals

This interview guide is in respect of a PhD Studies at the Technical University of Munich, Germany, on the topic; **Blockchain Technology for a Transparent Land Administration System: Feasibility Assessment for Adoption in Ghana's Land Sector.**

The interview guide is designed to help elicit data on the current status of land administration in Ghana, towards Blockchain technology adoption and implementation possibilities. It seeks to assess land professionals experience of land digitalization in Ghana, the main issues of concern, the opportunities, and ways forward towards a modern digital land administration system.

As a professional in the land sector, your participation, and responses in this interview will greatly help to understand the situation as it exists, and to accordingly identify policy implications towards advancing an efficient digitalization system to enhance land administration transparency in Ghana.

We assure you that the information provided for this interview is strictly for academic purposes only as part of the PhD studies. The information shall therefore be held **STRICTLY CONFIDENTIAL**, and your identity if desired will be kept **ANONYMOUS** and shall not be passed onto a third party for any other purpose other than for the purpose of completing the PhD which involves publication of journal articles, and the final PhD dissertation.

For any questions, or further clarification concerning this interivew, and the PhD studies in general, please contact the researcher, via email; aprincedonkor.ameyaw@tum.de Thank you.

Please note, when writing the report, the use of direct quotations, and pseudo names assigned to respondents, and sometimes respondents position becomes necessary as part of the methodology. Please kindly let us know if you consent to this by ticking the appropriate box below

- I give consent [ ]
- I want to remain anonymous [ ]

Please, freely, but objectively respond to the interview questions below to the extent possible for you. Where you are not comfortable to answer any of the questions, or have no idea on the response to any of the questions, you are free to skip it to the next. Thank you.

Institution

Lands Commission		Otumfuor Customary Land Secretariat (OCLS)
Accra Lands Commission	Kumasi Lands Commission	

About Respondent, Division and Activities

1. What is your age bracket?
   18-25 [ ]
   26-30 [ ]
   31-40 [ ]
   41-50 [ ]
   51-60 [ ]
   61 and above [ ]

2. Which division of the Lands Commission do you belong

Lands Commission		Otumfuor Customary Land Secretariat (OCLS)
Accra Lands Commission	Kumasi Lands Commission	
PVLMD [ ] Valuation [ ] Survey and Mapping [ ] Land registration division [ ] Other	PVLMD [ ] Valuation [ ] Survey and Mapping [ ] Land registration division [ ] Other	

3. Briefly describe the main function/ activities of your division

4. To what extent will you consider the functions/ activities of your division as digitized/ automated?
   Fully digitized/ automated [ ]
   Partially digitized [ ]. About what %.....
   Fully manual [ ]

Professional course, orientation

5. What is your course of study at the tertiary?

6. Are there opportunities for continuous professional development programs in your division especially in land digitalization related courses?

If yes, have you personally benefitted from this, or knows someone that that has benefitted from it and the exact program taken?
If No, why?

Technical/ Software orientation

7. From the list of software, programming languages, and databases below, tick the ones that you have work experience with, for which activity you use it for, and how frequent you use in your profession

Software	Experience	How did get experience with it	Which activity do you use it for?	Frequency of use
PostgreSQL	Yes [ ] No [ ]	From tertiary study program [ ] Learning on the job [ ] Continuous professional development [ ] Other.....		Daily [ ] Weekly [ ] Monthly [ ]
Solidity	Yes [ ] No [ ]	From tertiary study program [ ] Learning on the job [ ] Continuous professional development [ ] Other.....		Daily [ ] Weekly [ ] Monthly [ ]
Python	Yes [ ] No [ ]	From tertiary study program [ ] Learning on the job [ ] Continuous professional development [ ] Other.....		Daily [ ] Weekly [ ] Monthly [ ]
Oracle Database	Yes [ ] No [ ]	From tertiary study program [ ] Learning on the job [ ] Continuous professional development [ ] Other.....		Daily [ ] Weekly [ ] Monthly [ ]
Informix Database	Yes [ ] No [ ]	From tertiary study program [ ] Learning on the job [ ] Continuous professional development [ ] Other.....		Daily [ ] Weekly [ ] Monthly [ ]
GIS Type?	Yes [ ] No [ ]	From tertiary study program [ ] Learning on the job [ ] Continuous professional development [ ] Other.....		Daily [ ] Weekly [ ] Monthly [ ]
Other.....				

About Available Systems, and their Interoperability

8. What is the current land information (management) system in use at your division or in the institution at large? If solely manual, move to 12, otherwise, continue

A. On a scale of 1-10, how familiar are you with the identified system where;
   1=Not familiar at all
   10=Very well familiar

B. If familiar, how often do you use it?
C. To what extent will you consider this system as digitized/ automated?
   Fully digitized/ automated [ ]
   Partially digitized [ ]. About what %.....
   Fully manual [ ]

9. In the adoption, and deployment of the identified system, in what ways were you involved?
10. Which people have access to the system in your division and why?
11. Who assigns/ grants access to the system, and how does a staff qualifies to gain access to it?
    A. Do non-staff, example, clients of the Commission have access to the system? Example, through a frontend interface?
    B. How is the system managed/ regulated to prevent abuse example; unscrupulous changes to data, or addition of
    C. Is there any back-up for the system?
       If yes, which is it and how secure in this in your opinion?
    D. How does the system update?
    E. Do other divisions have equal access to the system?
       Yes [ ]
       No [ ] Why?
    F. Does the system permits data sharing/ exchange amongst all divisions in your institution?
       If yes, what sort of data?
       If no, why?
    G. Does the system allow you to make changes to data in it?
       If yes, what data can you make changes to, and which ones can you not change
       If no, why?
12. What is the working relationship between your division and other divisions of the institution and how is this facilitated digitally?
13. What is the working relationship between your division and other land sector institutions like the Lands Commission, LUSPA, CLSs and others and how is this facilitated digitally?

Support Facilities for the Available Systems

14. Do you have the following devices, and or system available in support of services at your division and to how will you describe their functionality efficiency for land services and processes?

Device	**Presence/ Absence**		**Functionality status**			
	Yes	No	Fully functional (reliable)	Somewhat functional (Not always reliable)	Not functional at all	No idea
Laser printer						
Color inkjet printer A3						
Color inkjet printer A4						
Scanner A3						

Scanner A4						
Photocopier machine A3						
Photocopier machine A4						
Monitor						
System unit						
Laptops						
Wi-Fi connection						
Standby power plant/ generator						

15. Based on your experience as a professional in Ghana's land sector, how will you rate the level of digitalization on a scale of 1 – 5, and why?
    1 = Very low
    2 = Low
    3 = Indifferent
    4 = High
    5 = Very high

16. How can we improve the system based on your response in 15 above

For the Accra Lands Commission Only

About the Online portal and the ELIS Systems

1. Why was GELIS replaced with ELIS?

    A. Are there any challenges currently with ELIS and if so how are they being, have they been addressed?
    B. How have the identified shortcomings been resolved in the new system?
    C. Which policy, either governmental or institutional informed ELIS?
    D. Are all staff from the different divisions permitted to access this system?
    E. Who assigns access to the ELIS system?
    F. How do you access the ELIS yourself, and what are the requirements for you to access it?
    G. Are you allowed to make changes to data in the ELIS system?
    H. How is ELIS protected to keep the system safe?
    I. Is there a back-up system for the ELIS, and how are data updated in the system?

2. The Commission now has a frontend interface for clients to conduct search online, and receive their feedback. What was the main motivation for the online search system?
1. What database software underlines this online search portal?

2. How will you describe the patronage or use of the online search portal on a scale of 1-5? Where;

    1=Very low [ ]
    2=Low [ ]
    3=Neither low nor high [ ]

4=High [ ]
5=Very high [ ]

3. Are there avenues for feedback on the use of this online portal system for the customers?

   If yes, are there any feedback being received from clients on the usability of this system? For instance on the ease or difficulty of use, level of level of satisfaction/dissatisfaction in its use etc

   If no, why?

4. To what extent were the public (clients) involved/ consulted/ engaged in the design, adoption, and implementation of this online portal
5. Which policy, either governmental, or institutional informed this online portal initiative and why?
6. How was the design, adoption and implementation of this online portal done and why i.e.

Solely by the Lands Commission

Partnership with external local companies

Partnership with external foreign companies

Other, please specify.....

7. How will you describe the public acceptance and use of the online portal for the designated services?
8. Are there any measures in place to ensure that clients use this online portal service?
9. Based on your experience of the ELIS system, and the online portal, what implications can we be deduced for future design of other digital systems, and their acceptability, and usage by the public, and the staff?

On Blockchain Adoption: All Case Study Professionals

1. Do you know about Blockchain technology, and its possible application in land administration
2. The firms below are involved in the application of Blockchain technology for land related services. Are you aware of any of them
   A. BenBen (Accra)
      Yes [ ], No [ ]
   B. Bitland (Kumasi)
      Yes [ ], No [ ]

Video Elicitation: The short video below shows the concept of Blockchain's application in land administration for services including in land registration and other documentations, searches, and purchases, among others. Please watch and answer the questions that follow: (Source: https://www.youtube.com/watch?v=MvsHIEJsNvY)

After watching this video,

3. Are there any specific challenges in the land administration services of your division for which you foresee that a Blockchain-system can help to resolve, or improve for the better?
   If yes, which are these and how?
   If no, why?

4. In your opinion, will you recommend this concept/ technology be adopted in support of land services in your division, and why?
5. If your institution is to adopt such a system, what other functionalities/ activities in your division would you wish to be integrated into it?
6. If your institution is to adopt such a concept/ technology, in your opinion, do you foresee the clients to readily embrace this system and why?
7. From your experience, what challenges can you envisage as likely to be encountered if your institution is planning to adopt such a Blockchain-system and why?
    A. In what ways do you think the identified challenges can be addressed/ forestalled to allow for a successful adoption, and sustainability of the system?
8. As is in the video, it can be seen that the Blockchain system is highly interoperable.
    A. To what extent can you say that the coordination, interdependencies, and or relationship between your division and other divisions of the institution is well structured to support it and why?
    B. To what extent can you say the coordination, interdependencies, and or relationships between your institution, and other institutions like the Commission, LUSPA, CLSs, and others is well structured to support it and why?
9. In your opinion, which of the following approaches to adoption will you recommend if your institution is to adopt the Blockchain system, and why?
    Gradual/ evolutionary i.e. multiple systems coexist for a long time [ ]
    Disruptive/ revolutionary i.e. a discrete change, or conversion to a new system [ ]
    Rapid i.e. not a drastic sudden change but still a change within a fixed timeframe [ ]
10. In consideration of Blockchain adoption, is it necessary for management to engage all stakeholder groups, and why?
    If yes, how?
11. What is your general take on the readiness of the Ghanaian land sector for Blockchain technology adoption in support of land administration transparency and in what ways can we improve the current state to foster such adoption possibility?

THANK YOU SO MUCH FOR YOUR PARTICIPATION IN THIS INTERVIEW.

Appendix 3

Survey Questionnaire for All Case Study Land Professionals

SECTION B: For All Three Study Cases
Assessment of Digital Maturity and Readiness Based on the Eight Focus Area Framework as Developed Based on Empirical Data, and Adaptation from Literature.

In this section, respondents were asked to indicate the extent to which factors under each of the 8 focus areas are present at the land institution. Where a factor is identified as existing, respondents are to give a rank on a scale of 4-0, to show the extent of existence where (4= those factors are present and actually functional, and are also monitored/ measured, 3= factors present and functional, and ways to measure them are implemented but somehow not measured yet, 2= factors are present, and measurable indicators are defined but somewhat not implemented 1= factors are being defined, 0= not applicable/ non-existent).

Focus Areas	**Indicators**	**Rank**				
		4	**3**	**2**	**1**	**0**
Policies, legal laws, and political commitment	• Is there a specific digital law on land transactions and processes and which allows for digital signatures, electronic documents, and electronic contract?					
	• Is there a comprehensive digital land policy document? i.e A policy document that is only focused on digitalization issues in the land sector?					
	• Are there legislative instrument as basis for specific digital transformation initiatives? eg; for GELIS					
	• Are there national, or internal policies that empower the adoption of digital tools by the land sector agencies as and when it becomes necessary?					
	• Does the government show commitment to accelerating digital transformation of the land sector?					
	• Do we have cyber-security strategy, and policy document in place for digital land transactions and processes?					
	• Do data protection laws exist for, and actually work in land transactions and processing?					
	• Is there a Digital Identification legislation passed for digital land transaction, and processing purposes?					
	• Is there a law on Public-Private Partnership in such areas as technology adoption?					
	• Is there any law that allows for "Open Access to Land Information" in the land sector?					
Institutional arrangements, and data standards	• Does a lateral institutional structure exist for land digitalization initiatives and implementations?					
	• Are there any standardized data management strategies across the various land sector institutions?					
	• Are the available data credible, complete, accurate, consistent, and usable for digital systems?					
	• Is there a defined national spatial data infrastructure?					
	• Is there roadmap or modernization strategy in place that can support a digital transformation agenda?					

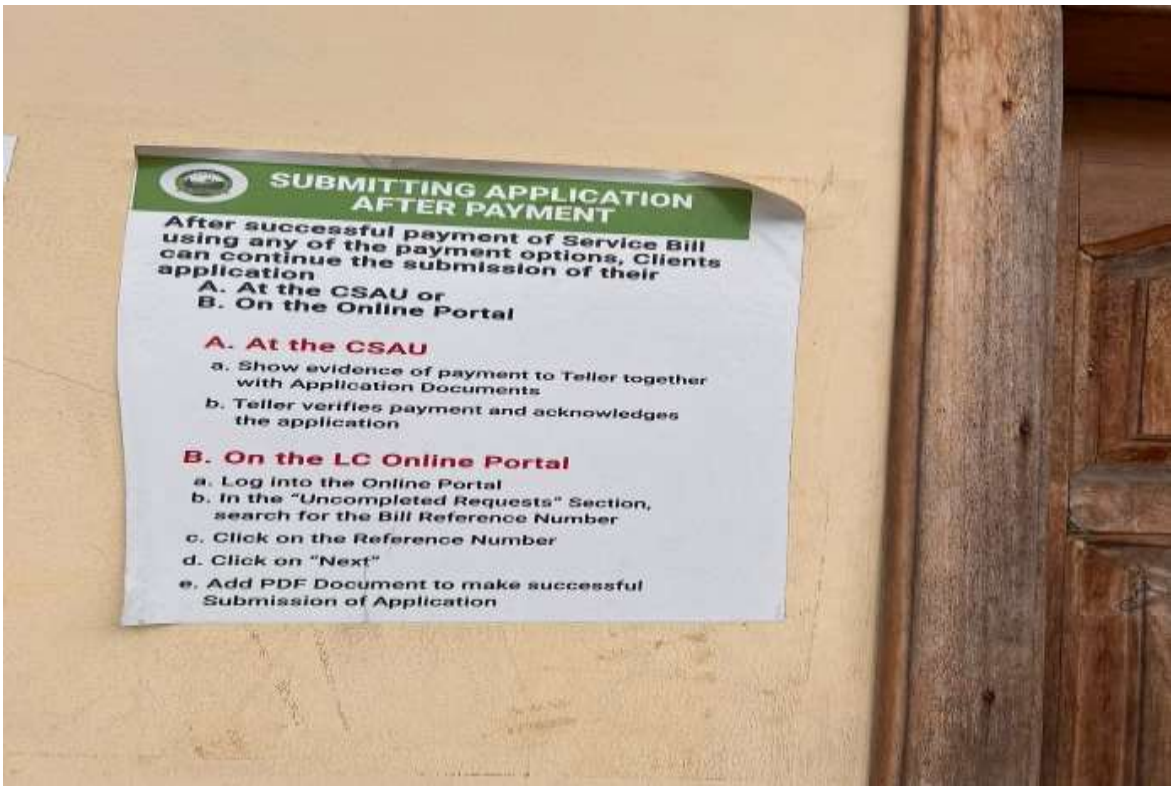
	• Is there a Data Sharing Agreement or Data Exchange Protocol with other land institutions?					
	• Is there a point of contact to address inquiries on land services or to document complaints from the various user groups?					
	• Are there guiding principles established to define the design and implementation of digital or e-Services for land user categories?					
	• Is there an outreach/marketing strategy and plan to promote digital or e- Services' uptake across all available channels?					
	• Are there standard procedures to simplify, digitalize, and optimize land services?					
	• Is there a defined, digitized and shared set of 'basic data registers' across land sector institutions					
	• Does any management information systems for land services and transactions?(such as: e-Business, Land MIS, etc)?					
	• Is there cross-land sector referential data (e.g. Personal ID, Business registry, Land database, and Non-Movable assets registries) that is consistently shared electronically across institutions?					
	• Does this institution invest in change management practices (training, skills, culture, knowledge, HR, etc.) towards digital transformation?					
	• Is there a clear view on the digital capabilities requirements, both business and technical, in your institution and across land sector institutions to support realization of digital transformation agenda?					
Technical considerations	• Are land institutions adequately resourced with the technological tools necessary to support digital transformation (computers, servers, cloud services, laptops, printers, scanners etc)					
	• Does any common digital portal that acts as the front-end interface for all planned digital or e- Services (Online portal, Mobile Apps etc) exist for your institution?					
	• Is there any Government-wide digital network that connects all entities (at the national and local levels) to share services and data through a secure Data Center hub					
	• Existence of core services applications					
	• Is there any national, or institutional document/ guideline for ICT/digital operations' good practices for all user groups?					
	• Is there an already underlying software for certain digital services which we can build on to advance land digitalization?					
	• Does your institution, or the land sector in general use Disruptive technologies such as Cloud services, IoT, Blockchain or AI - or is it open to the idea of doing so?					
	• Have core land service applications been developed? Eg. Document management or correspondence management applications for your institution?					
	• Is there a Computer Emergency Response Team (CERT) in your institution to offer technical support to staff?					
Socio-cultural issues	• Is the public open to, and likely to accept digital systems as portals and others for land transactions and processing?					
	• Are the public adequately involved by way of their input, and also educated on digital services' initiative and implementation?					
	• Have the public clients had previous experiences with digital land transactions and processing with your institution?					
	• Does the customary land sector support land digitalization idea?					

	• Does digital initiatives recognize, and align with customary tenure systems, arrangements, laws, and customs?					
Financial considerations	• Is there a sustainable funding schemes solely dedicated to digital land service initiatives?					
	• Are there avenues to access funding for digital land initiatives and if so, how easy is this?					
	• Are there any international development partners currently supporting with finance, and expertise for land digital initiatives					
	• Are there any banks and investment institutions supporting land digital agenda in the country?					
Collaborations, and partnerships	• Is the land sector open to outsourcing digital services enabling functions to local private firms?					
	• Is there data exchange among the different land sector institutions both within the statutory and customary sectors?					
	• Does collaborative culture around projects amongst staff in different land sector institutions exist in Ghana?					
	• Have partnerships been formalized with local private sector operators in support of digital land services delivery?					
	• Are civil society and/or the private sector engaged in consultative processes to inform the user- centered digital design?					
	• Are there any collaborations between the State land sector institutions, and the customary land sector institutions on digital land systems?					
Leadership and stakeholder involvement	• Is there a clear land digital vision document for digital transformation?					
	• Are there specific, measurable, and achievable goals towards digital transformation?					
	• Are the leadership passionate about land digitalization and uptake of new land digital tools					
	• Does leadership create an open environment to encourage digital innovativeness within the land sector?					
	• Are all stakeholder-groups brought in consultations on digital initiatives					
	• Are operational level staff involved in digital initiatives decision making, and implementation processes					
	• Are users invited to participate in design, test and use of new digital services?					
	• Is there a process and mechanism to accommodate users' feedback for improving online user-interface if there is such an online portal?					
	• Do leaders exhibit positive attitude towards modern digital systems and services?					
	• Are the leadership of the land institutions well informed, and aware of modern digital land administration systems?					
Capacity, and know-how	• Are land professionals knowledgeable in modern digital tools like Blockchain, A.I, IoT etc?					
	• Are there opportunities for digital training of land professionals on new land digital tools?					
	• Is there an internal digital education and training for land professionals?					
	• Opportunity for continuous professional development (CPD) programs in technical courses?					

	• Does the land sector have enough skilled, qualified staff (with business and technical capabilities) to deliver on the digital transformation strategy?					
	• Does the land institutions have enough and powerful hardware tools like computers, laptops, scanners, photocopiers and others to support digital transformation?					
	• Can the land sector access new specialized talent from local universities or industries for specific projects in the digital transformation plan?					
	• Are there national universities or institutes that offer programs in digital business and technology relevant for digital land services delivery?					
	• Are land holders' technical know-how on online services good enough for digital land operations?					
	• Are there innovation hubs and startup accelerator programs to promote and support innovations?					
	• Are land professionals aware of Blockchain technology's use possibilities for land services and processes?					

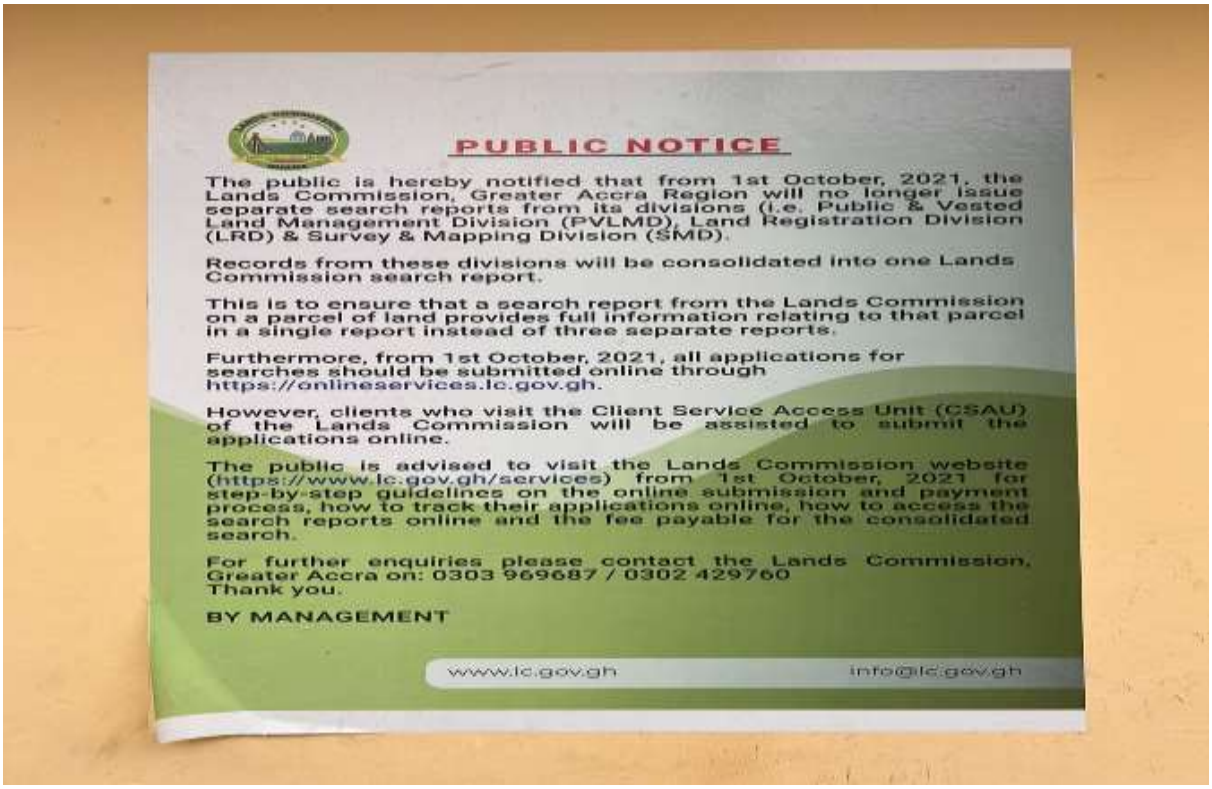
Source: Based on fieldwork responses, and adaptations from (World Bank, 2020; UNDP, 2022)

Appendix 4. Post for public notice on the LC online portal in Accra



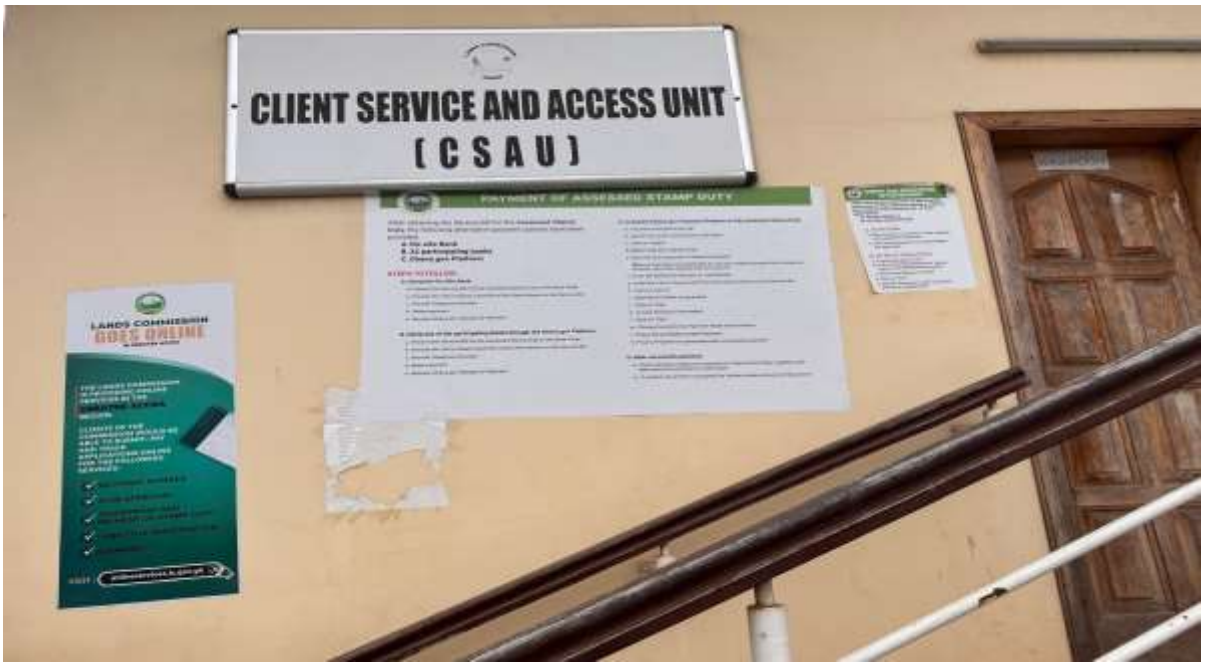
Source: Fieldwork 2022

Appendix 5. Public notice post on change from separate search to consolidated search.



Source: Fieldwork 2022

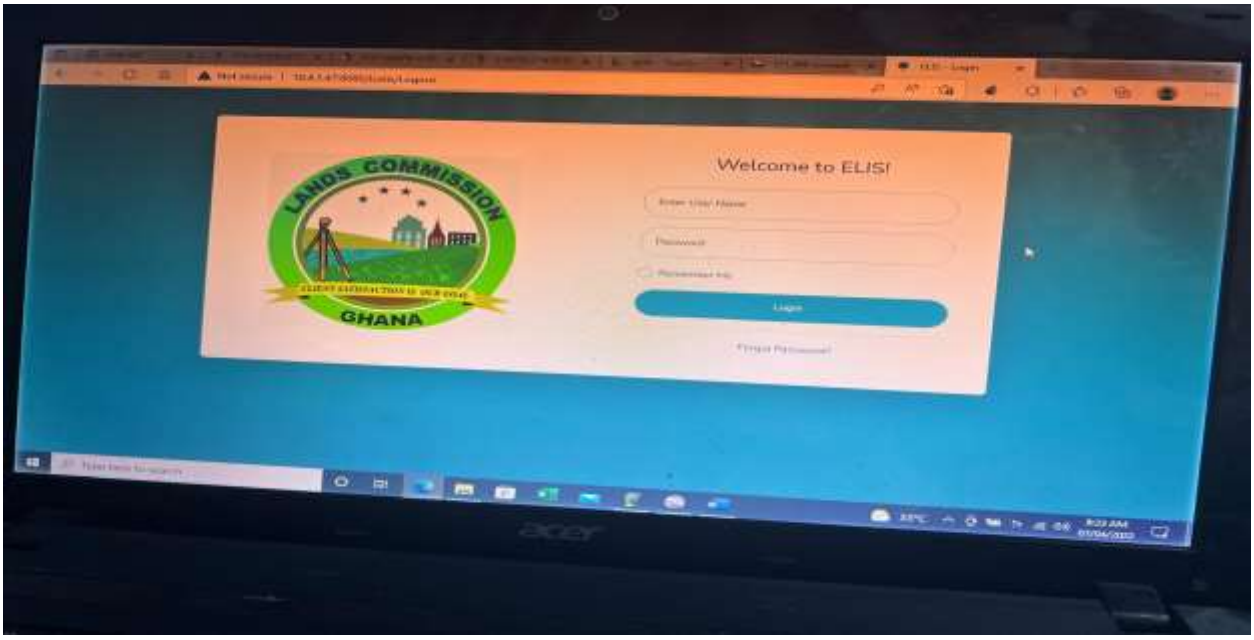
Appendix 6. CSAU office



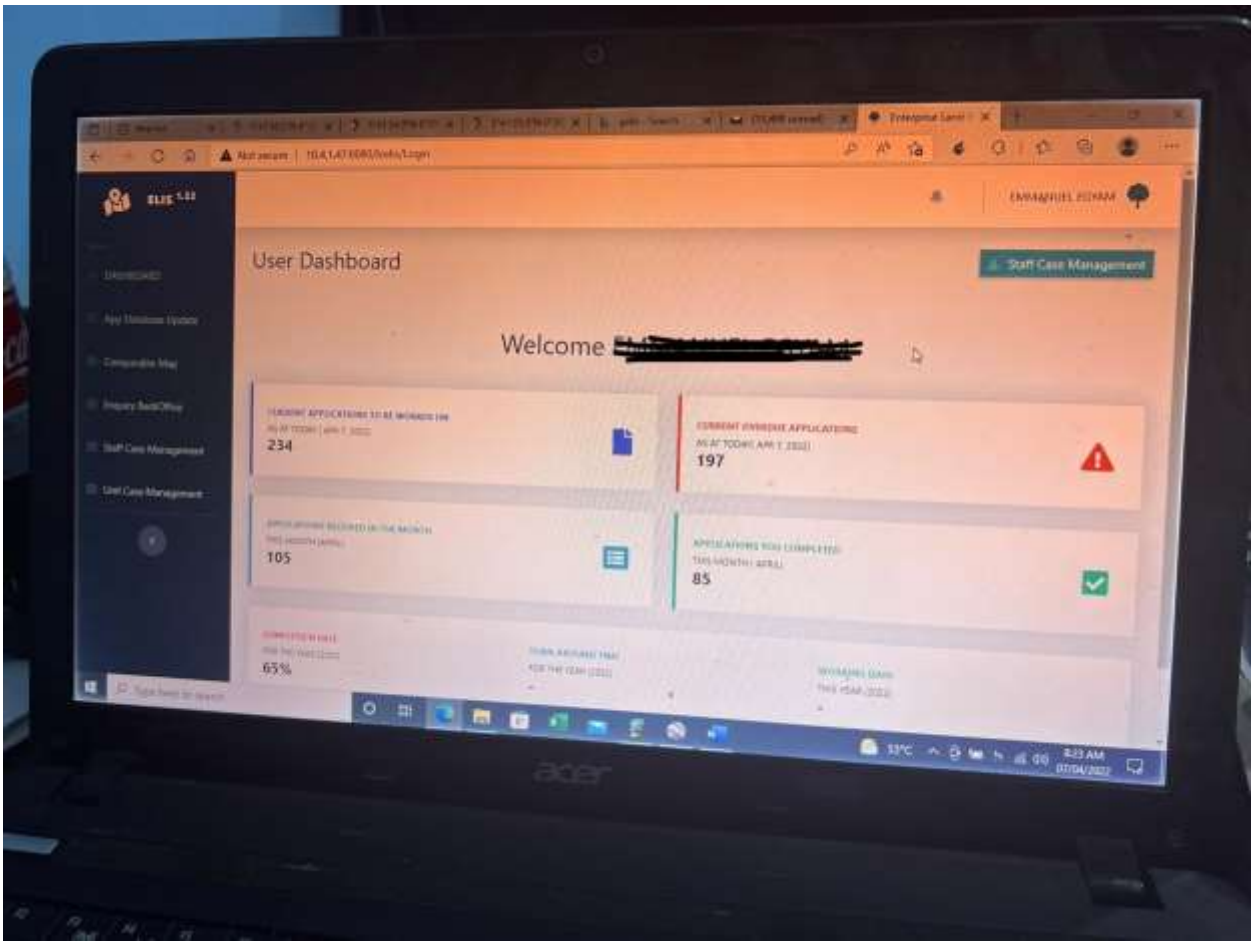
Source: Fieldwork 2022

O

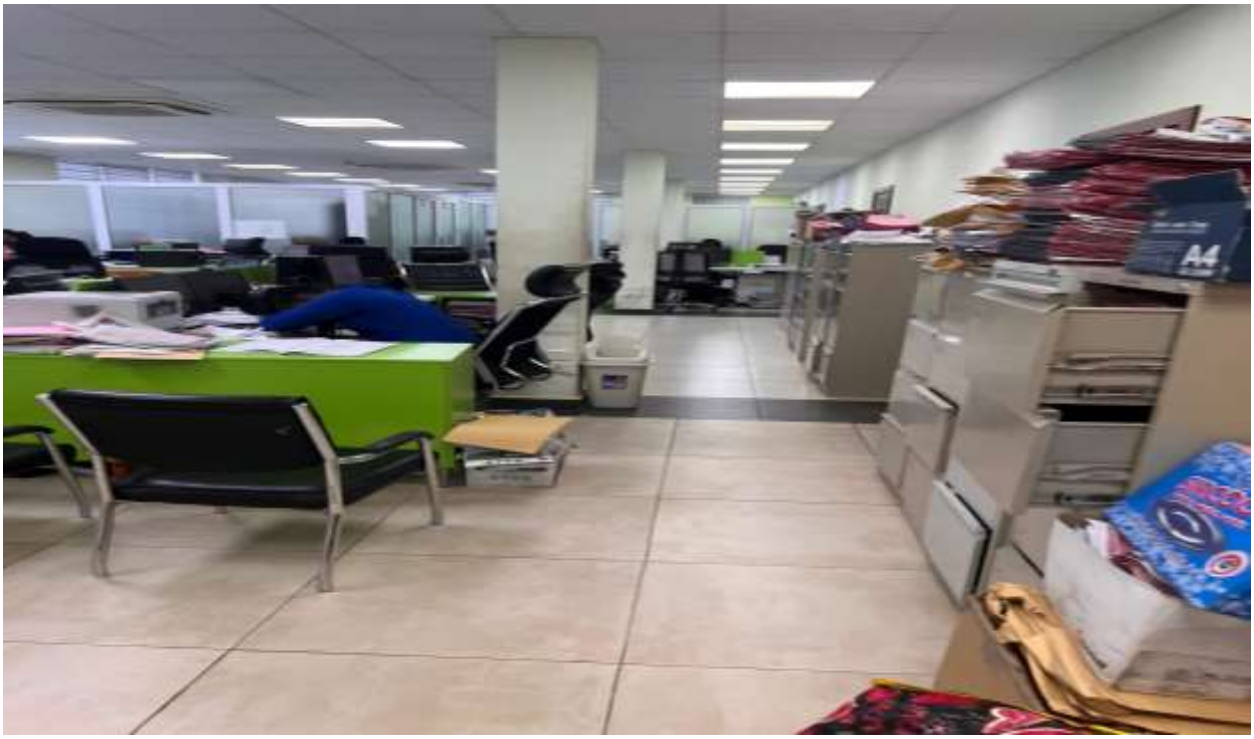
Appendix 7. ELIS



Appendix 8. ELIS User Dashboard



Appendix 8. Office with Stack of files over file cabinets in Accra



Appendix 9. Scanning Bay in Accra

Appendix 10. An office at the OCLS