BEYOND THE HYPE: EXPLORING BLOCKCHAIN TECHNOLOGY IN LAND ADMINISTRATION

A case study of Ghana and property rights

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Regardless of property type (cars, land, real estate) accurate records of ownership is important because it provides proof that a person is indeed the owner.
Such records can be used to protect owners' rights, resolve disputes and protect from fraudulent activities. It is therefore crucial to maintain correctness and completeness of the information as to secure the property rights of the respective owner (Mizrahi, 2018).

ACKNOWLEDGEMENTS

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ABSTRACT

Purpose/methodology/approach: This study uses a mixed-method approach comprised of qualitative and quantitative data to assess whether blockchain technology can resolve some of the issues in the land administration system in Ghana that weakens land and property rights. By reviewing data and interviewing key stakeholders, this exploratory case study will also aid in providing a realistic depiction of the potential and limitation of blockchain technology in land administration in a development setting. An inductive pragmatic approach to the topic was chosen incorporating both positivist and interpretivist perspectives to analyze and discuss the findings of this study.

Findings: Private (permissioned) blockchains was found to have significant advantages in lowering the likelihood of corruption, in particular document forgery and fraud and in alleviating the extent of bribery. Further, the lack of governance over local land-administrative structures could be alleviated by introducing a distributed Proof-of-Authority consensus mechanism that enables multiple stakeholders to audit the registry process thus ensuring transparency and immutability for all parties.

However, Ghana's weak institutional framework and the limited political influence and reach of the central government in rural areas is a major impediment for a blockchain-based solution to be viable today. Ghana's government would need to address the substantial legislative, structural and cultural hurdles that diminishes tenure security for their citizens, primarily those living in communities situated in peri-urban and rural Ghana. Critical prerequisites such as orthophoto-mapping for land demarcation and digitalization of records are missing in Ghana which strongly diminishes the potential for blockchain technology to be utilized in land registration, because it would result in inadequate recordings stored on the blockchain. Second, emphasis must be put on the educational aspect of land rights; as stated by both case-companies interviewed, informing the land-owning community of their rights to land and the impact of having written agreements is paramount to changing attitudes in the society. The push to change customary practices must come from within as the communities cannot be forced to register their land. Last, land records only provide security to people if backed by legal enforcement and a political will to uphold such rights. To secure land and property rights in Ghana, effort must be allocated to all three mentioned pillars to be successful.

Originality/value: This paper contributes an original analysis of the application of blockchain technology in Ghana's land administration system and expands on the scarce existing academic literature on blockchain use-cases.

Keywords: Ghana, property rights, land tenure, blockchain technology, distributed ledger technology, land administration, land registries.

DEFINITIONS

Secure land rights: Property rights that are legally protected, secure, recorded in a single, accurate, widely accessible electronic registry and that lead to high levels of formal ownership for all citizens (CIPE, 2013)

Land tenure: The rules and arrangements connected with owning land, especially land that is used for farming (Cambridge University, 2018).

Tenure security: The legal right to continue living in or using a building, land, etc. that is rented from the owner**,** with security against arbitrary rent increases and landlord's attempts to repossess the property through eviction (Cambridge University, 2018).

Stool and Skin Lands: Land in south-Ghana is referred to as Stool Lands while in the northern region is referred to as Skin Lands (Biitir & Nara, 2016).

Blockchain Technology (BCT): Blockchain can be defined as *"a shared, immutable ledger for recording the history of transactions. It fosters a new generation of transactional applications that establish trust, accountability and transparency."* (IBM, 2018). Although no formal definition has been agreed on, blockchain is a combination of cryptography, shared/distributed database technology (P2P) and trustless consensus mechanisms.

Cryptocurrency: A digital virtual currency which is being transacted amongst investors using blockchain technology.

Tokens: Digital currency most often in form of cryptocurrencies, which are used to incentivize people on the network to make accurate validations of transactions.

Bitcoin: The most acknowledged and traded cryptocurrency to date, which also characterizes the classical open blockchain structure with Proof-of-Work protocols as the validation mechanism.

Distributed: All copies of one document are constantly and automatically synchronized, hence they are identical at all times. Furthermore, "there is no canonical copy; all copies are created equal" (Berryhill, Bourgery, & Hanson, 2018)

Immutability: The concept describes that something is unchanging over time or unable to be changed. In the context of Blockchains, it means once data has been written onto a blockchain, not even a system administrator can change it. Immutability allows senders, receivers, and any interested party to be able to verify that data have not been altered.

Nodes: A node is simply a user or computer on a blockchain platform that is running blockchain software (Berryhill, Bourgery, & Hanson, 2018). Nodes maintain the distributed ledger such that information is always synchronized across all nodes. Mining nodes perform tasks of validating transactions while other nodes ('lightweights') are devices such as smartphones that only produce data but do not validate transactions.

Hash: A function that converts an input of letters and numbers into an encrypted output of a fixed length. A hash is created using an algorithm and is essential to blockchain management in cryptocurrency (Investopedia, 2018).

Double spending: The risk that a digital currency can be spent twice. Double-spending is a potential problem unique to digital transactions because digital information can be reproduced relatively easily.

Mining Pools: A mining pool is a joint group of cryptocurrency miners who combine their computational resources over a network (Investopedia, 2018).

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INTRODUCTION

The emergent topic of blockchain technology (BCT) has been examined as a potential silver bullet for fighting corruption and strengthening property rights through immutable, transparent and secure registration of land (WEF, 2016) (The World Bank, 2017) (WEF, 2018). Today, 19 of more than 200 blockchain-projects in 46 countries explores the technology's potential in land administration and land registries, indicating a solid interest in uncovering the potential symmetries of BCT, land registration and secure property rights (Berryhill, Bourgery, & Hanson, 2018) (IFC, 2017) (UNRISD, 2016) (Deloitte, 2017). In addition, BCT is also suggested for addressing de-risking and deliverance of financial services in emerging markets, governance of development aid, and as a tool for reaching the UN sustainable Development Goals (Danida, Sustainia, & Coinify, 2017) (Myers & Lubin, 2018).

The majority of reports from institutions such as the IFC, WEF and the UN has primarily been focused on the potential of BCT and its many use-cases. Much less effort has been put into implemental considerations, implications of current policies, environmental contingencies and infrastructural challenges that inevitably influence the capability of using BCT (Pisa & Juden, 2017). In a recent research article covering benefits of BCT in governments, Ølnes, Ubacht and Janssen argues that too much literature deal with the possibilities of BCT but *"tend to ignore the issues located between extremes, such as implementation, trade-offs, limitations, materiality and governance aspects"* (Ølnes, Ubacht, & Janssen, 2017, p. 355). A similar statement has been made by blockchain critics such as Rod Thomas, who emphasizes that BCT need to be demystified, bypassed from the 'hype' and instead research must be focused toward *"bringing a sense of reality to the debate"* to *"deal with the hard-hitting realities of the necessary requirements (...) before implementation"* (Rod, 2017; pp. 362).

This academic research paper will strive to do exactly so, by analyzing the potential of BCT in solving some of the problems in Ghana's land administration system. The system and its stakeholders will be used as a case to evaluate whether BCT is compatible in better securing property rights by adressing the identified issues of land administration and provide a more realistic picture of its potential when putting such novice technology to use in a development setting.

The following chapter will take point of departure in the case study of the long-residing problem of property rights in Ghana and the role of institutions in securing these fundamental rights.

CHAPTER I - PROBLEM STATEMENT

1.1 Problem identification

The Republic of Ghana in West Africa is squeezed in-between Burkina Faso to the north, Togo to the east and Cóte d'Ivoire to the west, commonly known as the Ivory Coast. Ghana is known for their dual registration systems of land rights that is split between the official government and the customary authorities that administrate land in the peri-urban and rural areas of Ghana (Hughes, Knox, & Jones-Casey, 2011). Approximately 80% of land is held under the customary system, while the remaining 20% is recorded within the statutory system, i.e. formally registered and protected land (LandLinks, 2013).

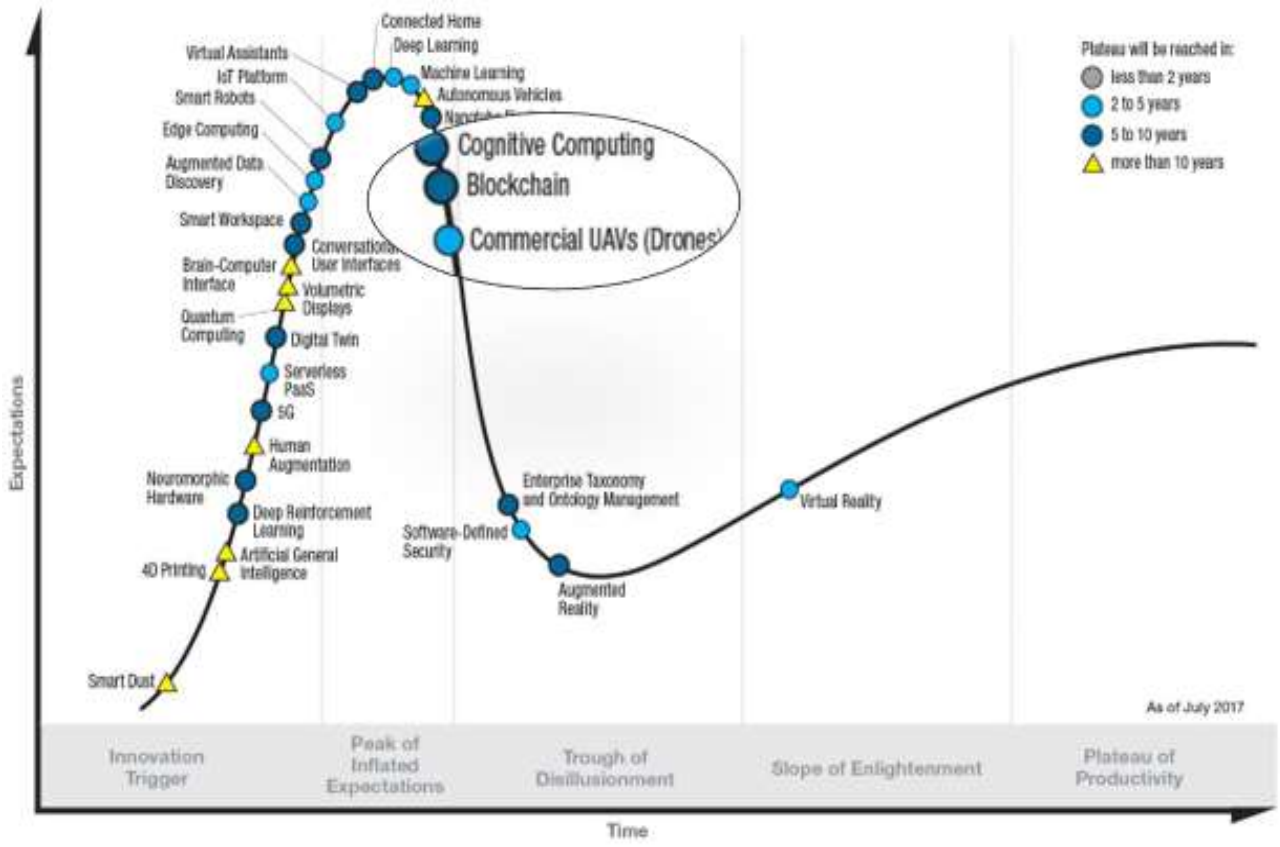
Ghana has for many years been struggling with formalizing land ownership and the enforcement of tenure and property rights and is accredited to be one of the primary inhibitors for sustained growth and underinvestment in the agricultural sector (ibid.) (Gradstein, 2004) (Feder & Nishio, 1999) (Besley & Ghatak, 2010) (de Soto, 2001).

Ghana struggles to develop strong property rights regimes and the institutional well-being is ranked 69th of 144th in the Global Competitiveness Index placing the country amongst many other SSA countries (CIPE, 2013) (WEF, 2017). As a consequence, an immense reform-plan by the Ghanaian government and the World Bank was initialized in 1999 to lay the foundation for Ghana's future land administration, under the name of the *Land Administration Project (LAP-1)* (MLNS, 2018) (The World Bank, 2003). Beside their effort, the project has not yielded good results and was evaluated *moderately unsatisfactory* by the Implementation Completion and Results (ICR), an independent evaluation-unit of the World Bank (The World Bank, 2013). As the LAP-1 ended in 2011, the 2nd phase (LAP-2) was initiated with the primary objective to consolidate gains made under the initial phase (MLNS, 2018) (The World Bank, 2011).

With the emergence of BCT, a general-purpose technology that facilitate exchange and transaction of information and digital assets, both NGO's, supra-national organizations and entrepreneurial firms are looking into its use-value in land administration in Ghana and several other development countries such as Kenya, India and Georgia (Mwanza & Wilkin, 2018) (Oprunenco & Akmeemana, 2018). Developed and transition-economies such as Sweden and Russia have gone further and are currently piloting government-backed projects of land administration through BCT (ChromaWay, 2018) (Ministry of Economic Development, Russia, 2017). However, scholars and field experts call for much required research on the externalities that such technology will be imbedded into (Ølnes, Ubacht, & Janssen, 2017) (Rod, 2017) (Lemieux, 2016). A general tendency of new technologies is the hype that follows in the initial years, both in organizations and the general public. As experienced with the emergence of the internet in the 90's and the following IT bubble in the 00's, technology hypes can cause stakeholders to overlook the dangers of adopting infant technology and overstate its use-value (Gartner, 2017).

As seen in figure 1-1, expectations of BCT is still estimated as being inflated and is further characterized as being 5-10 years from mainstream adoption. Therefore, more realistic and in-depth research on BCT is required to assess its contribution to a more efficient, transparent and secure land administration system, and to create a better/realistic understanding of the infant technology's potential.

Figure 1-1. Gartner's Hype cycle



Source: (Gartner, 2017)

Today, the issues of property rights in Ghana are plentiful but have not been thoroughly investigated in relation to the capabilities of BCT. This will serve as a research topic and be driven by the need for a deeper and more realistic understanding of the technology and its potential in land administration and impact on property rights.

1.2 Problem formulation

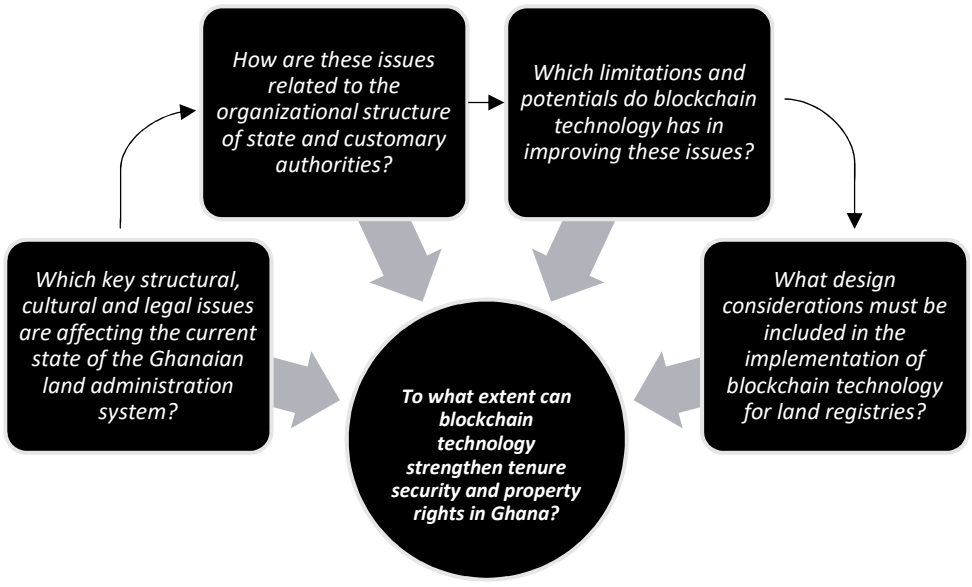
Fundamentally, the objective is to conduct an in-depth analysis of the issues that exist in the current land administration system and its relation to property rights and tenure security. The paper will then assess the potential of BCT in solving these issues and its impact on property and tenure rights. Last, implementational and design considerations will be discussed in relation to the feasibility of introducing a blockchain-driven land registration system. The author wishes to answer the following:

To what extent can blockchain technology strengthen tenure security and property rights in Ghana?

The following research (sub-)questions has been formulated to represent various sides that will be analyzed to answer the main research question. The questions will further be used to guide the researcher in fulfilling the objectives of this study.

1.3 Research questions

- *(1) Which key structural, cultural and legal issues are affecting the current state of the Ghanaian land administration system?*
- *(2) How are these issues related to the organizational structure of state and customary authorities?*
- *(3) Which limitations and potentials do blockchain technology has in resolving these issues?*
- *(4) What design considerations must be included in the implementation of blockchain technology for land registries?*



Given the four research questions that is heuristically represented above, the paper will critically analyze and discuss the potential of BCT in alleviating tenure and property rights insecurity.

1.4 Topic delimitation

The study delimit itself to the Ghanaian land administration system and the close actors involved in maintaining land records and administrating land on a national and local level. Within this breadth, the Land administration system is defined as including private land-registry organizations, the Lands Commission, its respective institutions and the Customary Local Secretariats as local structures. The World Bank has also been identified as a close actor involved in the establishment of the land administration, which therefore is included under this definition.

The study primarily deals with land tenure security and property rights in rural areas because previous academic literature suggests that property rights are particularly weakened in customary lands (Wily, 2011) (Knight, 2010). It was therefore decided to primarily focus on peri-urban and rural areas of Ghana.

The paper includes political perspectives but will however not comment on the broader subject of political tensions between opposing parties of the central government. Political perspectives and underlying political motives between government and local authorities is included as it is considered important for analyzing for the current state of the land administration system. The paper examines the surrounding institutions of land registration (courts, legislation and alternative dispute settlements) but only to evaluate the legal law in regard to the requirements for registering land, customary law and how disputes are handled at the local level. The reason for excluding dispute-mitigation, is because it lies to far from the main topic of this paper. In a more extensive analysis, mitigation could be included. A theoretical discussion of the importance of enforcing property rights is included in chapter III and VII to obtain an academic and critical perspective throughout the paper.

The physical infrastructure in Ghana and of the further development of BCT are also discussed briefly. In order to gain knowledge regarding the use of blockchain technologies in similar or different circumstances, a perspectivation to other projects outside Ghana is be included in the paper. However, only specific and closely related perspectives from other countries has been included to extrapolate useful insights and to attain critical thinking.

It was chosen to leave out an analysis and discussion on costs and funding of a blockchain-based land system because little documentation of either was found to base such an analysis on and would therefore provide no insights on the subject. However, it is acknowledged that any implementation of modern technology is substantial, especially when considering variable costs of emergent ‘untested’ technology.

CHAPTER II - RESEARCH AND DESIGN

2.1 Research philosophy

The research philosophy chosen is based on a pragmatic approach within the ontological philosophy framework. Given the pragmatic nature of the study and the evaluation of BCT in addressing issues of Ghana's land administration system and subsequent property rights, the study of objective cause-and-effect patterns fit neatly with this approach. However, it is recognized by the author that the Ghanaian situation of property rights and land registration is influenced by subjective opinions on best practices for land administration, the distribution of power and for who a change in status quo will favor the most. Such changes will further invoke subjective opinions as to who should be in control (e.g. customary authorities or the state) or how power should be distributed amongst the involved actors of the land administration system.

The chosen research philosophy is based on this recognition; more specifically, that a combined philosophy approach is better suited to incorporate both positivism and interpretivism perspectives. Pragmatism assumes that one approach may be better at answering some questions over others and a dual philosophical approach is needed when the topic being researched holds more than objective facts but also interpretation of subjective actions and behavior (Saunders, Lewis, & Thornhill, 2007). The base assumption for a positivist approach is that reality exist independently of the object being studied (ibid). Were the study purely about opinions and the interpretation and creation of these, a pure constructivist (interpretivism) approach had been chosen.

2.2 Research approach

An inductive approach is selected to answer the research topic. The characteristics of this approach lies in in the move from specific data gathering into generalized findings. The inductive approach has a good fit with the overall objective of the paper, namely to generate new insights that emerge from specific observations and data collected on the topic. The inductive approach is also useful in this paper because the author wishes to evaluate the applicability of BCT in an almost untested setting. Because BCT is infant and very little academic research and theory has been generated on its ability to perform in a specific environment, it makes no sense to base the approach on hypothesis testing before more elaborate research has been conducted. Instead, the goal is to gather data of both the technology and the environment it will be implemented into and thereafter form a generalization of its applicability in such a setting. The approach is thus that *theory will follow data* in the context of forming a better and deeper understanding of the technology's limitations and potential.

It must although be mentioned that a theoretical foundation is included in this paper. The point is however not to test the theories but rather use them to better understand the findings of the analysis and discuss them in accordance with the theories Were the main objective to test the fit with theories in explaining phenomenon's, a deductive hypothesis test approach would have been chosen.

2.3 Method

To answer the research topic, both quantitative and qualitative data has been used. The study is classified as an exploratory study because the purpose of the research is to investigate the inherent nature of insecure property rights and the Ghanaian land administration system. Only apparent hints of the problem and its impact has been found, henceforth a deeper exploration of insecure property rights in relation to BCT is required. An exploratory study is particularly valuable in discovering *"what is happening, to seek new insights; to ask question and to assess phenomena in a new light"* (Robson, 2002, p. 59).

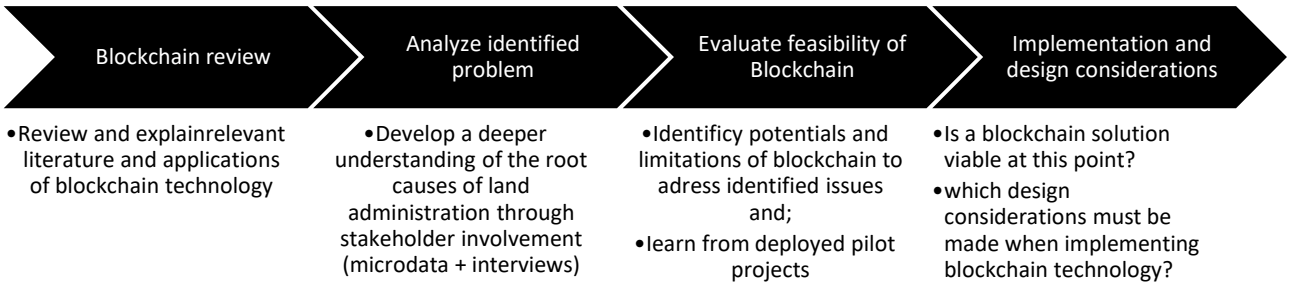
First, to uncover the issues of property rights and land administration in Ghana this study adopts a dual data collection approach. Qualitative interviews with stakeholders gave the required depth to understanding fundamental issues. Before interviews were conducted, a thorough academic search was made on existing literature that explain the various sides to the problem. The interviews thus fill out the blanks and help include potential implicit or uncovered issues, causality aspects and explanations to the problem. It must be noted that Ghana is a developing country which translates into less-developed information channels compared to developed nations. The qualitative interviews also act as a counterweight to this issue.

Microdata has been retrieved from the World Bank and later processed using statistical software to investigate the perceptions of property rights and to measure the degree of sub-categorical issues of disputes over land. The method for data collection is thus a mixed-method research because the paper relies on quantitative and qualitative data collection techniques that are sequential, i.e. collected separately from each other (Saunders, Lewis, & Thornhill, 2007). This also implies that quantitative data is analyzed quantitatively, and qualitative data is analyzed qualitatively (ibid.).

In regard to the third research question, namely the evaluation of BCT in improving the identified issues of property rights and land administration, a subtler and less structured method was required. Knowledge of this subject has been retrieved by reading dozens of research papers, reports and articles and by being involved in blockchain communities, workshops and lectures. The evaluation between the identified issues of the first research question and BCT attributes occurs through a sequential discussion; each of the identified problems has been weighed against traits of the technology and a discussion of its applicability as a solution followed.

2.4 Research design

A case study-approach was selected for this paper. The Ghanaian land administration system act as the case-setting while private organizations is included as individual cases that highlight important sides to land registration in peri-urban and rural Ghana. Empirically investigating a phenomenon with a real-life context provides both concrete answers to blockchain applicability in that particular environment but can also be indicative of forming more generalized insights in other settings (Robson, 2002). However, the impact of the environment must be well considered before any generalizations can be made.



The approach was to conduct a review of BCT to concretize the technology itself, its use-value and the more unknown sides to the technology. By collecting and selecting important conclusions and facts from research papers and other relevant sources on BCT gave a broad overview and understanding of the attributes and limitations of the technology. The review also provides the reader with fundamental knowledge of the technology and will serve as an important contributor to understanding the following chapters of the paper.

Second, a deeper understanding of the Ghanaian land administration system and its core components was obtained by contacting experts and involved actors that has been identified as being close to the studied topic. Knowledge has been retrieved in form of interviews, e-mail correspondences and document exchanges. Two blockchain organizations operating in Ghana were included as case studies to provide a broader perspective on how BCT can be utilized. A third blockchain organization operating in Sweden and India has also been included. The cases has been discussed relative to the feasibility of BCT and the approach they have taken to secure land rights through the use of BCT.

Third, the suitability of BCT were evaluated on blockchain attributes and traits and discussed according to identified issues and the case-projects analyzed.

Last, a discussion regarding implemental considerations and choice of architectural design relative to BCT has been made. The discussion focuses on a long-term orientation toward developing a better performing land administration system in Ghana.

2.5 Data Collection

2.5.1 Primary data

1.1.1.1 *Microdata*

Raw microdata from the World Bank on the perceived tenure security of citizens in the Awutu, Effutu and Senya Districts has been processed using Stata 15 while graphs and visual representations has been done in Excel. The microdata was collected during 2010-11 and later released on November 2015 for public access (The World Bank, 2010/2015). Specifically, data was analyzed to give insights to 3 distinct areas: (1) land registrations and contract relations, (2) disputes, causes and resolution channels and (3) land alienation.

The World Bank has been a key stakeholder and supervisor of the Land Administration Project initialized in 2008 and stands as a credible source of information. Up-to-date quantitative data has proved to be too difficult to collect due to time and monetary restraints and limited access to participants which are to be found within the Ghanaian community itself. Instead, the thesis relies primarily on quantitative data obtained through The World Bank and the conducted interviews done by the author.

1.1.1.2 *Interviews*

A total of 3 interviews were made with Land Layby, Bitland and the World Bank. The interviews were conducted after reviewing relevant literature to gain an understanding of the subject in general and to get an overview of which sides that had not been enlightened. In this way, questions could be incorporated into the interviews such that insights could be obtained that was not initially covered by the literature. The sequential approach also helped form precise questions to the interviewee and gave good grounds for conducting the interviews on an elevated/higher level. Transcripts of the interviews was made and thereafter fitted to exclude irrelevant information and increase readability. The transcripts were made using transcribing software and has been attached in appendix D in this paper. The Interviews with stakeholders was conducted throughout the second quarter of 2018.

The World Bank

Document-exchanges and an interview were made with Victoria Stanley, Senior Rural Development Specialist at TWB, who have been the primary consultant and supervisor of the Land Administration Project in Ghana (The World Bank, 2018) (Land Portal, 2018). Victoria has proved important to gain insights to the political and structural issues of the current land registration system. Several informal conversations occurred during the data collection period while the initial meeting was set up as an interview. Victoria Stanley gave in-depth knowledge on the current development of Ghana's Land Administration Project and was also helpful in uncovering the structure and roles of the state and land divisions. She further ascertained power structures in regard to local authorities, chieftains and tribes that act as custodians of land in rural areas of Ghana.

Land Layby

Land Layby has most recently started a blockchain pilot-project in Ghana under the name of Land Layby Listings (LLL). The focus of the interview with Raymond B. Kaniu (CSO) was twofold; (i) provide clarity to Land Layby's newly started operations in Ghana and (ii) their strategy and business model for implementing a blockchain land registry in Ghana. A series of questions was formed based on good interview practices and further fitted to the match the specific context of the interview and the extrapolation of the interviewee's knowledge. The interview conducted proved to give valuable insights to how Land Layby will implement a functioning blockchain land registry system in Ghana.

Bitland

An interview was conducted with Larry Christopher Bates (CSO) of Bitland Ghana, to clarify their role in land registration in Ghana. The interview gave some insights to the operational issues of using BCT in a development setting and further provided some clarification in the importance of involving the customary community in decision-making and mapping their own land.

Both Bitland and Land Layby were very useful in understanding the practical context of IT in development countries while their business models served as important contributions to the discussion of legal enforcement of property rights and land tenure. The interviews further gave a thorough overview of their approach to registering land.

2.5.2 Secondary data

Benben Lands, a company operating in Ghana with land information queries, property record management and electronic land transaction has provided the author with technical documents on land registration and property evaluation practices in Ghana. The documents were shown to be useful in understanding the processes of registering property in Ghana. An interview with Benben Lands was not possible to conduct after an initial request was made. The paper makes use of most recently produced and peer-reviewed academic articles in acknowledged journals. However, the limited literature on some specifics of land registration in Ghana and particularly BCT itself require a broader inclusive approach of documents by NGO's, government and supra-national institutions. Moreover, less-academic articles covering BCT was included because only scarce academic work has been produced on certain areas of BCT.

2.6 Validity and reliability

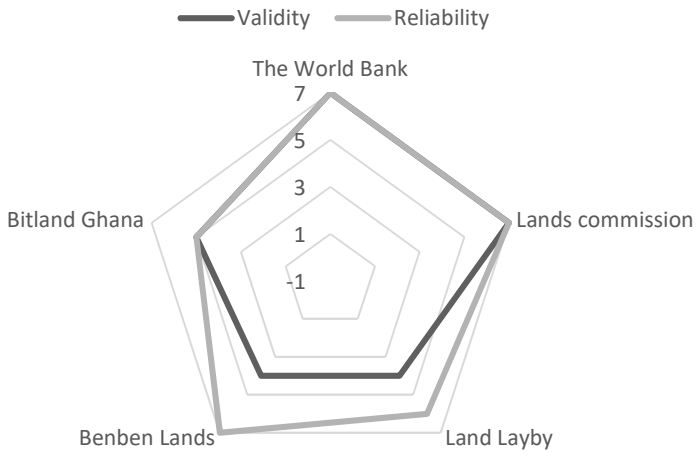
The limited academic literature thus poses considerations of the reliability of the findings in this study. Because more academic research is required to accurately depict the use-value of such infant technology, it may be possible for later studies to reach different conclusions regarding the technology's potential or find other evidence that improves / inhibits its use in land administration and its impact on property rights.

Further and more extensive research is therefore encouraged on the interlink between BCT and land administration to validate or disprove the findings of this study.

2.6.1 Reliability and validity of data

Given that this study is partly driven by qualitative data, a data quality assessment was made. Data quality was evaluated on two parameters on a 7-point scale; *Validity* pictured as distance to the source of knowledge and *Reliability* of the source itself. The scale is represented in chart 2-1 as a radar chart. For example, the World

Chart 2-1. Validity and reliability measures on data



Bank is rated 7 on both parameters because the source of information is viewed as very reliable while the validity of the information itself is valid to gain insights to the issues of the land administration system. Benben Lands, Bitland Ghana and Land Layby have scored lower on the *validity* dimension because they are private organizations operating independently of the formal land administration system. The validity is therefore perceived lower because they are not part of the formal land registry in Ghana. Furthermore, Land Layby has only operated in Ghana for a short period, which results in a lower score on the validity parameter relative to Bitland and Benben Lands.

In regard to the *reliability* of data, the private organizations have scored lower in general as compared to the World Bank and the Lands Commission. This score reflects the natural subjectivity of private organizations that have much at stake and are less inclined to disclose negative information of their company or their

performance. Benben Lands scored high because only formal reports were exchanged which was considered credible.

The lower score is also a reflection of the authors perception of *credibility* during the interview process. The use of technical interview-skills during the interview was meant to place critical questions and take note of the interviewee's response. When critical questions were asked it was also perceived how the interviewee responded and the precision of his answer. The technique proved usable during interview questions where it would be expected that the interviewee would have subjective opinions that concerned their company's integrity or business model and helped evaluate the data collected afterwards.

2.7 Access to data

A great extent of this paper given the nature of qualitative studies, was to retrieve, select and evaluate pieces of information from various stakeholders of the Ghanaian land administration system and adapt it to knowledge previously gained through literature analysis. The study is thus a continuous process of learning in which new information was either analyzed further or cut from the study if it had no meaningful insights to the research objective.

Retrieving information in some circumstances proved challenging because identifying and accessing specific stakeholders was not as intricate as initially thought. Setting up interviews was difficult because several organizational gatekeepers complicated the process of getting through to the right people. It was emphasized to reach people in executive or senior positions who had direct knowledge of their operations in Ghana, which added to the complexity of the qualitative data collection.

Establishing an interview with the Lands Commission was not possible as they did not respond to requests or emails after initial contact was established with Executive Secretary, Wilfred K. Anim-Odame of the Lands Commission. The inclusion through an interview could have been worthwhile for the depth of the analysis because of their active role in the land administration system. Some useful documents regarding the registration process and the organizational structure was although shared with the author through e-mail.

CHAPTER III - THEORY

A theoretical section has been included in this paper because it legitimatizes the research narrative in a broader context than simply identifying issues of land administration and potential and limitations of BCT. Second, the included theory can provide clarity of the role of the institution in securing property rights and help explain some of the findings from a theoretical standpoint

Two theories will be described here and later used in the discussion section, namely Institutional theory and Contingency theory. The concept of organizational decentralization related to institutional theory will be included later in the paper where applicable.

3.1 Institutional theory

The theory of institutions by Douglas C. North is used to create a base for understanding the importance of institutions and its connection to economic performance. North was a pioneer in understanding the role of institutions for achieveing prosperity and economic development and will provide this paper with a theoretical backbone for discussing the Ghanaian situation. The theory further highlights the importance for the Ghanaian government to put effort into securing property rights for the benefit of its citizens and the national economy. North argues that institutions has a direct economic effect on growth and performance of an economy through the enforcement of property rights. Furthermore, by reducing transaction costs and uncertainty through formalized procedures in the exchange of goods, efficient trade is established (North, 1991).

North also describes in his paper, *"Institutions",* the major development stages a nation will experience as the institutional infrastructure develops toward more complex structures and facilitates complex exchange and trade of goods (-and services) (North, 1991). As the society of a nation grows and cities urbanizes, North argues that markets *"need effective, impersonal contract enforcement"* because *"(...) personal ties, voluntaristic constraints, and ostracism are no longer effective as more complex and impersonal forms of exchange emerge"* (North, 1991; p. 100). In connection with the topic of this paper, his point would be that as communities grow beyond personal contractual relationships, the institutios increasingly play a key role in reducing uncertainty in exchanges of value between persons with no previous relationship and secure that exchanges are being traced and enforced in case of future disputes over the exchange. In other words, uncertainty, but also information asymmetry, increases transaction costs and should be dealt with on an institutional level.

3.2 Why some institutions do not evolve

North further argues that until security of property rights are in place, an efficient market will not evolve (North, 1991). Property rights often acts as security to later enable exchange of the property (i.e. goods, items, patents etc.). Such a security provide an incentive for the property right holder to invest time, energy and resources to improve the material quality of that property. Yet, some institutions do not evolve towards

securing such rights which would improve both the value of goods being exchanged and the monetary compensation for the good. North (1990) uses the analogy of primitive exchange in Suq's (bazaars) to illustrate his argument; A way of trading that has existed for thousand of years and still exist in some areas of Africa and the Middle East. He describes the Suq as a place with no price quotations, production reports and employments agencies. Product information is unhead of, and consequtive trading involves search for trusted partners to secure decent prices. In summarization, the Suq's is characterized by North as (i) high measurement costs; (ii) continuous effort at clientization (the development of repeat-exchange relationships with other partners, however imperfect); and (iii) intensive bargaining at every margin. In a generalized manner, profit is being generated from information asymmetries i.e. having better information of the trade than the buyer. Such a dynamic will benefit those better informed, most oftenly the merchant selling the good, as he knows the origin of the good and the amount spent creating it. Over time, the merchants being best at exploiting information assymmetries would benefit the most. As wealth is a predecessor for influence and power in Africa and Middle East (and to a large extent in Western countries also), the incentive to challenge status quo and regulate such information asymmetries, will dissapear. In other words, the institutional framework will simply not evolve if it benefits the people in power and not the majority of people. This effect is further strengthened if a democractic system is not in place to uphold for these unfair asymmetries that the majority of people suffer from and only few reaps benefits from.

3.2.1 Caravan trade

In tribal communities, the balance of power was often threatened from within and outside the community. Each person was always accountable for securing their own position of ownership. Customs in trading was flexible and so was the extent to judge whether an exchange of goods was executed rightly – it simply varied from case to case. Measurements in regard to weights and scales could vary and much of the payments for the exchange of goods was mutually agreed upon dependent on the quality and the quantity of the good. Furthermore, logs of transactions was mostly only recorded by the trader, but not done consequential. The non-existing standardized way of trade imposed some structural issues as caravan-trading began to expand outside these communities. This argument of Douglas North is closely linked to some observations made in rural Ghana and the link is made later in this paper.

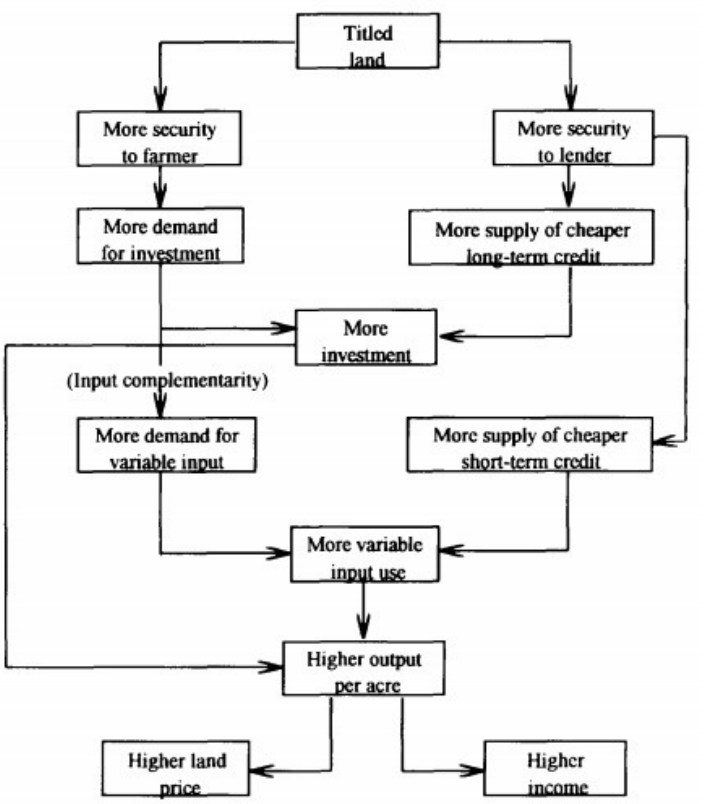
3.3 Economics of property rights (a conceptual framework)

A conceptual framework has been proposed by Feder & Nishio (1999) to explain the economics of entitled land rights and the subsequent ripple effects on productivity. It further demonstrates why institutions' role of securing property rights has a much more extensive importance when analyzing the subsequent effects on the economy. The framework was initially based on the economy of Thailand regarding rural farmers but are considered to have adequate explanatory effects in the Ghanaian case because of the generalizability of the model (ibid.).

The productivity and hence use of land is dependent on additional investments in the form of drainage, structures, clearing of stones and trees and other improvements that contribute to the use of the land (Feder & Nishio, 1999)

While the costs and expenses of these are realized initially, it cannot be considered sunk costs as the investment in both monetary and physical terms yield benefits over time. The expectations of the yield on investment is altered by the horizon of the ownership over the land, hence it depends on the risk of future challenges and potential disputes over the land, whether it be ownership disputes, eviction, invasion or simply expropriation by the local ruler. Such risks are commonly denoted as 'tenure insecurity' and will also be denoted as such throughout the paper.

Figure 3-1. Land security and productivity



Source: (Feder & Nishio, 1999)

Registry systems arguably emerged as an enabler for institutions to provide security to land owners in cases of disputes over the rightful ownership and thus acted as a risk-reduction measure which further reduced the time and costs a of solving a dispute. This allows for the rightful owner to allocate resources to investments instead. Further, it enables the user of land to obtain access to credit through financial institutions as the land can be used as collateral to guarentee the loan will be repaid. The mechanism of financial access to credit and reduced uncertainty through formal land rights will thus have a multiplying effect on the productivity of the land through increased investments (see figure 3-1). While borrowers also have the opportunity to access loans through informal actors if no collateral can be put as security for the loan, it would typically result in a much

more expensive solution given a higher interest rate to account for the increased investment risk of the lender. In other words, the securitization of land rights will decrease the chance of financial constraints to increasing productivity over a person which do not have formal land title rights.

Another aspect of possessing formal and legally binding land rights and proof-of-ownership is the effect on land and property prices in the scenario of a sale and is linked to the issue of assymmetric information.

3.3.1 Assymmetric information and title ownership

Asymmetric information increases when transactions occur between distant relatives, unrelated actors or when land markets expand, for example in the case of globalization. Beforehand, customary systems were sufficient as much of the transactions happened within a community and the buyer was often in close proximity of the seller (Feder & Nishio, 1999). Recent data shows that foreign investments in land in Sub Saharan Africa (SSA) and recent land demand has been surging, indicating that international actors are increasingly showing interest in land acquisitions and most likely have little to no relation with the seller of the land (Kauttu, 2014). This development calls for efficient statutory registry systems to improve market efficiency, reduce asymmetric information and uncertainty to facilitate better/accurate prices and ultimately better economic conditions for both parties. Furthermore, land that are not protected through formalization (registered) also bears the risk of being expropriated without any remuneration to the person living on the land (Gebre-Egziabher, 2013).

3.4 Contingency Theory

Contingency theory was initially introduced by the Austrian Psychologist, Fred Edward Fiedler in his article “A Contingency model of Leadership Effectiveness” (Fiedler, 1964). The theory was later adopted into organizational research (Donaldson L. , 2001).

The theory reviews the design of an organization as being constrained by environmental and internal contingencies that influences the organizational performance (ibid.). The organization thus tries to maximize the performance by minimizing the effects of these constraints. The theory further claims that there is no predefined formula or recipe for a fully optimal organization simply because some organizational styles fit better in some environments than other, and no environmental factors is the same. For an organization to be optimal, the approach should always be weighed against the internal and external factors that influence decision-making (ibid.).

Contingency theory thus emphasizes adaptive changes within an organization or institution to fit with the internal and external contingencies that affects performance (Donaldson L. , 2001). The three contingencies are environment (external), size and strategy (internal); a change in any of these shall result in a structural alignment of the organization to fit the new paradigm.

Contingency theory in an organizational context will be used to analyze the observed structure of the land administration and their multiple actors. It can prove to be important in explaining the inconsistencies that are imbedded in the land administration system today and why the observed choice of government structure was selected for land administration.

CHAPTER IV - BLOCKCHAIN EXPLAINED

4.1 Blockchain fundamentals

Blockchain (BC) technology, also known as Distributed Ledger Technology was initially introduced in a white paper named *"Bitcoin – A peer-to-peer Electronic Cash System"* by a person/group under the alias of Satoshi Nakamoto in 2008 (Marr, 2018) (Nakamoto, 2008). Nakamoto described the technology as *"A purely peer-to-peer version of electronic cash that would allow online payments to be sent directly from one party to another without going through a financial institution"* Which marked the beginning of virtual cryptocurrencies and the creation of new decentralized and digital money markets (ibid. p. 1). The general-purpose technology has further been renounced by Amy Webb as one of the most important technology trends that will disrupt and shape business and society for years to come (Webb, 2015).

The blockchain can be defined as a data structure that enables the creation of a digital record of transactions which is shared across a group of network participants (Nakamoto, 2008). The transactions are stored in a block that also contains a cryptographic hash of a previous block. The hash value is basically a digital fingerprint of the content inside, which is unique to that block. Since all blocks contain a timestamp and the previous block's hash value, the sequential order can always be determined, making it extremely difficult to alter the content or remove the block itself which requires internal coordination with the majority of network participants also termed 'nodes' (ibid.) (Pilkington, 2017).

BCT can be summarized as a composition of (1) *Cryptography* (data is encrypted), (2) *Distributed data* (transparency and immutability) and (3) *Consensus across people in a network* (one single source of truth).

BCT further has three major characteristics; It is **distributed, permissioned** and **secure** (IBM, 2018)**.**

The ledger is **distributed**, because it works as a shared form of record-keeping, ensuring no person or organization holds ownership of the entire system. For example, when a land documentation is being processed for a plot of land, everyone involved in the process is **permissioned** to have access to every record or piece of data needed to facilitate the process. Important to note, is that all participants in the process shares the same original file/document between them (i.e. there are no 'copies'). Further, no transaction can be added to the blockchain without consensus across the participants. This means that no individual person can alter the information being stored on the blockchain, making a tamper-resistant and **secure** storage of data. It further decreases the risk of fraud and error since all actions are recorded instantly.

In other words, a blockchain stores all details of a transaction including the information used in the process but only after consensus has been achieved by all parties. Everyone connected has access to the same identical information and the information cannot be changed after stored on the blockchain (See appendix 10-1).

4.1.1 The link with land administration and property rights

Blockchain has gained the attention in land administration because of the beforementioned characteristics. By utilizing an immutable record that has no centralized storage and uses encryption methods to safeguard against unauthorized access, the digital record of land transactions, deeds and titles can protect the land owners' physical assets from being altered, stolen and misused. Because property rights are directly linked to documental proof that an asset is indeed his/hers, BCT offers a (potential) revolutionizing way of securing these rights through immutable, decentralized record-keeping.

However, because BCT is an infant technology, very little research exists on the implications of using the technology and few academic studies has been made on whether the technology truly can protect property rights when considering the external environment and the multitude of factors that also affects secure rights (Anascavage & Davis, 2018). Even less research has been made on the use of BCT in developing countries where property rights are believed to be particularly weakened.

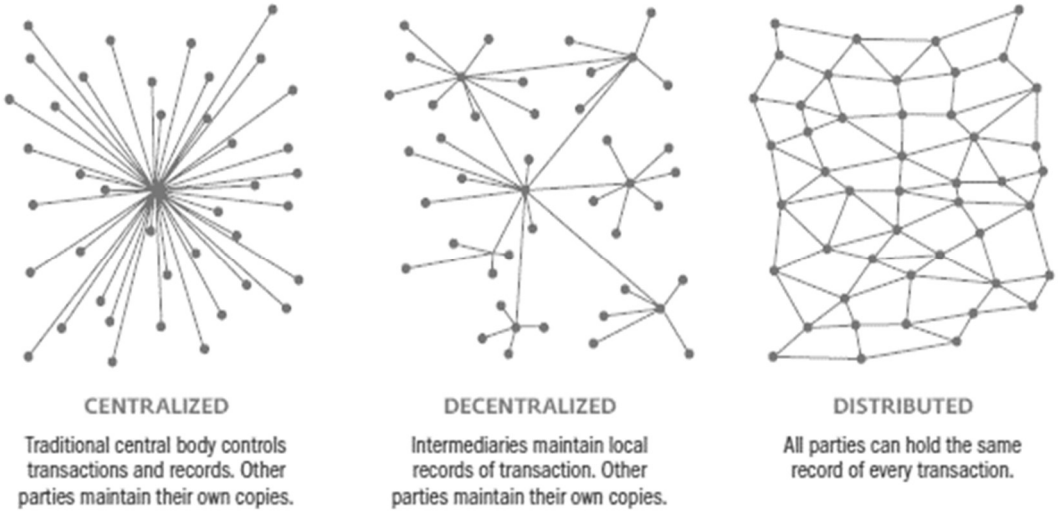
4.1.2 Cryptography

BC technology shall be understood in the context of cryptography and cryptographic techniques, which in essence allows for the protection of sensitive information in the broadest sense; information can be essentially all type of data, whether it be currency, licenses, patents, government documents and transactional information (ET, 2016). Cryptography is primarily based on mathematical theory and computer science and can be understood as the process of converting plain text into unintelligible text and vice-versa. It is thus also a technical method for storing and transmitting data in a format that only persons with the right cryptographic key can process and read. An example of early cryptography or "encryption" as you may, can be understood as the ENIGMA machine/typewriter during the WWII (Koldbye, 2008). The machine was used primarily by the German navy to transmit secret codes of instructions to distant parties, without the Allies being able to interpret it.

4.2 Peer-to-peer networking

While BC technology uses cryptographic techniques to encrypt the content being stored or transmitted, BC technology has several other layers and dimensions added to it. First and foremost, BC technology utilizes peer-to-peer (P2P) networking, a term known from Computer Sciences (TechTerms, 2012). In such a network, a user utilizes and simultaneously provides the network at the same time, through their computer system, referred to as a 'peer' or 'node'. A peer makes a portion

Figure 4-1. Classification of information systems



Source: (World Bank, 2017)

of their computer system available to others on a network, whether it be database-storage, processing power or network bandwidth, without any need for coordination by a central authority (3rd party). This setup refers to the **distributed** characteristic of blockchain as pictured in figure 4-2 because the component being shared is independent of a central server and thus operates purely by utilizing each peer's own system while only having a single digital ledger distributed between them.

In contrast to a centralized system, for example when a professor downloads a recently submitted study paper from a student, the file has been stored by a third-party (the university) on a centralized server, which acts as an objective 'keeper' of that study paper to ensure that neither the professor or student has changed or altered information after a submission-deadline. In such an example the 3rd party coordinator is the university. The file being put on the centralized server is basically a copy of the original file. In a P2P system, only the original file would exist between the professor's and student's computer and the blockchain would ensure that nothing had been tampered with after a deadline had been met.

Another example is the purchase of a product from an online retailer; here, the financial institution assures that the buyer has wired money to the retailer before the product can be shipped to the customer. In a peer-to-peer

network such a third-party does not exist which make the transfer of data vulnerable to fraud or opportunistic behavior – it would simply rely on mutual trust that the buyer will pay, or the retailer will ship the product.

4.3 Consensus protocol

So why can the P2P network be considered secure when no validation or 3rd party actor is involved? This is because the file is stored on the blockchain and relates to the immutability characteristic the technology provides. However, to validate that a file truly has been submitted ('transacted') digital witnesses must be present that can reach a consensus that the file has indeed been sent. To circumvent this problem and thus create 'trustless' transactions, Satoshi Nakamoto invented a revolutionary way of assuring trust through digital witnesses when sharing a file, making a payment online or conduct any other transaction with another party online. His solution was termed the *'Proof-of-Work'* (PoW) or *'Nakamoto-'* consensus mechanism which solved a longstanding technical problem in Computer Science referred to as the *'Byzantine Generals' Problem'* formulized in 1982 (Lamport, Shostak, & Pease, 1982) (Vaidya, 2016). Today, there are however several other consensus protocols available while the PoW protocol is the original mechanism that is still being used in the Bitcoin network today.

4.3.1 Proof-of-Work (PoW)

With a typical Bitcoin transaction, it can be explained how such a community-authenticated transaction works. When a Bitcoin is being traded, a group of unrelated individuals termed 'miners' receives an algorithm puzzle with a specific hidden transaction code inside (Pisa & Juden, 2017) (Acheson, 2018). The transaction can only be confirmed and processed when several of the unrelated individuals has solved the algorithm by spending a large amount of their computing processing power. In exchange, the individuals are rewarded with tokens as proof of their work, hence the term 'Proof-of-Work'. This token has monetary value and can be used as an online payment for goods and services. The miners only get compensated if the algorithm is solved correctly and only a proportion of the most efficient miners are rewarded for their effort. The miners therefore act independently and with the sole purpose of verifying a specific transaction, disguised within a complex algorithm. The mechanism of miners receiving tokens in exchange for accurately validating transactions is thus a replacement for a single third-party. Further, the miners are anonymous and cannot be contacted in advance of a transaction, which ensures illegit coordination is impossible.

4.3.2 Proof-of-Stake (PoS)

Opposite of the PoW protocol, PoS utilizes predetermined transaction fees as rewards for validating transactions (Lisk, 2018). In this protocol, individuals deposit an unspecified number of tokens into the network also referred to as the 'stake'. Dependent on the amount of stake an individual has, the higher the chances are that he will be chosen to solve the algorithmic puzzle and forge the next block thus validating the transaction. The stake further acts as a security deposit to secure that the individual doesn't approve fraudulent blocks (ibid.).

Since the protocol is not based on competition as in PoW but rather is parallel to a lottery, the network uses considerably less electricity and is more efficient in approving blocks because algorithms are not nearly as difficult to solve while competition to solve the puzzle is removed. The miners, in PoS terms named ‘forgers’, are also anonymous which assures bribes cannot alter the incentives to validate only rightful blocks.

4.3.3 Validation and consensus

Important to mention is that reaching consensus and validating a transaction is not the same thing. Validation happens only by one or few of the ‘miners’ or ‘forgers’ when they solve the algorithmic puzzle or approve a transaction and continues to broadcast the solution to the network. All nodes then reach consensus by assuring that the particular algorithmic solution offered by the miner, gives the same result. It is much easier reaching consensus once the algorithm has been solved because the mathematical formula has been found; nodes only need to confirm that this formula is indeed correct. As with the Enigma machine, once the algorithm was cracked, the Allies could easily interpret the content of the encrypted messages and similarly to the nodes on a network, confirm that messages was transcribed in the same way.

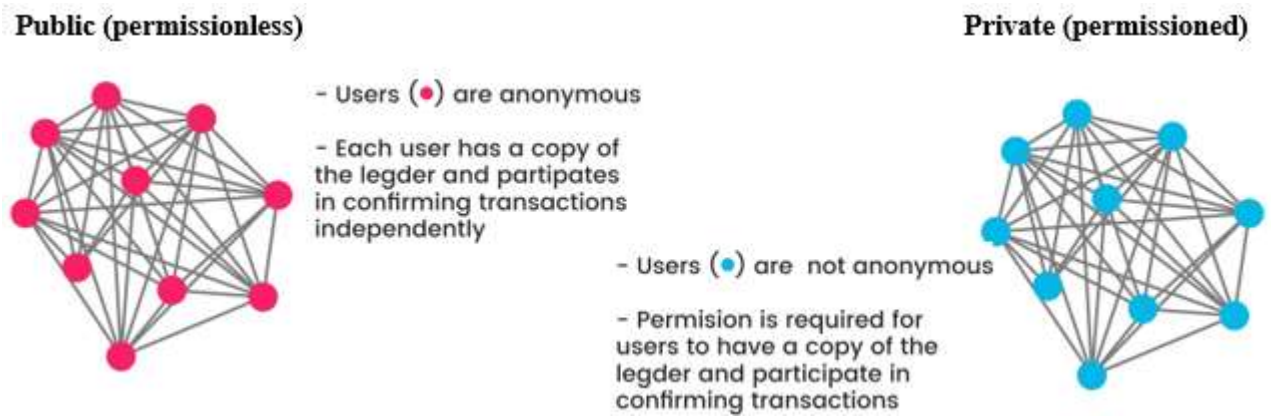
4.3.4 The GIGO principle

It is also important to note that the Garbage-in-Garbage-out (GIGO) principle is still at play implying that the validity of the data itself is not secured by the consensus mechanism; the nodes only reach consensus that a transaction of a particular set of data has taken place. Information which contain heterogenous content and thus varies from transaction to transaction must therefore be surveyed before being put on the blockchain.

4.4 Blockchain structures

Two main types of blockchain structures exist, namely private (permissioned) and public (permission less) blockchains (Sinrod, 2018). Some hybrids do exist which will be elaborated in chapter VIII.

Figure 4-2. Public (permissionless) and private (permissioned) blockchains



Source: Own creation using

4.4.1 Public blockchains

Public blockchains operates on an open network in which the authenticity of transaction is confirmed by the miners that compete with each other to verify that a transaction has taken place (Sinrod, 2018). Such a network is characterized by complete openness to all participants (nodes) where everyone has access to the same digital ledger and all information is accessible (See figure 4-3). Furthermore, anonymity of nodes (users) are imbedded to prevent corruptive actions between nodes on the network.

4.4.2 Private blockchains

When blockchains are considered private, the information shared amongst the participants are being administered through moderation (Sinrod, 2018). This means that authenticity and verification of transactions on the private ledger happens through dedicated administrators on the network who also controls which information is being shared with all nodes on the network. Such a structure is yet to be demonstrated in full scale such as the bitcoin network but has been proposed as an optimal solution to e-governance in the public sector because it mimics existing systems with verified administrators (Ølnes, Ubacht, & Janssen, 2017).

In other words, Nakamoto's innovation, which is basically an innovation in accounting, was based on the idea that validation can be achieved, by incentivizing nodes (persons) on the network to solve a cryptographic maze in exchange for a token (Pisa & Juden, 2017). The maze, once solved, would then produce a record of transaction that all participants can see* (*dependent on whether it is public or private ledger). Since the Proof-of-Work only can be achieved by investing a large amount of processing power and thus incurs high electricity

cost, honesty is encouraged, and also makes it extremely difficult to be dishonest. This mechanism is important to understand why BCT has experienced such an interest from organizations in the developing world where institutional 'trust' is lacking and authentication untrustworthy. It reorganizes the basis of approving transactions and securing consensus of information shared between parties.

4.5 Smart contracts

The term 'Smart contracts' refers to an automated execution of a process found within a transaction (IBM, 2018). Basically, the idea is that contracts are 'self-executing' without any human intervention when certain terms and conditions have been met (See Appendix 10-2). Typically, when a contract is signed between a house buyer and seller, the money is transferred to an escrow account held by a reliable 3rd party until all details of the contract have been met (e.g. two weeks' notice, title had been received, mortgage is approved etc.). With smart contracts, the execution will happen when all criteria from the buyer and seller (and potentially other actors) are aligned with the specifics negotiated and recorded on the smart contract. This enables transactions to be less dependent on human interaction which can be a source of inefficiency in a system with many manual processes.

Smart contracts have also been referred to as 'code is law' because they can act and carry out procedures based on pre-specified scripts i.e. programmable codes built into the contract (Filippi, 2018). Such scripts can mimic law that govern contractual relationships between individuals, firms or governments. However, the concept that 'code is law' has been criticized by several scholars on the argument that code cannot replace law because law will always be subject to interpretation and coded systems will never be able to contain this characteristic (Rod, 2017).

4.6 Blockchain limitations

To attain a realistic perspective on BCT, it must be mentioned that the technology has inherent flaws and inconsistencies that negatively affect its use-value in land administration. The following section will be dedicated to highlighting key issues that are prevalent in BCT today.

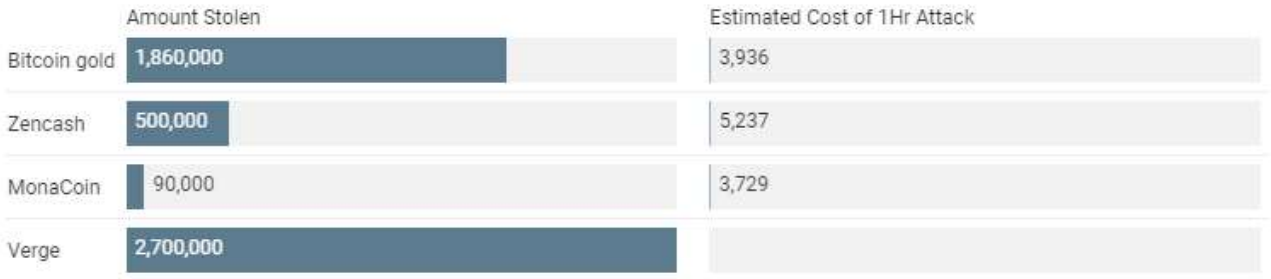
4.6.1 51 percent attack

Manipulating data stored on the blockchain is extremely difficult. However, it is still possible through a 51% attack mentioned in Satoshi Nakamoto's white paper (Nakamoto, 2008). The term refers to the scenario of "overpowering honest nodes" and is linked to the issue of the Double-Spending Problem that exist in digital currency (Hruska, 2014). In the event of a person achieving control of more than 50% of the processing power or nodes used for validating transactions, the person can add transactions and broadcast them to the network. It though implies that the person would need to be in control of many thousands of computers and combine their computing power to validate transactions.

This problem is perceived as the single and most pressing threat to the Bitcoin network as it compromises the essential of the bitcoin system, namely that the transaction is considered valid if it's validated by a majority of the nodes (>50%) (Varshney, 2018) It was for several years only a theoretical scenario but was first realized in January 2018. Most recently, in May 2018, 5 of these attacks happened on 4 cryptocurrencies giving weight to a serious shortcoming of public blockchains running on the PoW protocol. Figure 4-3 shows the type of cryptocurrency that experienced a 51% attack in May and the amount stolen denoted in US dollars.

The 51% attack can have crippling and withstanding effects if the land registry were to be based on a pow system and is at this point a real threat to blockchain systems. The attacks were possible because of an accumulation of central processing power found in PoW consensus mechanisms, referred to as mining pools (see definition section).

Figure 4-3. Events of successful 51% attacks



Source: (Hertig, 2018)

4.6.2 Price fluctuations

Relevant to public blockchains, tokens of monetary value are the incentive for nodes on the network to validate the information before being put on the blockchain. Such a token gain value from Initial Coin Offerings (ICO); equivalent to stock market IPO's such as a stock being offered to a large pool of investor, a token derives its value from market expectation of the future performance. As seen with the cryptocurrency, Bitcoin, price volatility was immense, and the market was very unstable and almost collapsed several times since its introduction (Harwick, 2016). Partly because such ICO's are largely based on pure speculation and partly because the cryptocurrency market is yet to undergo strong regulation, the incentivization-mechanism is at risk of price fluctuations. This is an inherent flaw that can affect the stability and performance of public blockchains because a crash could disincentivize people to verify information on the network.

4.6.3 Scalability

A key impediment of current BCT is the issue of scalability. Scalability issues applies largely to public blockchains in form of data processing speed because the consensus mechanism dictates that data sent or received on the network must always be synchronized between nodes on the network (Young, 2018). In other words, to ensure that each piece of information is verified and confirmed, a consensus across all participants in the network is necessary. This has implications if the blockchain is open and thus in many cases has several hundred thousand nodes/participants on the network.

The above is particularly problematic under the original PoW developed by Satoshi Nakamoto. This is primarily because the PoW mechanism utilizes computing processing power with increasingly difficult algorithms to solve, which in turn increases the transaction time needed to solve it and thus add it on the blockchain. Secondly, a PoW mechanism consumes tremendous amount of electricity from the miners because of their increasing need for more processing power to be competitive. In regard to scalability and performance, a PoS consensus mechanism is better suited because it excludes miners and competition from the equation and thus improves the speed of adding new blocks.

4.6.4 Block size

An impediment for BCT to be used for database storage is the amount of transactions data which can be stored on a block. Secondly, because digital ledgers that contains the transaction data is distributed, blocks must be relatively small in size for the network to be efficient when synchronization occurs (i.e. Consensus has been established) between nodes. In other words, if the newly added block contains many Megabytes (MB) of data, synchronization times are increased and the rate of transactions per minute are slowed.

Block size restrictions therefore poses an issue for land registration because land recordings in many cases consist of several documents such as parcel (cadastral) information, legal documents, proof-of-ownership

(deeds, titles), identification papers and perhaps also financial information such as bank loans and bank approvals, accumulating to several Megabytes.

CHAPTER V - FINDINGS AND ANALYSIS

The findings have been structured into four main sections, namely structural, corruption, cultural and legislative issues. The distinction will help to provide a much-needed overview of the multi- and interrelated issues that exist in the Ghanaian land administration system. A brief analysis of the consequences will be given through each section while the discussion and relation to theories are elaborated in the discussion chapter. First, the findings from the analyzed microdata are presented. The reader is referred to the appendix for some of the tables. The microdata will be used to highlight fundamental issues that is later linked to issues in the context of land administration.

5.1 Insights from Microdata analysis

The latest survey data of Land titling in Ghana has been retrieved from microdata.worldbank.org and used in this paper by augmenting the data into valuable insights. Stata has been used to process data from a total of 3672 respondents from 20 communities in Ghana (The World Bank, 2010/2015). Not all respondents have answered all questions (only if applicable to them) which explains the lower number of respondents in the following tables. Tables that are not shown in the text can be found in the appendix. The microdata was initially split between male and female which required an amalgamation of the two data files (module_4_part_A_Female and module_4_part_A_Male). The data collection followed the CAPI approach and was based on structured questionnaires that was personally collected by trained enumerators (ibid.).

The microdata will provide a much-needed overview of the most fundamental issues of securing property rights and internal issues of land administration in Ghana.

5.1.1 Land registration

Of all respondents, 2734 or 91,32 % of respondents replied “no” to whether their land was registered at the local secretariat in the area (see Appendix 10-3). The remaining 260 respondents (8,68%) had registered their land or lease at the Customary Local secretariats (CLS).

The microdata did not give guidance to whether land or land records was registered/kept elsewhere than the CLS. However, Table 5-1 show that only *8* of *98* chiefs said they made formal written contracts with leaseholders while the remaining 85 (or 87%) has an oral contract with their land tenant.

Table 5-1. Type of formality agreements between customary authorities and the land tenant

A59 What was the formality of the contract at the time when you first gave out the land	Freq.	Percent	Cum.
Formal contract	8	8,16%	8,16
Oral contract	85	86,73%	94,90
Other (specify)	5	5,10%	100,00
Total	98	100,00	

Next, a computation of the respondent's knowledge about land registration was also conducted. The result show that 1802 of 2434 respondents or 74% said *"no"* to whether they have heard of a government program to register land in their area (see Appendix 10-6).

5.1.2 Disputes over land

Table 5-2. Number of disputes and frequency

A6b How many disputes have you had since you started using this land	Freq.	Percent	Cum.
1	97	69,29%	69,29
2	19	13,57%	82,86
3	12	8,57%	91,43
4	4	2,86%	94,29
5	4	2,86%	97,14
10	4	2,86%	100,00
Total	140	100,00	

Of 2,097 respondents, only 76 had experienced a dispute over land. Table 5-2 shows that the people that had experienced a dispute over land, 69% of respondents had experienced at least one dispute since their tenure began. Moreover, roughly every 3rd of respondents had experienced two or more disputes over the same piece of land.

Next, it was analyzed why such disputes arose. The data pictured in Table 5-3 that the majority of disputes (49%) are caused by multiple claims to the land followed by disputes over boundaries of land (41 %). Other causes of disputes were breach of contract by former owner (6%) and breach of contract by potential buyer (4%).

Table 5-3: Causes of Disputes

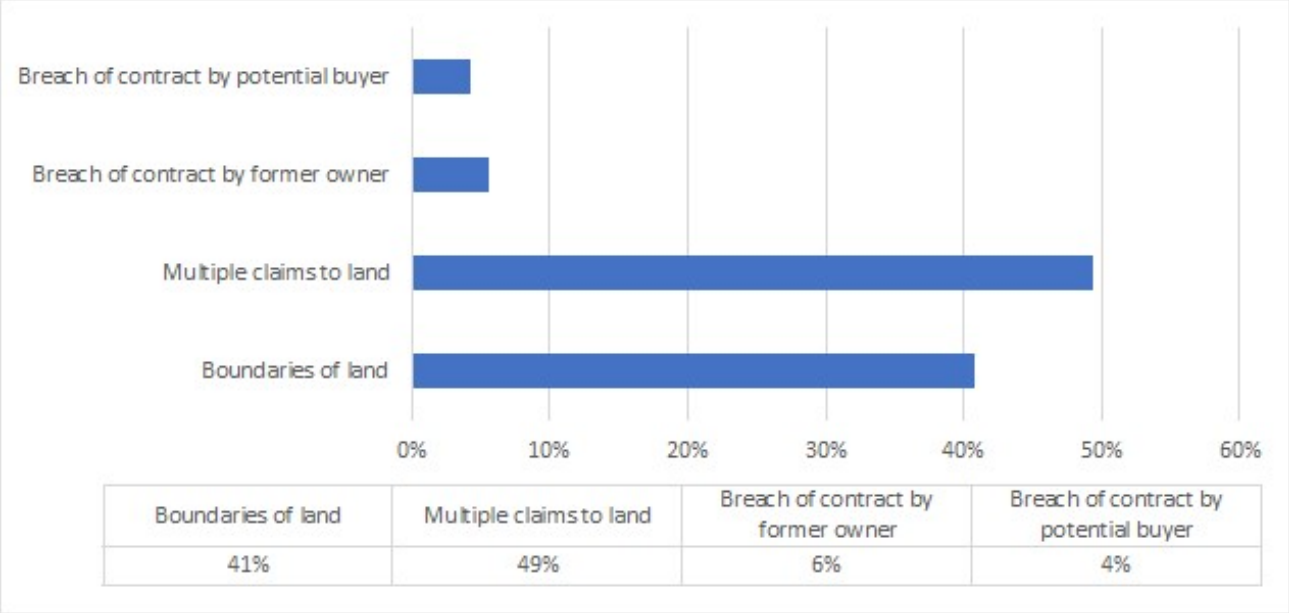


Table 5-4 shows that disputes were most often dealt with directly between the disputants or through the traditional system. Formal courts scores lowest as an instrument for dispute resolution indicating that the large majority of disputes are being resolved locally with few occasions of involvement of the formal courts.

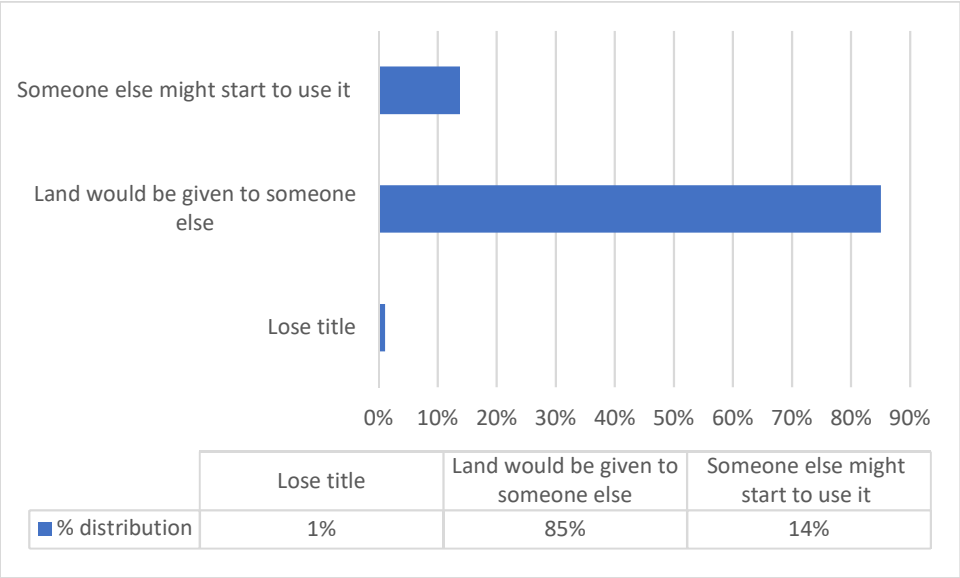
Table 5-4: Dispute resolution channels

A11 How did you resolve this dispute	Freq.	Percent	Cum.
Directly with person	44	46,32	46,32
Involved traditional authority	39	41,05	87,37
Formal court	4	4,21	91,58
Involved family members	8	8,42	100,00
Total	95	100,00	

5.1.3 Land alienation

An analysis of the fears of losing land was also conducted. The results showed that 32% of the respondents was afraid of losing their land if they were to leave their land empty for several months (see Appendix 10-7). Concerning why they may lose the land; three major reasons was recorded as shown in Table 5-5.

Table 5-5: Reasons for the loss of land



A majority of the respondents (85%) was afraid that their land would simply be given to someone else. Unfortunately, the microdata analyzed gave no clues to the circumstances of how land could be given to someone else. However, studies of tenure security in rural Ghana pointed at fallowing, the concept of leaving land fallow for the soil fertility to regenerate, as the primary period for people to lose the right of use for a plot; local authorities (chiefs and land facilitators) would simply give the rights to others when cultivators left the land fallow and thus lost their tenure (Otsuka, Quisumbing, Payongayong, & Aidoo, 2003) (Goldstein & Udry, 2008). the studies suggested it was because of decreasing rents that was generated to the chiefs when land was fallowed (ibid.).

5.1.4 summary

The microdata analyzed suggest that a significant proportion of the respondents interviewed experienced disputes over land and many of the disputes arose as conflicts over the boundaries of the land or who had the legitimate right to cultivate and live on the land. The findings indicate that severe structural issues with land tenure demarcation and the registration of land stems from a poorly constructed land system in which boundaries for parcels of land are not accurately defined. Further, the unawareness of existing lands registry programs in rural communities are indicate that little has been done to inform and enlighten citizens of this

opportunity. The finding that contractual terms and conditions are primarily not written down and registered when a land arrangement is negotiated, is indicative that citizens in that area have little knowledge of the importance of registered tenure on tenure security. Without any proof of tenure, a dispute over negotiated terms can become a source of quarrel with the local chief.

The microdata also suggests that disputes over land is solved locally through and rarely involves the formal institutional system in resolution. This has been found to be caused by the lengthy expedition times of formal courts and the introduction of Alternative Dispute Resolution mechanisms analyzed later in this paper (Ubink J. M., 2015). Finally, 1/3 of the respondents indicated fears of losing their land if they left it for a short period which is particularly concerning given that fallowing of land is important for earth fruitily and was found as one of the primary reasons for loosing rights to cultivate land.

5.2 Structural issues

5.2.1 Land Administration Project (LAP)

The overall goal of the Land Administration Project, initiated in 2003, was to create the foundation for an accountable, harmonious and transparent land administration system through a bottom-up approach (The World Bank, 2003) (Amanor & Ubink, 2008). More specifically the Land Administration Project introduced administrative reforms in the land sector to endorse harmonization and regularization of management practices between the government and customary authorities. The reform-agenda was to include the customary land into a broader registry system where local authorities (chiefs, families, clans) in rural areas would be made accountable for, and required to, take care of customary land administrative practices on behalf of the respective land-owning community (Bitir, 2014). LAP is characterized as a long-term project stretching over a 25-year planning horizon over a 3-step period. Currently the second phase of the LAP (LAP2) is undergone and the expected closing date is January 31st, 2019 (The World Bank, 2011). LAP2 is focused on strengthening and consolidate institutional services to provide rural citizens with land and tenure security, land administration services and establishing dispute resolution mechanisms locally (ibid.) (Stanley, 2018).

5.2.2 Restructuring project (2008)

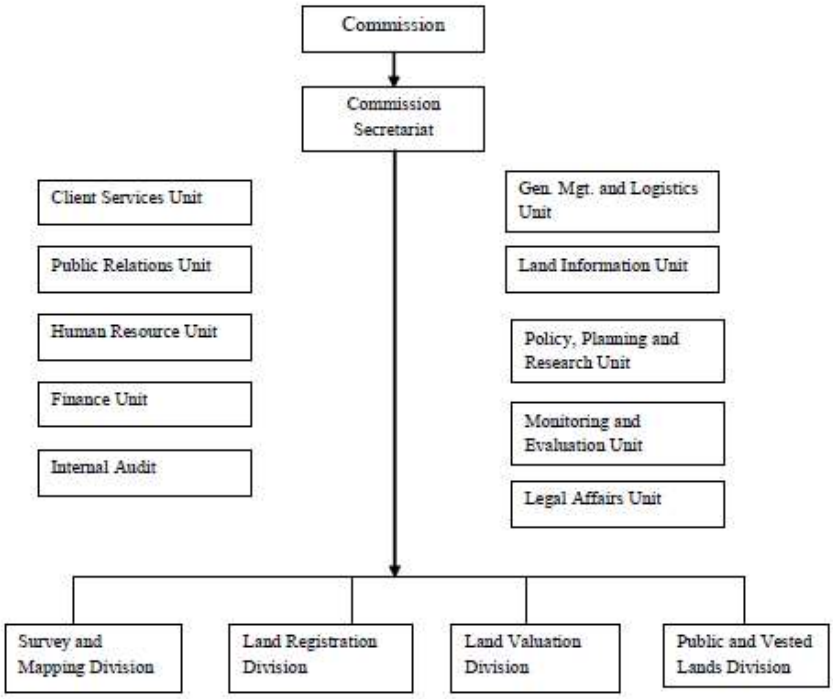
In 2008, The LAP was restructured to fix some of the land market problems that still exist today, namely the issue of tenure insecurity, land disputes, spatial development and litigation, human resource deficits and financial problems within the land institutions (Forkuor, Kyei, & Wusu-Adjei, 2013). The objective of the restructuring was to *"develop a sustainable and well-functioning land administration system that is fair, efficient, cost effective, decentralized, and that enhances land tenure security, through:(a) harmonizing land policies and the legislative framework with customary law for sustainable land administration; (b) undertaking institutional reform and capacity building for comprehensive improvement in the land administration system; (c) establishing an efficient, fair and transparent system of land titling, registration, and valuation; (d) developing community level land dispute resolution mechanisms; and (e) issuing and registering land titles in selected pilot urban and rural areas"* (The World Bank, 2013).

5.2.3 Lands Commission (Act 767)

The Lands Commission Act 767 was inaugurated in 2008 as part of the Restructuring project. The Commission has a twofold objective; (i) promote the judicious use of land by the society and ensure that land use is in accordance with sustainable management principles and the maintenance of a sound eco-system and (ii) ensure that land development is effected in conformity with the nation's development goals (LC act 767, 2008).

Previously, the land institutions that each performed specific parts of land administration, was considered as working autonomously from each other and with weak coordination amongst them (Bitir, 2014) (Forkour, 2011). The Restructuring project was explicitly aimed at unifying the six autonomous institutions that had been established by different Acts up until 2008 (ibid.). However, for undetermined reasons, only four of the six institutions did get unified under The Lands Commission during the restructuring project, namely the Survey and Mapping Division (SMD), Land Registration Division (LRD), Land Valuation Division (LVD) and the Public and Vested Lands Management Division (PVLMD) (Ghana.gov, 2018). The divisions were placed under the directive of the Commission Secretariat as seen in figure 5-1 and were coordinated through the Lands Commission. The remaining two, Spatial Planning and Monitoring and Revenue Mobilization Dept. were left

Figure 5-6. Organizational structure of the Lands Commission



Source: (Forkuor, Kyei, & Wusu-Adjei, 2013)

out of the formal structure and is managed by the Office of the Administrator of Stool Lands (OASL) or the District Assemblies under the supervision of the customary authorities (Forkuor, Kyei, & Wusu-Adjei, 2013).

5.2.4 Customary Lands Secretariats (CLS)

Component 2.3 of the Restructuring project was aimed at addressing the dis-synergies of central governance of land administrative tasks in peri-urban and rural areas of Ghana. It was politically decided to support the development of *"Customary Land Secretariats (CLS) in Ghana, as effective, accountable local structures (…) with particular attention paid to strengthening the capacity of CLS to address the needs of diverse populations within their communities and recognize the great range of customary tenure systems in different regions of the*

country" (Kakraba-Ampeh, 2008, p. 8). In other words, more weight was put on decentralizing the land administrative functions to better deliver services to local communities (The World Bank, 2013) (Stanley, 2018)

The CLS is duly recognized by the Lands Commission as a key participant in customary land administration and is supposed to assist the Public and Vested Lands Management Division in recording, documenting and registration of customary lands in their respective area (Ministry of Lands and Natural Resources, 2018) (Bitir, 2014). The expected effect on CLS would be to improve the quality of records and accessibility of land information (titles, parcels/plots of land) at the local level and to move the registry services closer to the citizen in rural areas. More specifically their function is to give provision of land information such as rights, ownership and use, promote alternative dispute resolutions and recordkeeping of dispute settlements and keeping and maintaining accurate and up-to-date land records (Ministry of Lands Foresty & Mines, 2010).

However, the CLS was created to operate within existing power structures of chiefs and customary authorities and did not attempt to induce more democratic rule in customary land administration (Amanor & Ubink, 2008). This meant that the political choice of decentralization during the restructuring project, allocated control and influence of chiefs over the local secretariats in rural Ghana (Ubink J. M., 2015) (Amanor & Ubink, 2008). IEG, an independent assessment group of the World Bank, agreed that by leaving the chiefs control over the CLS *"unchallenged"* will have reduced tenure security for cultivators, in particular in areas with rising land values (IEG, 2013, p. 16). This argument is supported by the evidence that some chiefs exercise power over customary land to their personal interest and thus redefines rights of ownership (Ubink & Quan, 2008). The latter will be elaborated later in this chapter.

5.2.5 The CLS and the Lands Commission

The Lands Commission can although exercise some power over the chiefs and the CLS. The Lands Commission is supposed to restrict the local chiefs' power over planning and urban development processes such that new development is coordinated with the formal administration system (Yeboah & Shaw, 2013). However, it was found that chiefs did in several cases not conform with the development goals set out by the government, by excluding the federal planning authorities from new land leases and altering existing land-use plans (ibid.). The study found that such practices was common and was considered unlawful by the government, yet little was done to encounter it. Such practices point to the fact that little governance control is done to keep local authorities in place and that enforcement of government regulations are weak in customary areas. Victoria Stanley pointed out that coordination and cooperation with customary authorities was "a mixed bag" meaning only some authorities was willing to cooperate while others weren't; the World Bank only pushed forward with their agenda of harmonizing registries with the authorities that already had showed willingness to do so (Stanley, 2018). The findings poses credibility issues since customary and statutory authorities have also previously proven to lack trust and is unfaithful in their cooperation and have is

considered to have very different perspectives on land administration matters (The World Bank, 2013) (The World Bank, 2018).

Land Management Committees has also been appointed to provide governance of the CLS. The committees will act as a mechanism such that CLS functions are in line with the aspirations of the rural community and the land 'owners' i.e. the chiefs (Ministry of Lands Foresty & Mines, 2010). Moreover, the committees will be constructed by representatives of the stools, skins, families and clans, primarily the chiefs of these, but also professional land surveyors, lawyers and valuers from the respective community, if available (ibid.). The Committees will further be in charge of hiring and firing all categories of staff at the CLS (Ministry of Lands Foresty & Mines, 2010).

Today, 87 CLS's has been established and 36,178 land rights recorded (The World Bank, 2017). Given the end target of 25.000 recordings in 2017, the World Bank concludes that the Ghanaian community are beginning to strongly embrace the CLS and their function in rural Ghana

5.2.6 Lack of proper control mechanisms

Auditing and governance by actors that are not independent/objective from the CLS being audited, arguably has severe consequences for controlling the actions of CLS in their respective areas of operation. It can be argued that especially the Spatial Planning and Monitoring Department, now under the control of customary authorities, is important to formalize under the unified administration system because of their dual purpose; measure and map plots of land and monitor the customary land authorities in their peri-urban and rural development planning (The World Bank, 2013). Since this function is outside the formal institutional framework, it complicates the objective to effectively coordinate land spatial planning of land in rural Ghana. More importantly, the Spatial Planning and Monitoring Department is under the influence of the District Assemblies which are part of the customary system and therefore strongly decreases the effectiveness of governance and control of land registration in rural Ghana. Similar, is the issue of composition of Land Management Committees that govern the respective CLS in the area; if a board of chiefs and high-ranking professionals are supposed to be self-monitoring the CLS they are in charge for, little auditing can be expected from them.

The governance mechanism can therefore be considered flawed since the Spatial Planning and Monitoring Department and the Land Management Committees is indirectly controlled by the same authorities they are supposed to audit. It thus poses risk of corruption and lack of quality control of land recordings when land records are processed in rural Ghana. This issue was also raised by Victoria Stanley who characterizes the government as having very little control over the registration process and customary authorities' influence on the individual CLS's (Stanley, 2018).

5.2.7 CLS and document handling

A significant problem raised by Victoria Stanley, was the storage of documents including parcel data (cadastral information) and deeds at the local level (Stanley, 2018) (Ehwi & Asante, 2016). It was found that documents had not been digitized as set out by the second phase of LAP-2 but still was stored in paper-form. Furthermore, documentation had not been organized and categorized. According to Victoria Stanley *"There are piles of paper everywhere and no one knows who they belong to and what it represents. Some of this paper is even rotting (…) Right now we keep trying to get the IT system that we already have, rolled out to the offices and to get the documentation they have, organized and systematized and eventually digitized to begin and reap some of the benefits of this project."* (Stanley, 2018, p. 3).

Although electronic devices such as computers and digital scanning devices had been delivered to the secretariats during the restructuring project in 08', they were not being used, primarily because of lack of skills from the land officers (Ehwi & Asante, 2016) (The World Bank, 2013). In 2013, the LRD stated that roughly 16.000 documents had been scanned and digitized but was not part of a central database system yet; the digitized documents were stored on an external hard drive kept at the LRD (Ehwi & Asante, 2016). An LRD consultant stated that the project had been halted because of the high financial input required to set up the system. More specifically, an internet portal and high-speed broadband was supposed to facilitate better coordination and higher efficiency between the divisions involved in land recordings. The portal and the high-speed broadband are yet to be finished and is currently halted due to lack of resources (Ehwi & Asante, 2016) (Victoria Stanley, 2018).

The problem of missing digitalization is further backed by Mahamudu Bawumia, the vice president of Ghana. In a recent visit to the local secretariats, it was found that record-keeping was still paper-based and recovering a past document could take up to a month (Yeboah R. M., 2018). He further emphazised the need for a digital solution and urged the need for a consolidation of records in a single place such that titles were easily accessible, easily searchable and safe from fraudulent activities (Ghana.gov, 2018).

5.2.8 Orthophoto mapping

Orthophoto mapping is the process of combining Aerial photography (high-resolution photos taken from a plane) with georeferenced points and later applied with Topography-adjusting software to account for steep and undulating terrain which distort the measurability and accurateness of aerial photos (Ghana.gov, 2018).

So far inaccurate cadastral information in form of orthophotos maps has shown to be problematic for title and deed registration (The World Bank, 2013). Victoria Stanley confirmed that orthophoto mapping issues are still prevalent in Ghana today, especially in the peri-urban and rural areas. Victoria further told that orthophoto mapping of the entire country was initially included in the LAP but was later taken out of the project because of a $20-25 USD financing gap that did not materialize into further funding (Stanley, 2018).

While shown later in this paper, private organizations in rural Ghana has used GPS coordinates and simple opensource maps such as Google Maps to demarcate land plots, the official requirements dictate that orthophoto mapping is the only legitimate way of mapping the land (Ghana.gov, 2018). To be deemed legitimate for land use mapping the resolution should be at least 1m per pixel which required special equipment to be measured accurately. Although Google lives up to this requirement on flat surfaces they cannot provide any guarantee to positional accuracy in elevated areas as of the CE-90 requirement policy (Google, 2018).

This missing orthophoto mapping is particularly troubling in regard to registering land because it compromises the validity of a deed or title if the plot has not been accurately mapped. To have any useful information of what people are trying to entitle, the orthophoto mapping is paramount to this process (Stanley, 2018). The findings are in line with the analyzed microdata that disputes over boundaries of land is a prevalent issue.

The lack of land mapping is thus also a severe inhibitor for a digitized registry along with paper-based data storage of documents and thus the potential of using BCT to better secure land tenure and property rights. It can although be discussed to what extent fine-grain orthophoto procedures are needed in rural Ghana, particularly in areas which are flat enough to enable simple software such as Google Earth. A compromise could be very relevant in some areas since such data is almost freely available online and is considered to be sufficient by researchers in most cases of developing countries (Donaldson & Storeygard, 2016) (UN, 2012).

5.3 Corruption issues

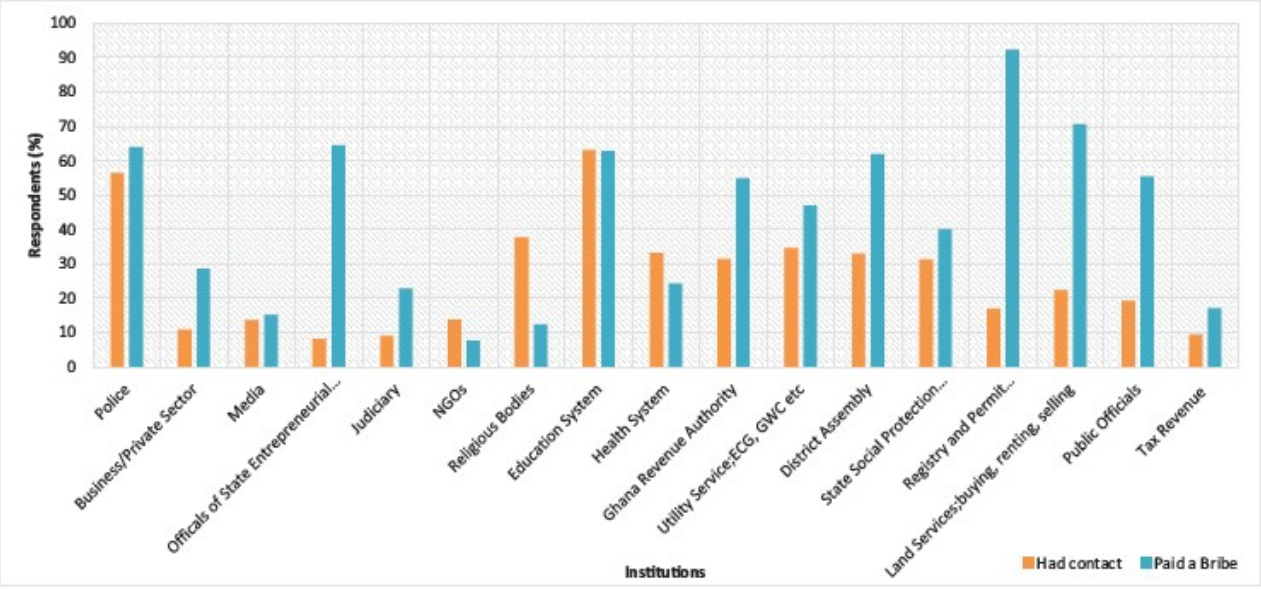
Corruption is defined as the *"the abuse of entrusted power for private gain"* and corruption can be characterized as *"grand, petty and political, depending on the amounts of money lost and the sector where it occurs"* (Transparency International, 2018). The level of corruption must also be distinguished on two levels: (i) the corruption of petty crime characterized by bribes given to staff at the lands commission and CLS to speed up the entitling process and (ii) the corruption characterized by unauthorized alterations of land records, multiple sales of land and document forgery/fraud.

No direct quantitative source of information was found on the approximate level of corruption in the registering process of a title or deed, nor could quantitative information be retrieved on the extent of fraudulent change of existing titles and deeds. However, data on the extent of bribes in the registering and handling process was recovered which do have some indicative significance in estimating whether corruption and fraud is present. Data on perceived corruption in Ghana was found and formulated in the below graph

5.3.1 Bribery

Figure 5-7 divides the extent of corruption in Ghana into sectors and reports citizens interaction with the institutions. The orange colored graph shows the percentage of people that had contact with the institution

Figure 5-7. Payment of bribes (divided by sector)

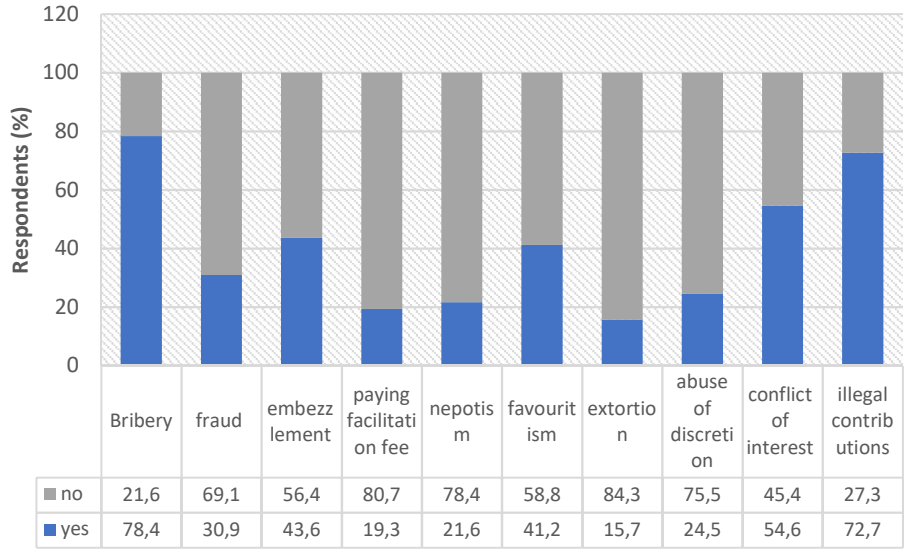


Source: (ADISS, 2017)

within the last year while the blue line represents the proportion of those people that paid a bribe. It is clear from the figure that institutions dealing with (i) registry and permits and (ii) land services are most involved in bribery, with 92% and 71% of respondents paying a bribe, respectively.

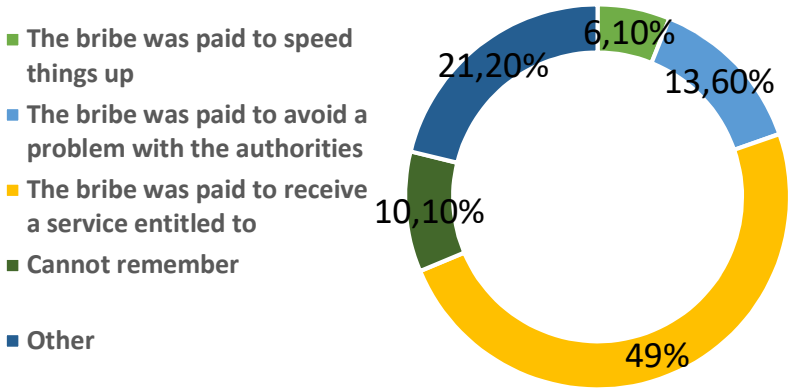
Graph 5-8 shows the perception and experiences of various forms of corruption in the Pru District (rural Ghana). The respondents were asked to answer *yes* or *no* to whether they had experienced or perceived any of the 10 types of corruption. Both bribery and illegal contributions was most commonly perceived/experienced though all types of corruptive actions had been experienced amongst the respondents. 78% pointed at bribery as being either perceived or experienced personally, strengthening the argument of widespread petty corruption that happens in rural areas of Ghana. Moreover, every third of respondents had perceived fraud in the Pru district.

Graph 5-8. Perceived corruption in the Pru District



Source: own creation using data from (ADISS, 2017)

Table 5-9. reasons for paying a bribe



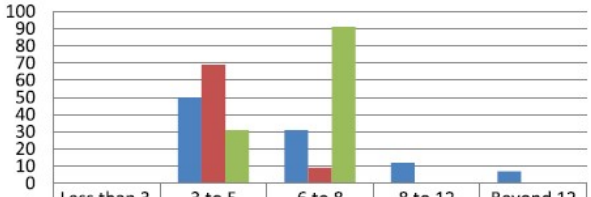
Source: own creation using data from (ADISS, 2017)

The survey from ADISS also captured the reasons for paying bribes (see table 5-9). Of all respondents, 49% said their bribe was paid to receive a service they were already entitled to as a citizen. Moreover, 1 in 5 respondents believed that bribery is not a true act of corruption but merely an unofficial fee paid to facilitate the service (ibid.). Bribery therefore seems to be very emerged in the Ghanaian culture and a natural way of making transactions with both public and private services. It shows the rough reality of the extent of petty corruption.

5.3.2 Bribes as facilitative measures

BCT has the potential to complicate the extent of bribery but will have little effect on bribes that happen in between the use of technology, such as the processing time. A study on bribery in the facilitating process shows that bribes was often paid to speed up the processing time of deed or title applicants. Figure 5-10 shows that 69% and 9% of respondents received their title between 3 to 5 months and 6 to 8 months (respectively) after paying bribes to officers at the Lands Commission to increase the processing time. It also shows that 69 % of respondents got their title faster by paying a bribe, compared to 31 % that did not pay any bribes to facilitate the process.

Figure 5-10. Bribes paid in the facilitation process of land



	Less than 3 months	3 to 5 months	6 to 8 months	8 to 12 months	Beyond 12 months
% of Respondents	0	50	31	12	7
% of Respondents who paid a bribe	0	69	9	0	0
% of Repondents who did not pay a bribe	0	31	91	0	0

Source: (Ehwi & Asante, 2016)

Although BCT is inaccurate for dealing with facilitative bribes, it is better suited for lowering the extent of bribery for services that citizens are already entitled to. Because blockchains work through the internet, applications can be processed online and does not necessarily need to happen physically at the CLS; such applications could be made available online which strongly reduces the potential of bribery to execute the application at the local level because the application would be shared amongst the involved parties in the Lands Commission at once. In other words, registration applicants would not only have a single-entry channel through the CLS that enables them to demand in-kind bribes for their services. By using online applications, it further diminishes the possibility of demanding bribes because the submission-system is automated, and no physical meeting takes place initially. This discussion will be taken in Chapter VIII.

The findings underline that bribes are still widespread and continuous problem in the Lands commission and the CLS. It is also found that a large proportion of income for chiefs and is created through the CLS in form of extended fees and bribes (The World Bank, 2013).

5.3.3 Fraud

The issue of fraud is believed to be prevalent in the land administration system in Ghana but only very little evidence in form of actual court rulings are available. The lack of proper documentation was found to also be an issue within the customary court rulings which strongly decreases the ability to find solid examples of fraud. It is assumed that the reason for the missing documentation of fraud is linked to the use of paper-documentation and the findings that disputes are often dealt with outside the formal system as evidenced in the microdata presented earlier. Table 5-8 do although give an indication of the amount of fraud. Moreover, the findings from the microdata (table 5-1) shows that less than $1/10^{th}$ of the respondents have their land registered through a formal contract with the chief, it is very hard for the victim to contradict a dispute and most likely do not seek legal retribution in fear of losing the case.

5.3.4 Unclear definitions

Chiefs are in principle merely the trustees of the land on behalf of the surrounding community and their future generations. This 1992 constitutional right forbids the chiefs to sell land but not to lease it to outsiders (Ghana.gov, 1992). However, in practice it was found that the difference between leasing and selling is unclear and trustees of land misused this for private gain (Amanor & Ubink, 2008). According to the study such practices was widely acknowledged by communities and the leasing/selling of land could happen multiple times. This correlates with the study's findings that multiple claims to land was the primary cause of disputes.

5.3.5 Document forgery

It was further discovered in a study covering the regulation of Customary Land Management in Ghana, that chiefs used the CLS for what could be classified as corruptive actions (Jones-Casey, Knox, & Ailey Kaiser, 2011). The Chief changed negotiated long-term land allocations to outsiders by using the local secretariats as vessels to alter the original lease period. The study indicated it was because of rising land values that incentivized local authorities to commit fraudulent activities (ibid.). A similar finding was made by Goldstein and Udry (2008) that *'reinterpretations'* of negotiated tenure conditions happened because of land scarcity and thus rising land values (Goldstein & Udry, 2008).

A more recent study found that a CLS near Tamale in the northern region had been used to illegally broker the sale of land that was registered by members of a family in the community (Andrews, 2017).

Such activities do arguably have severe impact on tenure security for affected people as they will be in a disadvantageous situation of proving that the original copy, if any, has been tampered with. It will result in distrust towards the customary authorities that engage in such activities and can have damaging effects on citizens perception of the CLS and the effects of registering their plot of land.

5.4 Cultural issues

5.4.1 The role of culture

It is important to mention the complex sociocultural heritage of the customary land. In a case-study of three communities with in-depth interviews of land title holders it was found that the allodial title holder are in principle trustees of the community only, and therefore not the "legal owner" of the land (Paaga, 2013). Instead, the trustee is holding the land on behalf of the larger community, together with the councils and land allocation committees and the right to use the land is derived from being a member of that particular social group, here understood as a clan or family. Customary land tenure can therefore be described as a set of rights, derived from generations of customs and culture and therefore implies that land ownership is not appointed one person to own and further not commonly recorded in writing. In other words, it means that chiefs are not the legitimate owners but rather acts as custodial holder of the land for the community at large.

It may sound peculiar for a western-oriented person, but it shows the misconception of how big an influence culture still is in the developing world. However, it was pointed out by Paaga (2013) (amongst others) that these traditional customary principles are "fast eroding" as a result of urbanization, population growth and commercialization of land (Kasanga & Kotey, 2001) (Wehrmann, 2008). If such principles are eroding, it may also imply that chiefs decreasingly see themselves bound by these principles and responsibility toward their community. It was found that the chief's role as a mere keeper of lands, in practice was often more than just administrative but also enacted the power vested in them as a personal right and was further enhanced by their position to influence local institutions (CLS) (Ubink J. M., 2015). According to the same study, this power was often used by the chiefs to allocate occupied farmland to well-paying foreigners on the consequence that farmers lost their cultivation or tenure rights.

5.4.2 Women's rights

An important finding is the marginalized rights of women in land tenure matters, where traditional customs and law govern. From a gender perspective, customary systems often exclude women from land ownership and cultivation of land because of the patriarchal values and customs that are imbedded in them (Whitehead & Tsikata, 2003). Moreover, it was found that women's risk of losing land tenure during fallowing was twice as high as males (Goldstein & Udry, 2008).

The missing rights for women are further acknowledged by Land Layby as a key issue for tenure security (Kaniu, 2018). A further analysis on the legislative concerns of women's rights are found in the next section.

5.5 Legal Issues

5.5.1 Ghana's 1992 Constitution

Ghana's constitution has nationwide coverage meaning that stool and skin lands are also within the periphery of the constitution. However, Ghana distinguishes from other SSA countries concerning the allocation of power to traditional or customary authorities (Yiri Il, 2006). The constitution founded in 1992 allows for control of customary land by the custodial holders and thus implicitly the governing chiefs of stool and skin land. More specifically, article 270 in the 1992 Constitution provides that the *"institution of chieftaincy, together with its traditional councils as established by customary law and usage, is hereby guaranteed."* While Article 267 dictates that *"All stool lands in Ghana shall vest in the appropriate stool on behalf of and in trust for the subjects of the stool in accordance with customary law and usage"* (Ghana.gov, 1992, pp. 150-153).

The latter quote therefore doesn't recognize stool's (chiefs, clans) as legitimate owners of land but precedes that they shall act as custodians of land in trust for the stool's subjects. This distinction is important because it acknowledges that chief's selling of land without prior agreement from the community could be considered unconstitutional. Also, the constitution ascertains that customary law is the governing law.

Further, article 17 [1-2] of the Constitution guarantees equality of all people and dictate that discrimination based on gender is unconstitutional (Ghana.gov, 1992). However, article 17 [4] permits exceptions of discrimination in case of personal law such as adoption, marriage, divorce, burial, devolution of property on death, which strongly affects women's ability to own land in stool and skin lands (Ibid.) (FAO, 2018).

As briefly mentioned, land tenure is different than in many other African countries. The constitution gives authority to the customary authorities in administering the vested land which has complicating issues to harmonize nationwide land administrative functions into a unified system. The work of the local land secretariats is strongly influenced by the community heads which limits the amount of control and governance intended by the central government of Ghana (The World Bank, 2013).

5.5.2 Title and deeds

A title can be characterized as the legal right to own a particular item; in this case a piece of property or land (Ference, 2017). The title is necessarily not a physical document but often a mere registered acknowledgement that a person has the legal right to use the item registered. A deed however, is a physical document used in an exchange between a buyer and a seller to state that a transaction and transfer of ownership/use-right of land/property (or parts of) has occurred. Several deeds can therefore exist if land or property under several occasions has changed hands and is also believed to be the root for disputes and dual registration of same pieces of land. The importance of the distinction will become clear in the next two paragraphs.

Registration of a title in the very essence means the entering into a digital register or record-book that a person is the legitimate title owner of a specified land (Ehwi & Asante, 2016). A further explanation between title and deed and the defects of the latter will follow this section.

5.5.3 Land Registry Act (Act 122)

Enacted in 1962, Act 122 was aimed at registration for deeds and enforced that parcel descriptions such as a map or plan, should be attached to the instrument being admitted for the registration process (Gyamera E. , Duncan, Kuma, J.S.Y, & Arko-Adjei, 2018). However, many of the descriptions was non-existent or in writing which provided no clear boundaries for the plot(s) of land being registered such that it resulted in poor and unverifiable record-entering in the registry. The act further neglected proper examination by trained and skillful surveyors whose job was to inspect the instruments and descriptions of plots of land. The result contributed to dual registration of land, fraud and bribery and generally a poor entry to the land registry (Agbosu, 1990). Consult Appendix 10-8 for a detailed overview of legislation.

5.5.4 Land Title Registration Law (PNDCL 152)

The PNDCL (1986) was supposed to fix some of the inconsistencies in Act 122 (Gyamera E. , Duncan, Kuma, J.S.Y, & Arko-Adjei, 2018). PNDCL focuses on the registration of titles instead of deeds to ultimately state the rightful owner of property. Title registration was enacted as a solution to the flawed deed registration that caused disputes over who held the legitimate or most recent deed to a plot of land.

The PNDCL has a twofold purpose (Gyamera E. , Duncan, Kuma, J.S.Y, & Arko-Adjei, 2018):

- Provide certainty and facilitate proof of title to the land,
- Enable land transactions in which the transaction is safe, pro-poor and indefeasible.

However, PNDCL and ACT 122 are parallel laws that both are in force today. PNDCL does not have nationwide coverage and is only enforced in the major cities of Accra and Kumasi not in the peri-urban and rural areas of Ghana (Ghebru & Lambrecht, 2017). Act 122 was supposed to be out-phased with the gradual implementation of PNDCL and title registrations but proved difficult in rural Ghana as deeds still are still informally used as a primary proof of ownership. Furthermore, while Act 122 should provide some security over land that is registered, proper mapping of plots is still not attached to the instruments being admitted, most likely because they do not exist in many areas (Ehwi & Asante, 2016). Still, given the evidence from the microdata that only a minority of tenures are in writing, not even deeds exist that an agreement has taken place and a transaction has happened. More specifically, were such arrangements in writing, it would enable the rural community to register leases, freehold and tenurial periods through the CLS and Lands Commission in the form of a deed (Ghebru & Lambrecht, 2017).

5.5.5 Customary land ownership

Customary ownership can be described as being held by local councils of elders, chiefs and clan heads and are highly affected by generational family ties to the land, while customary law is defined as *"a normative order observed by a population, having been formed by regular social behavior and the development of an accompanying sense of obligation"* (Woodman, 2011, p. 10) (Paaga, 2013).

The principle of *abusua* relates to land being administered by a chieftaincy while the use of the land falls to the members in an *abusua,* often divided up in families (Goldstein & Udry, 2008). The principle has been summarized as *"the cultivated farm is my property, the land is the stools"* (Wilks, 1993, p. 99). It is however, not given by customary law that new family-members continuously gain the right to use land through generations and is subject to negotiation. For example, if the family head dies without a male heir, the land tenure will most often be passed on to his brother and not his wife or daughters (Otsuka, Quisumbing, Payongayong, & Aidoo, 2003). This mechanism provides very weak security to a family if the father is to pass away suddenly.

5.5.6 Customary law

The above findings gave reason to further investigate how customary law govern land tenure and rights of the cultivator and the impact customary authorities have on its community. Customary law can be considered fluid because the law varies between stool and skin lands and interpretations of the law are often decided by the chiefs and council of elders in power (Ubink J. M., 2015). Because the community considers them as guardians of land and thus also to an extent the person that knows the customs of that land, they are able to enact legitimate power in the use of law in that area. The persons in power therefore has significant maneuverability in forming the law to a particular narrative when needed. Such circumstances has been termed the 'shadow of the law' which is seen across Africa in areas governed by customary law (Ubink J. M., 2015) (Kasanga & Kotey, 2001). However, local media stations in Ghana has been found to increasingly focus on ongoing court cases and entangling customary law such that a greater awareness of the law-in-practice spreads to the community. This is an important role of local media since it was found that references to specific law by the community in regard to land tenure and rights of land, was often wrong or non-existent (ibid.).

A university project named Ascertainment of Customary Law (ACL) was initiated in 2011 which aimed at documenting the fluid customary law. The project strived to collect court decisions in a database so future judges would have a base of reference and thus assure greater uniformity in future court decisions. The project, led by the ILDA Clinic and faculty members of the University of Science and Technology in Ghana, was to record and publish past court decisions of traditional customary courts to ascertain transparency and accessibility for future decisions (Fenrich & McEvoy, 2014). The Asantehene (local tribe-community) approved the project and appointed a committee to oversee the project together with the project owners. In late 2014, 31 records had been made, a major proportion of it regarding land disputes over customary land. The

project was concluded unsatisfactory and shows some practical challenges when new initiatives are implemented in traditional communities; The ACL project was first of all driven by organizations outside the customary system and was constrained by scarce resources for the human-rights agenda which had no monetary value that could attract outside investments. Even though, the community personnel responsible for the recordings was provided with equipment but otherwise was not compensated for their efforts. Since the personnel also had other projects, the ACL project was given low priority and was reflected in the low amount of cases recorded in the system.

5.5.7 Alternate dispute Resolutions

As part of the LAP restructuring project in 08' it was also decided to increasingly use customary courts to settle disputes through the so-called Alternate Dispute Resolution (ADR) (Ghana Govt, 2018). The reason for allocating responsibility to ADR was described as a maneuver to relieve some of the pressure on statutory courts in handling land disputes and because it has been found more efficient (less handling time) in resolving disputes (Ghana Govt, 2018) (GhanaWeb, 2017). The Alternative Dispute Resolution (ADR) courts are however based on traditional law which discriminates women in owning/renting property and is severely affected by hierarchical and promotional thinking in form of special treatment that is dependent on family ties, authority and power (Crook, 2013).

The dispute resolution mechanism has proven to give good results in solving disputes and reducing the backlog of the many disputes that await trial. It further brings the dispute settlements closer to the actors such that transportation and expenses are kept at a minimum. But it can be called into question whether disputes are solved objectively, and the security of tenure outbalance each other relative to going through the formal institutions. The National Coordinator of Customary Courts in Ghana emphasizes this point and states that parties involved in a dispute over land should be realistic when presenting issues before customary courts because *"biases may affect the outcome of the process"* (GhanaWeb, 2017, p. 2).

Concluding on the findings of this section, it is clear that legal pluralistic systems and the establishment of fluid customary law in rural areas are questionable in regard to whether they secure the rights of the population that inhabit these areas. The Ghanaian constitution significantly reduces the potential for unifying statutory and customary law because it acknowledges the legibility of customary law in skin and stool lands. Furthermore, women's rights of land tenure are strongly reduced because of the marginalization of customary law. Last, ADR might prove to reduce the backlog on statutory courts, studies find that court ruling might be biased and subjective. Next, case studies of organizations working with blockchain will be presented to give insights to the use of the technology and how they try to tackle the issue of weak property and tenure rights.

CHAPTER VI - LEARNING FROM OTHER CASES

The Land Layby and Bitland organizations presented below will act as insights into blockchain projects that have been undertaken within Ghana. Furthermore, a perspectivation to a blockchain land registry project in Sweden and Andhra Pradesh is included because it gives a profound contribution to design considerations and further provides a contrast to blockchain solutions presented by the previous cases.

6.1 Land Layby Group

Land Layby consist of a group of companies originally founded in Kenya with operations in Australia, Kenya and recently Ghana (Strathmore University, 2017) (Kaniu, 2018). Land Layby Kenya (the original firm) began as an options provider, specialized in Land banking in Kenya, but had also realized inconsistencies in the Ghanaian market, namely the issue of poorly constructed land administration systems (Kaniu, 2018). Through their sister company, Land Layby Technologies, the development of a blockchain-based title registry system began under the name of Land Layby Listings (LLL). Together with Strathmore Institute of Mathematical Sciences, their key goal was to develop a title registry system for informal and formal land registration in developing countries. As of May 20th, 2018, the company launched Land Layby Listings in Ghana (Ayemoba, 2018). Their approach to the problem of registering land ownership is based on a public blockchain structure on a Proof-of-Stake mechanism to verify titles onto the blockchain ledger, in exchange of of Harambe (HRBE) tokens (cryptocurrency). The interview with Raymond, Chief Strategy Officer of Land Layby gave interesting insights to alternative approaches of implementing a blockchain land registry in rural Ghana. His background as a tribesman of the Ashanti tribe in Ghana was particularly interesting in gaining knowledge of their approach to dealing with customary authorities.

Land Layby Group is currently operating independently from the formal institutions in Ghana which means that they are not coordinating work with the government and the land administration system (Kaniu, 2018). They are however, directly involved with the chiefs and their respective community. The interview gave a strong impression that Raymond and his colleagues had initially tried involving the government but soon found the relationship burdensome and unwilling to cooperate. Raymond did however state that their intention is to incorporate both customary and formal land system in their registry but at later stages and when possible. The reason for this is their specific approach to changing the status quo; developing the land registry themselves and securing land tenure security from a bottom-up style, by putting pressure on the chiefs through their own community. Raymond equally saw the chief's power over land as uncontested and emphasized that chiefs at times used their power to personal gains. His experience from Kenya knew the role of chiefs in land administration and knew the hurdles they caused in changing status quo because the chiefs was the primary benefiter of the current situation.

The strategy set out for Land Layby was to use advocates within the communities of stool and skin lands to spread information regarding tenure security and their role in auditing their local authorities. He saw a possibility to influence people through knowledge and information and from within, create a pressure on the customary authorities to secure land tenure and property rights through land registration. According to Raymond, the strategy is successful but requires much time and results are slow to solidify because changing attitudes and informing people are difficult by nature.

Land Layby did although also try to influence the authorities by informing of the inherent attributes of registering land and tenure rights. "*By registering the land, it takes the responsibility away from chiefs to make sure that information is passed on through generations, and I believe that they probably want that. Although people fight the transformation (challenge status quo) the transformation will be irresistible at some point. The pressure will come from within*." (Kaniu, 2018, p. 3).

When the issue of independency from the government and its formal administration system was brought up, he was also asked to clarify their approach to compliancy with the legal system(s) in Ghana (both traditional and statutory/common law). Land Layby acknowledged the need for a legal guidance as to be considered a legitimate source of information in disputes over land or property that had been registered on their platform. He did on behalf of Land Layby, not comment on the need for professional land surveyors to demarcate land but later mentioned that verification of information (such as land demarcation and legitimate owners of land) will happen by including the community in the verification process and having advocates to assure legal compliance. In exchange they would be rewarded by HRBE tokens.

6.1.1 Challenges

During the interview, Raymond was asked to explain the key challenges they had experienced in Kenya and Ghana in implementing Land Layby Listings. Three challenges came to mind:

- Explaining Land Layby Listings to the government officials
- Educating, convincing and highlighting the importance for rural communities to register property
- Electricity outages and Wi-fi connections

Raymond mentioned that the challenges of electricity was 'being improved' but provided no further explanation (Kaniu, 2018).

6.2 Bitland Ghana

Bitland Ghana is a predecessor for Land Layby and has been operating in Ghana for approximately 2 years (Bitland, 2016) (Aitken, 2016). The strategy and objective to land registration are similar to Land Layby, namely that a permissionless open blockchain on the Openledger platform is offered as an alternative to the formal registration system. The consensus protocol is based on a Proof-of-Stake approach using Cadastral-tokens formerly issued by the Danish Cryptocurrency Exchange (CCEDK) but has, unlike Land Layby, included the use of GPS positioning and openmap API to map parcels of land (Bitland, 2016) (CMC, 2018). More precisely, coordinates are located based on the applicants sketch of his plot of land and then admitted to the transaction of the title on the block. Personal information is not stored on the block but instead a unique identifier is entered so that Bitland can link the title to a specific owner (ibid.). When Bates was asked how Bitland assured the applicant was the legitimate owner of the land being entitled without a search in the formal registry or publication of the request in local newspapers, his response was that Bitland did not check the validity of the claim to a parcel of land. *"What bitland nation is trying to do, is to make a ledger that is separate from the government although you can't have a ledger that is separate from the government and still be legal. The priority for us is to entitle people such that they can use land as collateral to obtain financial loans."* (Bates C. L., 2018, p. 3).

Similar to Land Layby, they do not currently cooperate with the Ghanaian government and are primarily operating outside the major cities of Accra and Kumasi (Bates C. L., 2018). According to Bates, they are working primarily with customary authorities outside the major cities because the government was causing hurdles in their operations (ibid.). In fact, Bates perceives the government as corrupt and unwilling to challenge status quo (Bates C. L., 2018). As with Raymond, Bates also believed that change will come from within the communities and thus focused a lot on informative actions toward cultivators of land.

6.2.1 Challenges

When asked about key considerations of operating a blockchain registry in Ghana, electricity and internet access was problematic issues for Bitland at this point. Achieving support from the community and trying to establish mutual cooperation with the government was also mentioned as problematic. In order to achieve electricity and thus internet access, solar-powered hubs had been built in local towns where cooperation with the customary authorities had been established. Transparency International had given an initial grant to the construction of these hubs. The hubs would provide access to the Bitland network and the ability to log their land prior to the application process (Bitland, 2016). In 2014, 63% of Ghana's rural population had access to electricity while 78-85% of the population had coverage urban areas (IGC, 2018). In regard to internet access, approximately 51% of Ghana's population has access to Wi-Fi through their phone, also with the majority concentrated around the urban areas (Geo Poll, 2015). The hubs therefore seem necessary for Bitland's project to be viable in rural areas of Ghana where both electricity and internet coverage is mostly missing.

6.2.2 Validity of land recordings

An interesting finding was the fact that none of the two companies interviewed was actively coordinating work or had a partnership with the Ghanaian government; they both worked independently with the communities in rural Ghana (Bates L. C., 2017) (Kaniu, 2018). The finding is striking since Land Layby was working towards a unified title registry system that could be used as a legitimate source in disputes over land (Kaniu, 2018). The interviews further gave the impression that both interviewees were rather naive in their rationalization that their records would be deemed legitimate in a dispute case or to obtain financial loans. The validity of the land records would most likely be questioned, at least in statutory courts, since the title has not been registered through the formal government channel and further has not been handled by formal surveyors from the Lands Commission or the CLS. Legitimacy in the registration process in regard to conformity of formal rules for land registration is therefore debatable since neither have involved formal surveyors from the government (Bates C. L., 2018) (Kaniu, 2018).

The consequences of missing coordination with authorities is also evidenced in past land registry projects. between 2007-2009 a consortium of companies led by Corporate Initiatives Development Group (CIDG) began documenting land rights of rural poor Ghanaians through a process they named the *'paralegal titling'* project (Rabley, Aboah, Deroy, & Edmead, 2008). The assumption for the project was that the paralegal titles they registered would later become formalized (i.e. recognized) under the Lands Commission. In collaboration with Trimble Navigation and ESRI/Sambus Ltd. they began using low-cost GIS software to capture satellite images and aerial photo documentation of the to-be registered land. The formalization through the Lands Commission did however never happen, and the project defaulted two years later (Jones-Casey & Knox, Ghana's Land Administration at a Crossroads, 2011). The case of the paralegal titling project exemplifies the risk of not having negotiated arrangements in place with the formal institutions before the project is initiated and shows why both companies interviewed should be wary of this danger.

However, since the legal court system is rather diffuse and customary courts do have legislative power in the communities, it will be up to the customary courts to decide whether the land registered by Bitland and Land Layby will be deemed legitimate.

6.2.3 Blockchains without intermediation

Land layby and Bitlands blockchain architecture both capture the essence of BCT because information is completely distributed and captures how typical open blockchain networks work. It is characterized by a vast number of nodes on the network giving perfect distribution of the shared ledger to all peers that is connected. Such public blockchains can often be found within informal financial institutions often in form of cryptocurrencies ('virtual cash') that are used to make rapid transactions through cryptocurrency-exchanges. A well-known example is the Bitcoin setup which is characterized by the classic open-ledger (public) blockchain. The institutional role of banks and public institutions is gone as transactions can happen without

any third-party actor. In other words, the bitcoin network is run without any intermediaries which diminishes the role of banks completely. In the case of Bitland and Land Layby their solution is similar; they work independently from the official registry system and without any involvement of the state or government.

6.2.4 The role of legal enforcement

Scholars involved in studying of the role of institutions in a world run by blockchain-based systems, has argued that the institutional role could become obsolete with the emergence of blockchain-based solutions (Ølnes, Ubacht, & Janssen, 2017). However, I argue that institutions in the form of governments will always have a legal role, regardless of digital or physical assets, because the enforcement of rights through the court system is crucial to an efficient market and to secure property rights. Furthermore, because land administration deals with physical assets that must be validated by professional, involvement of state actors is important to obtain accuracy and legitimacy of the asset. The government has the regulating role, such as to set out the "rules of the game" for all actors while facilitating low transactions costs and reduce information asymmetry. They do so, by providing the framework for which transactions can be made between parties, provide security through legal enforcement and the maintenance of transactions databases that records and stores previous transactions (transparency and information symmetry aspect) (North, 1991). Regardless of how property is registered, a dispute over land titles must always be facilitated by some form of court system. The usefulness of Bitland and Land Layby's land registries can therefore be questioned if authorities do not acknowledge the validity of their registries and therefore will not enforce and protect them through law.

6.3 ChromaWay

The previous argument is backed by the Swedish company, ChromaWay, that recently partnered with the Swedish government and the Indian state of Andhra Pradesh, to pilot a blockchain land registry system in both countries (ChromaWay, 2018). They too agree that blockchain registries still need a trusted third-party and such model is not yet quite escapable in land administration as initially postulated by Satoshi Nakamoto, the founder of Blockchain (Mizrahi, 2018). Instead, they emphasize to minimize the reliance on trust and create rules and mechanisms that make it difficult for illicit actions to happen. Their solution is to use the immutable and distributed characteristic of blockchain with more conventional governance methods, represented by the Proof-of-Authority consensus protocol (Strametz, 2018). This protocol is a replacement for PoW and PoS protocols which at first glance seem better suited for closed (private) blockchain structures that deal with disclosed (sensitive) information. Instead of relying on anonymous nodes solving complex algorithms, a dedicated amount of people working as administrators/authorities have the access to 'write' new blocks onto the blockchain. Such a setup looks particularly more like typical governance structures where adding new information is restricted to a limited amount of people. However, a predetermined proportion of administrators must reach consensus amongst themselves, before a block can be added which incorporates the consensus

perspective of BCT (ChromaWay, 2017). It therefore provides an extra level of security since independent administrators need consent from others to validate new entries into the system.

Another characteristic of ChromaWay is the self-developed blockchain architecture termed Postchain; a convergence of standard SQL databases and blockchain technologies (ChromaWay, 2017). Postchain enables organizations to implement BCT to already existing database structures which greatly reduces the complexity and costs of implementation. Second, block-size limitations mentioned in chapter III will not be an issue when considering the potential size of data such as cadastral plans and orthophoto-maps that must be linked to the land record (title, deed etc.). Instead, general documentation can be allocated to a standard database while specific information such as the title, the unique identifier, GPS-coordinates for demarcation of parcels and the negotiated terms are held on the blockchain. Furthermore, the blockchain is wired to the database such that all information stored on the two components gain the immutable and cryptographic characteristic (Yoon, 2018). This ensures that the database cannot be manipulated, regardless of the centralized storage of the SQL database. A visualized explanation has been put in appendix 10-11.

CHAPTER VII - DISCUSSION

7.1 Summary of results

The results from the analysis gave a broad representation of the prevalent problems that exist in land administration in Ghana. From the material presented in the earlier chapter, a large variety of interlinked and complex issues were found and highlighted. A brief summary is made to concretize the issues of land registration and its consequences on tenure security and property rights in Ghana:

Issue(s)	Consequence(s)
• Very little governance is in place to secure that CLS's are performing according to their responsibilities as set out by the Restructuring Project and the Lands Commission Act (see appendix 10-9).	• Multiple sales of land • Inaccurate and poor registrations processes. • Corruption in form of bribes and document forgery/fraud in rural areas of Ghana • Disputes over land
• Digitalization of records and orthophoto-mapping of the entire country has not been completed.	• Inaccurate land recordings • Inaccurate boundaries of land demarcation • Disputes over land
• Customary Land secretariats are controlled and strongly influenced by the local community heads (chiefs, elders etc.).	• The Ghanaian government do not have control/influence over Customary Land Secretariats that act as a bridge between state and customary land administration.
• Registry documents are still held locally and in paper-form and is unorganized, uncategorized and in poor physical shape	• Long processing times and risk of records being lost. • Dispute resolution becomes more difficult
• PNDCL does not have nationwide coverage and the Constitution allocates administrative and legal power to customary authorities over stool and skin lands.	• Deeds are used in rural areas which give little tenure security because no ultimate title holder is registered. • Chiefs can legally enact traditional (customary) laws which are considered fluid and undefinable.
• Women are marginalized in the customary land system because they do not have equal rights as defined by traditional law.	• Poor tenure security and property rights for women in cases of divorce, inheritance or death of the husband.
• Tenure agreements are not formalized and Customary law is fluid and interpretable.	• Easily alterable tenures and customary law can be interpreted subjectively to fit a narrative.

The findings point to much deeper systematic issues of structural and legal origin than initially thought. Many of the issues are interrelated and seem to be a result of many years of institutional neglect. Moreover, many of the issues seem to lie in the customary tenure system, the political power structure and the non-existent systematic registration of land demarcation and land rights. More remarkable is the very little governance made by the formal authorities over the CLS's that are supposed to be the link between customary authorities and the official institutional framework (Kakraba-Ampeh, 2008). It seems that customary land administration offers little organized land tenure security for their community which is based on customs and traditions that govern the traditional law of tenure. Also worrying is the issue of corruptive actions of chiefs to earn profits from rising land values for personal gains.

7.2 Theoretical explanations for observed structure

Before an evaluation of BCT's ability to solve the identified issues is presented, it was found suitable to provide the reader with theoretical and practical considerations of the observed structure. Because the long-standing issues of control over land between the state and customary authorities have implicating effects on property rights and therefore the ability to evaluate BCT potential, the discussion from a theoretical perspective is put here and relates directly to the second research question. The following pages concerning the decentralization concept and institutional- and contingency theory will help explain the potential underlying motives for decentralization, the observed structure and the consequences of allocating more power to the customary authorities.

7.2.1 Consequences of missing governance

From a theoretical perspective, the controlling organ for land administration can be the cause of conflict from e.g. corruption within the administrative organization but also be caused by incomplete controlling of these (Gyamera E. A., Duncan, Kuma, & Arko-Adjei, 2016). When a person or a group of people central to the process of titling and registering land is dishonest, conflicts can occur from the distrust and lack of moral behavior it brings to the inflicted applicant(s) as he/she will find the process dissatisfying and unfair. Either so, if the controlling mechanism that govern the administrative part is also not acting in an objective manner and in the applicants favor but rather covers up corruptive actions, a conflict is likely to escalate, perhaps even violently as the applicant's channel of complaint is itself dishonest (Lemarchand, 2009). Key to the functioning of an administrative part of a larger institutional network is the safeguard against fraud and corruption as this controlling mechanism ensure proper handling of complaints and objective processes of entitlement to land and property rights. A lack of accountability and responsibility within the administrative organ will upset applicants and users of this system which in turn will create turmoil and extensive distrust toward the system in whole (ibid.).

That traditional law is still enacted in rural Ghana indicate that the formal institutional framework in Ghana is relatively weak in enforcing legal government authority in areas controlled by chieftaincies. From an

institutional perspective, exercising control and influence over organs of the institutional framework is important to coordinate and administer the functions that society is crucially dependent upon (North, 1991). Different legal institutional setups can be observed around the world; municipalities in Denmark and sovereign states in the US are two different settings within a nation. But regardless of the institutional setup and their level of independence, both municipalities and US states fall under a national (federal) government and hence experience some extent of governance and control, but also protection from this setup. The chiefs and clans in rural Ghana fall under these settings as well, though under very different circumstances. While Denmark and the US has a strong and developed institutional framework, clear rules and legal enforcement of these, Ghana is yet to build such strong institutional capacity. Though the Ghanaian government has some influence on land matters in customary areas, their influence is arguably strongly limited in practice. Strengthening law and governance in developing countries has gotten much attention from international development organizations such as the World Bank because these elements are fundamental for institutions to function properly (the World Bank, 2018). It is therefore concerning that more has not been done to institutionalize land administration in rural areas of Ghana under the formal government and further enact unified legislation. However, several motives and constraints can provide explanations for the observed structure. These will be discussed through the use of theories of institutions, contingency theory and the decentralization concept.

7.2.2 The choice of decentralization

It is peculiar that a decentralization approach has been taken without considering an impartial control system to ensure and monitor that land registration and tenure security is upheld. It is important because previous studies find that such rights are not respected by the customary authorities. It should from an institutional perspective be a priority to ensure that land is not illegally sold, leased or allocated to other parties, without the consent of the state or its respective communities that inhabit the land. Idealistically, the responsibility is allocated to the formal government to ensure that chiefs respect the will of the local communities and therefore should assure that such rights are sustained.

It is hence surprising that the government restructured the LAP in 2008 to allocate further autonomy and responsibility to the CLS's given the less democratic nature of chieftaincies. An interesting question raised by political spectators is whether the government is truly in control at all outside Accra and Kumasi (Awal & Paller, 2016). They argue that hidden informal networks of local authorities have found their way into the formal institutions and the decentralization of responsibility to the CLS's and the subsequent control of chiefs over the secretariats is a facilitation of their level of power in formal institutions. However, the 1992 Constitution protect the right of ownership of customary lands which in part alters the level of influence the state can induce at the community level.

7.2.3 The decentralization concept

Through the perspective of decentralization theory, an explanation is provided of why decentralization has happened; namely that land services should be moved closer to the citizen; an argument already mentioned in the 2008 restructuring paper from the World Bank. Decentralization of public services is described as one of the "*essential institutional reform efforts (…) often implemented by donor agencies, especially by the World Bank and the International Monetary Fund"* (Saito, 2001, p. 30). The pro-argument is based on the premise that it will in turn improve accountability of services because people can scrutinize local institutions more easily than the central administration (government) (ibid.). However, the findings of this paper make it seem doubtful that scrutiny of chiefs is more easily obtained given that they can better influence the CLS after the Restructuring project. It is arguably less transparent for the people in local communities to scrutinize the custodial holders now, as the CLS can be used as a tool to corruptive actions and is even backed by the formal government in the form of legibility of operations. Another issue raised is the problem of sovereignty. Allocating power through decentralization ultimately allocates power to chiefs and their agenda (Brancati, 2006). This implies that the integrity of the government is weakened and thus limits their negotiating power in unifying land laws or governing mechanisms. This view is backed by critics of decentralization which claim that decentralization in developing countries, especially SSA, will increase power of local elites and incentivize them to act on personal benefits at the costs of the general population (Saito, 2001) (Prud´Homme, 1995) (Boye, 2015). It must although be mentioned, that assessing effects of decentralization has been proven difficult because numerous goals have often been pursued through decentralization, which are interconnected and interdependent from each other (ibid.). Previous studies has shown that decentralization shall be chosen with care because it is "*neither good nor bad for efficiency, equity, or macroeconomic stability; but rather that its effects depend on institution-specific design"* (Litvack, Ahmad, & Bird, 1998, p. 7). Whether it was well-considered to decentralize in this particular case is strongly arguable because of the circumstances highlighted in this paper.

7.2.4 Institutional perspective

Regarding the Alternative Dispute Resolution system that is based on traditional law, the central government has from an institutional perspective given up some of their responsibility in enforcing uniform legal protection for their citizen (North, 1991). The responsibility has instead been allocated to the local communities that obey to traditional laws which are fluid, strongly interpretable and lacks gender equality. However, the undisputable fact that disputes are solved quicker in traditional courts by lowering the amount of cases in formal courts, shows that efficiency gains have been made using ADR. This does however not imply that the cases have been resolved fair and objectively and should be researched further.

North's striking similarities of his theory on why institutions do not evolve, and the current structure is also noticeable. It can be argued that customary authorities have achieved substantial political influence in Ghana

because the chiefs collectively have common interest in keeping their power over stool and skin lands that make up the majority of Ghana's landmass. Their collective strength is also consolidated through the House of Chiefs, representative body within Ghana's political sphere (Stanley, 2018).Furthermore, the chiefs seem to have gained significant rule within communities and stands as a strong authority because of the land vested in them. While land- 'owning' chiefs have ceased control over the administration of vested land that supposedly should belong to the community at large, they are in the position to resist change that could challenge status quo and thus their power and source of influence. Further, their ability to influence interpretation of fluid traditional (customary) law, increases information asymmetry between the chiefs and the community members. The analogy of North on merchants that exploit information asymmetries to their own advantage is therefore well in line with the argumentation presented. However, North's theory do not explain why the government has not challenged their power to impose more democratic rule and better rights for the rural population. Next, an explanatory reason will be given.

7.2.5 Contingency theory

The analysis of the chiefs' significant influence in rural communities and the decision to decentralize administration to local secretariats can also be discussed through the contingency theory.

While North's theory of institutions depicts reality of the role of institutions in an idealistic sense and from the perspective of their ultimate role, contingency theory narrows in on the contingent factors of the institution that affect decisions. An alternative perspective is brought here, to analyze the government's choice of decentralizing land administrative tasks. Briefly, the theory claims that there is no natural optimal structure of organization but is instead contingent on the internal and external environment. Performance is thus dependent on the ability of the organization to restructure themselves accordingly and as dictated by the contingent factors that the organization exist in.

The analysis showed that customary authorities by the Constitution have autonomous control of land vested in them. Further, it was found that a unification of customary and statutory law had not been successful to the extent that a dualistic legal system is in effect today. Last, considering the long reign of customary authorities outside major cities, the choice of decentralization might be had been contingent on the existing power relations between state and customary authorities. In other words, moving forward with the formalization of land tenure rights and registration/mapping of customary land without provoking feuds between state and customary rulers, could only happen through a more subtle political approach. The realization and acknowledgement that power still resides strongly with the chiefs, and tenure security and land registration might only be possible by involving the custodians through allocation of responsibility influence. The LAP restructuring project in 2008 could thus be perceived as a result of adaptivity to the external environment and the recognition, that the primary goal of tenure security and land formalization only could be archived through political compromises.

Also considering the constitutional power, the choice of decentralization could therefore be explained by the realized power distribution between the state and the customary authorities.

Whether decentralization simply is the best approach to secure tenure and property rights or the choice happened out of desperation to accommodate progress can be difficult to evaluate. According to Victoria Stanley the reality lies in between the two; she argues that land administration had been decentralized even before the restructuring project, and the project was simply *"realizing the de-facto reality and trying to provide more support to those decentralized customary authorities to better manage their land resources"* (Stanley, 2018). A third perspective is also provided, namely that the current structure is a result of a '*non-interference policy'* by the government (Ubink J. M., 2015). Ubink argues that the lack of actions from state institutions are caused by political unwillingness, limited resources and a strong cooperation between chiefs to uphold their sovereignty. Moreover, she points out corruption and mismanagement factors that contribute to the current structure and the loss of control from the government (ibid.)

Regardless of the underlying reasons, contingency theory provides a framework for analyzing externalities that form organizational structure. According to the theory an organization irrespective of origin, will pursue performance optimizing structures that is best suited for the contingencies affecting the performance. In this case the realization of the power of local authorities (environmental factor) seem to have affected the internal strategy of the government to pursue a rather hands-off approach and allocate autonomy and responsibility of local authorities to manage their own lands. Although this papers analysis has showed that it might have decreased tenure security in rural areas, findings also show that more land has been registered after responsibility has been allocated to customary authorities and dispute resolutions has increased following the alternative dispute mechanism.

Next, the problems of tenure and property rights is linked to the potential of BCT. The following sections discusses the applicability of blockchain in addressing these problems and directly relates to the 3rd research question

7.3 Limited blockchain potential

It has become evident that many of the inefficiencies of the land administration system and underlying reasons for insecure property rights are not directly solvable through blockchains alone but requires much broader and extensive political and structural reforms to provide the citizens of Ghana, in particular the rural population, with land and tenure security. The insolvability of BCT in addressing many of these matters is simply because the fundamental problems are not of technological nature.

7.3.1 Legislative concerns

5 major legal issues was found to be causing decreased tenure security for the rural population of Ghana; (i) PNDCL has limited reach which inhibits the expansion of a title registry to the rural areas; (ii) The Constitution allocates sovereignty to custodians in managing own land and thus use of customary (traditional) law; (iii) the harmonization of traditional and statutory law; (iv) the missing right of women to own and tenure land and (v) customary law is fluid and exposed to subjective interpretation by the people in power.

The outdated deed system can only be replaced with a title registry system through reforms or by expanding the PNDCL Act to cover nationwide. However, entitlement have little value if the policy is not backed by legal enforcement and active governance over the registry process in peri-urban and rural areas. Implementing a title system will likely help reduce multiple sales of land as it will be determined and registered who is the true owner or leaseholder of the disputed land. However, expanding the PNDCL to cover areas outside Kumasi and Accra and further entangle the rightful land-owning and land-tenure individuals is a lengthy process and requires a considerable investment in resources and staff. Because responsibility of land administration is left to the land-owning communities, financial assistance from the state is believed to be hindered or at least very limited.

Important to recognize, is that entitlement through registration is a single side to a multitude of problems. To strengthen tenure security for women, they must achieve same or equal rights to cultivate and lease land as their counterparts as to uphold tenure security in the case of divorce or the husband's death. This is however unrealistic without harmonizing customary and statutory (common) law because women in customary law only gain use-rights through their husbands and do not themselves have the right to own land (LandLinks, 2018). To facilitate harmonization of laws the 1992 constitution must either be re-visited to enforce more democratic statutory law in rural Ghana or induce statutory law through negotiations with each local community. Second, customary law is not codified which has been shown to be exploited by authorities in land matters which decreases tenure security for the individuals being influenced by unlawful selling of land. Scholars argue that protecting the citizens use-right to land in customary land can only be achieved by direct state involvement because the customary institutional framework is inefficient and not suited to protect property rights (Schoneveld & German, 2014).

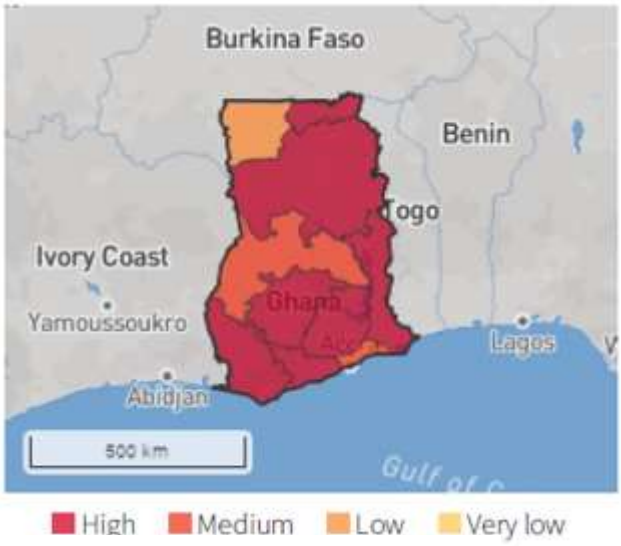
7.3.2 Structural concerns

Orthophoto mapping and the lack of digitalization is also a structural problem that blockchain alone cannot solve. It requires systematic allocation of monetary and physical resources and a systematic approach to land mapping and digitizing existing documents (Stanley, 2018). Further, it is evident that skills and training of professional surveyors of land are lacking and implementing BCT to the registry system of the land administration will only increase the technical complexity at this point.

7.3.3 Digitalization

Finally, the lack of digitization stands as a dire reminder of why BCT should be evaluated on practical considerations and discussed in the context of the environment. The paper-based system is a major impediment for introducing a blockchain system and might indicate that the technology has been introduced too early as the instrument for breaking the poverty cycle in Sub Saharan Africa (Kshetri, 2017). Digitization itself should be a priority from the government, because of the many disadvantages of holding paper records such as low accessibility, risk of tampering and fraud and risk of physical damage to the archives. Efficiency and performance are moreover characteristics of standard digitalized information systems, not just BCT. A very pragmatic example is the risk of natural disasters; Ghana is situated in Sub-Saharan Africa, a region known for its high probability of natural disasters (GFDRR, 2018). The latest report from Thinkhazard, an international reporting-services organization on natural disasters, has evaluated several types of natural disasters as being of high-risk occurrences in Ghana, namely risk of urban and river flooding, earthquakes and wildfires (ThinkHazard, 2017). Figure 7-1 shows the risk of a major urban flood that is expected in Ghana within the next ten years, based on trend analyses of previous flood patterns (ibid.). Due to Accra's poor drainage system and the changing weather conditions in Ghana, a heavy flood could severely inflict damage to the municipality buildings that hold recording of land transactions, titles and deeds (ReliefWeb, 2016) (FloodList, 2018). The 2010 earthquake in Haiti which destroyed a line of municipal buildings holding Haiti's land title records was evidence of such risk. The missing records proved to be a major challenge for Haiti's government and international NGO's in rebuilding the country as no-one knew who owned what and resulted in large disputes over land and an unseen scenario of land grabbing's (i.e. illegal occupation of land) in the country (Calais, et al., 2010) (Moloney, 2010). Haiti's example shows the potential consequences of both paper-based documents and a centralized location for storage.

Figure 7-1. Risk of urban floods



Source: (ThinkHazard, 2017)

7.3.4 Blockchain for attaining governance and control

Not all identified issues can be classified as being out of scope of BCT. To freshen the memory of the reader, traits of BCT was mentioned in the beginning of the paper as a tool for reducing corruption in the developing world (WEF, 2018). Further, its use in governance and transparency of processes is a key trait of BCT (Moyce, 2016).

It was found that corruption, in particular fraudulent activities and bribery is a serious problem in the registration sector. Moreover, evidence of document forgery was highlighted earlier. The lack of missing control over the registration process in rural areas enable illegit actions to become more widespread and extensive. Such a dilemma calls for more centralized governance of land administration in the rural areas to secure that tenure and property rights are done in accordance with the prescribed processes, including that land documents are stored correctly and securely to avoid illegal tampering. In this context, BCT do have some significant advantages in obtaining transparency through control and compliance when land is registered.

In the circumstance of document forgery/fraud and bribery, blockchain has the potential to strongly reduce the possibility of altering such documents when stored of the blockchain, because the order that blocks appear in and the encryption itself make it extremely difficult to change existing data. Further, a control mechanism that works in conjunction with the CLS and the Lands Commission is viable to assure transparency and diligence in the registration process of land. Instead of relying on blind trust that the CLS and other land institutions is conforming to rules and processes, the use of BCT can actively record the process between the stakeholders and disperse that information through a distributed ledger. For example, when a pending application for a sale or lease of land is made, the application could be distributed to all involved land agencies through the blockchain network, to prevent that the application is not only initially handled at the local level but be visible to all parties at once, such as to remove the probability of an application being altered or removed at any stage in the approval process.

Such a solution although assumes that applications are made electronically on a computer or mobile device. An electronic validation of the applicant would therefore be needed to assure that the person submitting the application is indeed who he says he is. The current paper-based system requires the applicant to meet up physically and must bring ID documentation at the secretariat which acts as the validating mechanism of an applicant's credentials (Akwensivie, 2017). A compromise could therefore also be to be physically present at the CLS, while the digital application is made in the presence of an CLS official. It however, do not remove the potential of bribery to gain access to already entitled processes.

7.3.5 End notes

It must be noted that a blockchain system for obtaining governance and reducing corruption is not considered applicable at this point. The issue of an existing paper-based registry system is simply incompatible to the fundamental requirements of blockchain. Moreover, it would not make sense to consider the implementation of a blockchain system because documentation for land demarcation, (i.e. orthophoto-mapping) is missing, and would result in inaccurate recordings on the blockchain and complicate things further. Victoria Stanley formulated her perspective by stating that *"Moving into a digital environment is involved with a lot of problems. Blockchain is a nice security technology but cannot help in solving the problem with several hundred and thousand parcels not been registered. This can only be done in the systematic process that involves both people and technology."* - (Stanley, 2018).

CHAPTER VIII - DESIGN CONSIDERATIONS

Although several issues have been found which strongly diminishes the ability to implement a blockchain solution to the registry system at this point in time, it is still believed beneficial to discuss implemental considerations and design with the assumption that current land documents had been digitized and orthophoto mapping had been extended to the rural communities. The author is well-aware of the implications of discussing design considerations when several missing prerequisites has not been realized. On the contrary, such considerations are important for the development of academic progress on the subject of blockchain capabilities; designs solutions must be linked to both specific contingencies and the functioning of a land registry in general, as to retain a long-term view of its potential in solving some of the identified issues of land tenure insecurity. The following chapter therefore provides some of the authors own and others reflections on the considerations that must be taken when designing a blockchain system for land administration. The three cases presented in chapter VI will be mentioned briefly to strengthen the discussion on design thinking and issues of privacy, anonymity and failure points. The following considerations assume that a blockchain-based land registry will be implemented through tight coordination with state and customary authorities and not independently by private organizations.

8.1 Architectural design

Given the infant technology a 'best-in-practice' framework is yet to be found for land registry applications (McKinsey, 2017). Numerous types of blockchain structures exist while each have strengths and weaknesses that might or might not be advantageous for the context of a state-owned land administration system. Analyzing which blockchain application and structure is best suited can therefore be difficult to nail down. However, the organizational case studies and the identified issues give some direction to which considerations should be taken when evaluating the fit of various blockchain structures. Further, more general design decisions such as control, data ownership, privacy and level of access should also be included, because it will inevitably concern the performance and quality of a blockchain-supported land registry.

8.1.1 Public or private blockchain structure

By applying the characteristics of figure 8-1 to Ghana's context can give a better picture of which structure to choose. For example, restricting the 'write'-access to appointed entities is encouraged when dealing with land registries because the processes involves professionals and it is important that entries (updates) into the system is monitored and can only be done by licensed surveyors, agents and other authorities. However, for the land registry to be transparent, citizens should arguably be permissioned to access insensitive information that is stored on the digital ledger while personal information should be restricted to permissioned officials. Furthermore, the title applicant/holder shall be able to produce data that can later be validated such as requests for information or new registrations. Such a structure is also classified as 'permissioned private blockchains'

and has been evaluated as good fit for governments and financial institutions because it regulates access into several layers or permission-levels (Xiwei, et al., 2017).

Figure 8-1. Comparing open and closed Blockchain applications

	Open blockchains	Closed blockchains
Who can update	Everybody	Appointed entities
Who can produce data	All users	Customers and/or partners
Incentive to follow rules	Economic	Reputation
Storage	Distributed	Centralized
Trust central actors	No	Yes
Transaction costs	Varies from low to high	Low
Capacity/throughput	Low/slow	High/fast
Immutability	Strong	Unclear
Currency/token	Yes	No
Examples	Bitcoin, Ethereum	HyperLedger, Corda

Source: (Ølnes, Ubacht, & Janssen, 2017)

8.1.2 Economic or reputational incentives

Regarding the *incentive to follow rules* in figure 8-1 (i.e. Validating information correctly) economic incentives used by many public blockchains has some inherent flaws. As mentioned, cryptocurrencies such as the HRBE token used by Land Layby, can be subject to large price volatilities and bears the risk of defaulting, hence jeopardizing the functioning of the registry system. Furthermore, it would require an initial coin offering (ICO) to tie the token to actual monetary value. This also implies that the tokens' value is decided by the financial market and therefore curbs stable costs of transaction which is crucial for efficient trade (North, 1991). Third, a public structure that incentivizes through tokens for completed work has the flaw that, as the competition increases on the network to validate transactions, it will become increasingly energy consuming as the algorithms will become proportionately difficult to solve. Last, private blockchains also rely much less on a network of nodes which implies that the dependence on internet access is considerably lower compared to public blockchains structures.

8.1.3 Public regulations and constraints

Evaluating the use of blockchain in government institutions must also be put in context of the regulations that surround it (Thompson, 2017). Due diligence of the parties involved in a transaction is an important factor for all formal governmental institutions and enforcing this can be tricky, particularly in public blockchains because miners are unknown (anonymous) by default. It imposes considerations on the balance of anonymity and security because, as mentioned, miners should be anonymous to each other to avoid the event of coordination between them leading to a 51% attack. On the other hand, if anonymity is guaranteed, who will be drawn responsible if the consensus mechanism proved faulty? (Vos, 2016) (Rod, 2017). This also raises the question of who should pay remuneration to the victim that possibly got influenced by it. These legal considerations must be dealt with on a state level if public BCT is to be utilized in land administration because such legal flaws could have significant impact on property rights if responsibility and remuneration cannot be placed to any party.

Though figure 8-1 perceives blockchain structures as a distinction between private (permissioned) and public (permission less) structures, the reality is less extreme as multi-level permissions also exist. Figure 8-2 shows a fine-grained division between public (fully decentralized) systems and fully centralized (private) systems. The reason for the changing terminology (i.e. centralized = private) is because in private networks, fewer nodes are permissioned on the network which make the ledger less decentralized and more centralized amongst the participating nodes. The less clear terminology is thus a reflection of the infancy of blockchain terminology and a lack of standard vocabulary definitions.

Figure 8-2. Blockchain-related design decisions regarding (de)centralization, with an indication of their relative impact on quality.

Design Decision	Option	Impact			
		Fundamental properties	Cost efficiency	Performance	#Failure points
Fully Centralised	Services with a single provider (*e.g.*, governments, courts)	⊕	⊕⊕⊕	⊕⊕⊕	1
	Services with alternative providers (*e.g.*, banking, online payments, cloud services)				
Partially Centralised & Partially Decentralised	Permissioned blockchain with permissions for fine-grained operations on the transaction level (*e.g.*, permission to create assets)	⊕⊕	⊕⊕	⊕⊕	*
	Permissioned blockchain with permissioned miners (write), but permission-less normal nodes (read)				
Fully Decentralised	Permission-less blockchain	⊕⊕⊕	⊕	⊕	Majority (nodes, power, stake)
		Fundamental properties	**Cost efficiency**	**Performance**	**#Failure points**
Verifier	Single verifier trusted by the network (external verifier signs valid transactions; internal verifier uses previously-injected external state)	⊕⊕	⊕⊕	⊕⊕	1
	M-of-N verifier trusted by the network	⊕⊕⊕	⊕	⊕	M
	Ad hoc verifier trusted by the participants involved	⊕	⊕⊕⊕	⊕⊕	1 (per ad hoc choice)

(+) is less favorable while (+)(+) and (+)(+)(+) is favorable and most favorable, respectively.

Source: (Xiwei, et al., 2017)

Given our discussion of having transparency through decentralization but only to the extent that citizens can view information while keeping centralized decision-making ('write-access') to verifiers, the *partially centralized & partially decentralized* design decision shown in figure 8-2 is applicable. This structure is rated favorable on all *Impact* parameters because it utilizes *cost efficiency* by not having a large network of mining nodes that is not restricted by heavy algorithmic calculations, which also affects the speed of transactions, measured as *performance* (Xiwei, et al., 2017). Further, failure points are dependent on the number of nodes in the system that maintains the ledger, as pictured by "*" in the *#failure points* column. This relates to the distributional factor of blockchain, namely that a digital ledger becomes increasingly robust as the number of nodes is increased on the network, because more people then hold the same ledger and thus is more resistant to tampering.

8.1.4 Verifiers

The idea of having multiple verifiers that reaches consensus thus establishing governance and auditing amongst stakeholders of land was briefly mentioned in the case of ChromaWay. Using figure 8-2, multiple verifiers would relate to M-of-N verifiers trusted by the network, also referred to as a *distributed verifier* which is *"comprised of several verifiers that provide the same functionality to check the external state (...) to authorise a transaction"* (Xiwei, et al., 2017, p. 4). Verifiers is therefore an analogy to the Proof-of-Authority mechanism used in ChromaWays Postchain system.

8.1.5 Proof-of-Authority

The PoA consensus protocol could be practical in Ghana's case for validating new records and recording them on the blockchain. The design has been developed to be used particularly by public institutions and private enterprises because it has been built around beforementioned needed attributes of privacy and less reliance on support- and incentive-systems such as tokens, heavy calculations and anonymous nodes (ChromaWay, 2017). However, several considerations must be taken if this mechanism is used;

- Identity of the administrator/verifier must be confirmed.
- Administrative roles should be linked with reputation and difficult to obtain.
- Homogenous selection procedures to assure integrity and trust.

Obviously, verifiers' identity should be confirmed so that no doubts can be raised who approved what. Further, the identity of the verifier should arguably be made public such that their incentive to act accordingly is linked to their personal reputation. The transparency which is imbedded in BCT also enables back-tracking and the culprit can easily be picked out. This will strongly reduce the incentive for verifiers to act carelessly because of the heightened risk of being caught. However, it doesn't imply the verifying role should be given easily, and the verifier must earn the right to their title.

Furthermore, it is crucial that verifiers are kept in silos such that the potential of internal coordination is kept at a minimum. More specifically, the preventive measure of allocating verifier-permission to unrelated actors assures that verifications are not at risk of one-sided and subjective approval. It is therefore advised that validating roles are spread across the functions of the Lands Commission, its Division, the CLS and the Land Management Committees and perhaps also an independent validating unit. Each institution would also be made accountable for providing their expertise at each step in the validating process.

8.1.6 Randomizing round robins

Given the extent of a nationwide system with thousands of registrations a year per region, several verifiers would most likely be needed within the same departments/division and committees. While only a single verifier from each department/division and committee is required to validate and approve an application, a randomized round robin principle could be imbedded in the system. Round robin refers to a rationalized order of turns. By randomizing the turns, such that verifiers are randomly picked in each location to verify a specific land recording, it would reduce the probability for events of coordinated verification (corruption) and the possibility of bribery in the verification process.

8.1.7 Storage and computation

The issue of block sizes can become a problem when transaction-data take up a lot of computer-space. Consideration on what to keep 'on-chain' must therefore be made to keep the blockchain efficient. In data management terminology, *raw data* such as orthophoto-maps and cadastral information could be kept off the blockchain, while text and numerical data that doesn't require much storage space, (such as GPS boundary coordinates for a particular parcel/plot) is stored on the blockchain. Alternatively, the large amount of data could also be boiled down to numeric hash values and stored on the blockchain altogether (McKinsey, 2017). The hash values thus represent data stored on traditional databases and can easily be recovered if needed. Since hash values is directly linked to the database and reflects the content, it still provides the immutability and transparency characteristics of blockchain (ibid.).

8.2 Reflections on design

8.2.1 Is it secure?

Considerations can be raised in regard to the security aspect of a blockchain ledger that is not as distributed/decentralized as public blockchains. It further raises reliability concerns because appointed administrators act as verifiers in a system which itself is corrupt. By relying on a private blockchain where illegit consensus can be achieved more easily than through decentralized public blockchains unquestionably raises doubts on the viability of such a solution. However, in retrospect of the findings and the part-conclusions drawn on the land administration, BCT do offer more security than the existing system because it utilizes database technology, involves multiple validators and has no centralized (and therefore vulnerable) storage of data. In addition, a private blockchain structure do not suffer from some of the same inefficiencies that public blockchain structures do and seem to be better suited for governmental institutional systems that has to be both reliable and robust.

8.2.2 Is it reliable?

An important note in addressing tenure security is the lack of records reliability that BCT does no possess (Lemieux, 2016). The GIGO principle is at play which means that a blockchain based land registry system is only as reliable as the data being put on it. As evidenced, the documentation that surround land records in Ghana today, are not accurate enough to be put on the blockchain. To utilize the technology, it must therefore first be established, through manual and lengthy processes, whom is the real owner of a plot of land and how parcel boundaries are demarcated. Once such fundamental properties are in place, BCT can be utilized to create a tamperproof system. Blockchain in registries can thus be summarized as having *record integrity* but not *record reliability*, without the process of ensuring true ownership first (ibid.).

8.3 Final remarks

8.3.1 Compatibility with other software

The de-facto reality is that BCT is still in its infant phase. We have yet to see a platform that sets industrial standards and delivers a uniform and inter-compatible solution which works across platforms and incorporates traits from both public and private blockchains. ChromaWays solution to technical integrations with existing support-systems such as databases and other governmental systems stands a preview of what could become standard practice given their pilot projects in Sweden and India are successful.

A good narrative is the Microsoft Operating System in the early 80s, the MS-DOS. The Disk Operation System (DOS) was first of its kind and had several limitations; most important was the incompatibility of new programs or software. A user would need to reconfigure the DOS so that it could read the software correctly. Today, everything is integrated with Microsoft Windows which greatly enhances the easiness and applicability and reduces costs of implementing new software. Unlike Windows, BCT has yet to go through the commercialization process in which it becomes mainstream technology and is adopted into common operating frameworks. Investing in a blockchain system might prove too tedious a task for the Ghanaian government and further incur some major structural and implemental challenges. On the other hand, much of their current processes are physical and in paper-form implying no actual digitized system of recordings yet. Ghana could arguably leapfrog that stage and avoid compatibility-issues with other systems and software. However, another issue with emergent technology is the potential short life-span it has in the initial years. When new technology is put on the market it tends to be highly volatile and new versions are created more often in the beginning (Adner & Kapoor, 2016). The life cycle of new technology therefore tends to be lower than average and implies some unintentional costs for the first-movers.

8.3.2 Risk of emergent technology

A business practice heard several times over is the consideration of firms to simply wait until emergent technology has been tested by a competitor such that the competitor is carrying the sole risk (and cost) of implementing the new technology (Adner & Kapoor, 2016). The other market players can then learn from their experiences and introduce the elements that work, subsequently.

In Ghana's situation it could prove beneficial to closely watch the multitude of blockchain pilot projects being undertaken and learn from their mistakes and successes. As the academic knowledge expands on the topic and businesses utilizes it to build new and better applications, Ghana could benefit from BCT later. Since orthophoto-mapping and digitalization is yet to be made, they are better off focusing on these fundamental problems and then reevaluate the potential of the technology.

8.3.3 The importance of community involvement

The system can be only so fruitful to the ability of convincing the community to register their land or property. As emphasized by both Larry Bates from Bitland and Raymond from Land Layby, the importance of informing and enlighten the communities about property rights therefore cannot be underestimated. If the community do not trust the system and thus continues using unwritten agreements with the chiefs, the registry has little durability in securing that their right of use is tracked, and records are secured from tampering (UN, 2012).

Equally important is the recognition of the power structure that resides in rural communities. The concept of chieftaincy in land matters is not new and must be included in the design. A blockchain registry must therefore still care for the customs and norms that imbeds land tenure and not impose a government system that neglects that land is still held by the indigenous community. On the other hand, the state must play a key role in the coordination and in restricting the potential of corruption and illegit actions by posing more governance over how land registration is handled in skin and stool lands. In other words, the state shall provide an efficient framework and procedures that enables accurate and secure land records but still respect customs that are not in direct opposition to tenure security and property rights in whole. Equally so, must chiefs be encountered by penalties from the state if land is not registered according to the registration process or legally respected.

CHAPTER IX - CONCLUSION

9.1 Conclusion

Despite BCT's appraisal in land administration, the technology has very little potential in addressing and strengthening the multifaceted and complex problems of Ghanaian property rights and tenure security that exist today. The study found that many of the problems that affect tenure security are caused by a weak institutional framework characterized by dispersed power structures between state and customary authorities, pluralistic legal systems and cultural norms which must be solved by other means than BCT.

BCT can provide immutability and transparency of land records to inhibit document forgery and dual registration of ownership/tenure but only on the prerequisite that accurate demarcations of land plots/parcels are ascertained, and the actual ownership/tenure are determined. These crucial components must first be unraveled to prevent that inaccurate land records are stored on the blockchain and can only be accomplished through orthophoto-mapping of land and physical inspections and dialogue with the communities that inhabit these areas.

However, securing property rights and tenure depends on several other factors than simply accurate and secure storage of titles, deeds and leases. The study emphasizes that legal enforcement and protection of one's rights are crucial components to a functioning land administration system that offers comprehensive security for all citizens. The weak realized control of the central government and its institutions in peri-urban and rural Ghana, stands as a major impediment for enforcing universal property rights and further decreases the potential for a blockchain-based land governance system to be implemented. Although such a system could prove valuable in attaining transparency and governance in the registration process, it will require that the customary authorities and the community at large are willing to adopt it. This implies that peri-urban and rural communities must understand the usefulness and importance of registered tenure and ownership to progress with the formalization of property rights and land tenure.

Considering the novice technology of BCT, it must also be noted that we have yet to see a functioning system that incorporates all attributes of both public and private blockchains. Each structure has strengths and weaknesses regarding the level of decentralization, secure storage and reliance on support systems. Nevertheless, the study gave a glance at BCT's potential but also of the reality it faces to become a widely adopted system in land administration. The study further discussed some of the design considerations that must be taken to accurately depict its use-value and potential. It is important for the further development of knowledge on this topic that such considerations are imbedded in future research on BCT for land administration.

With BCT projects being piloted in several other countries, future research should also be aimed at gathering empirical knowledge in the search for new insights that could promote the development of BCT. In addition,

it is advised to measure the effect of BCT on tenure security and property rights in pilot projects, to evaluate the technology's usefulness in strengthening these rights.

9.2 Reflection on the academic process

While the original thought of this paper, was to spur a realistic discussion on blockchain applications in securing property rights and its use-value in land administration, a much more extensive knowledge base must be created before its true potential can be evaluated accurately. While my fascination for both development economics and new technology has been the *primus motor* for the creation of this paper, the chosen research objective has proven difficult to answer because of the unstable and ever-evolving state of the technology and the limited information that exist on Ghana's land administration system.

Progress of BCT is constantly being made and new sides of the technology has continuously been elaborated while writing this paper. While it was emphasized that new findings from studies on BCT got incorporated in this paper, it was later necessary to make a sharp cut of new knowledge included as to not overwhelm the reader and deter the ability to reach a conclusion. It was further decided to keep a modest approach to the technology and avoid endless explanations of each detail of the technology. The academic output of this study is therefore not to give a complete picture of the many aspects of BCT, but to evaluate the core components of the technology relative to its usability in strengthening land administration and subsequent property rights.

Overall, much has been learned throughout the thesis. Not only has new knowledge been generated on the topic, but myself, as a student and person in transit, has learnt of the hardship of research. Collecting data and combining it into useful insights has been both frustrating, exciting, frightening and beneficial for my academic learning progress.

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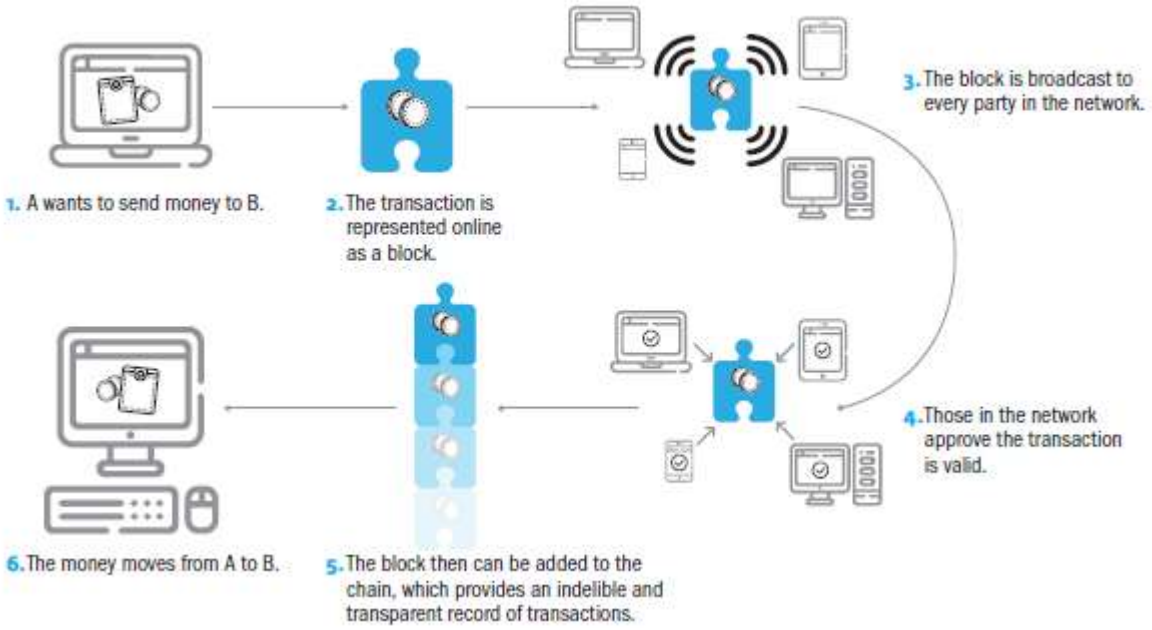
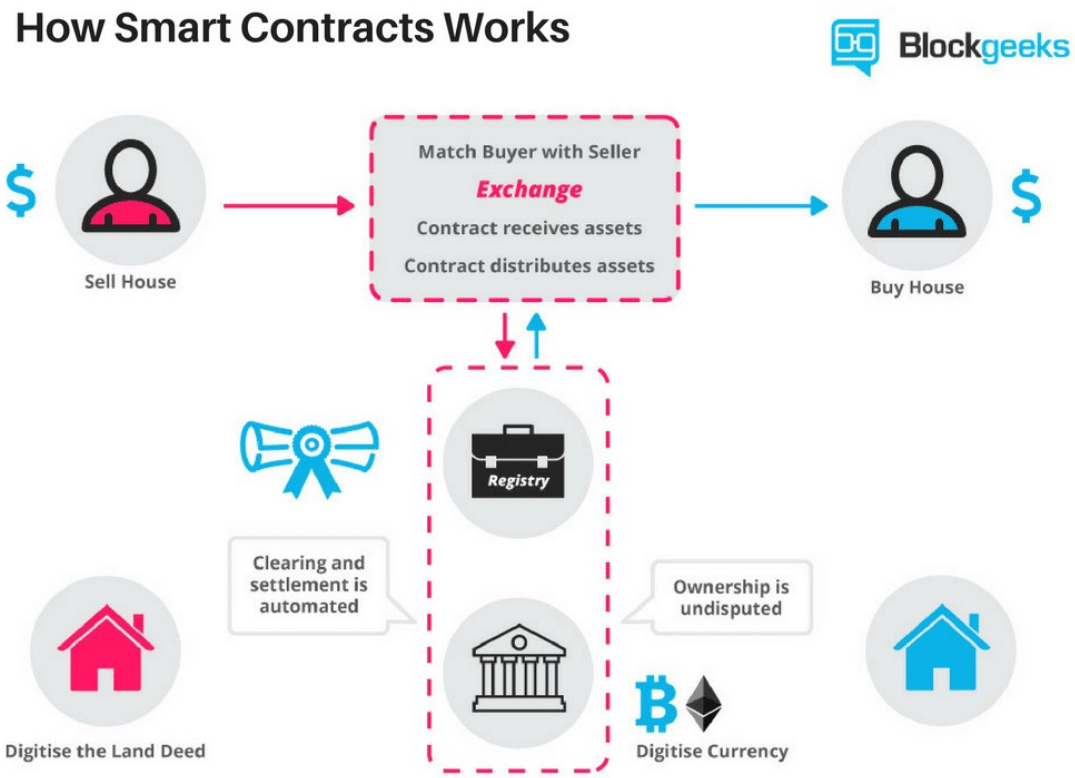
APPENDIX A – BLOCKCHAIN EXPLAINED

10-1. A blockchain transaction (process) explained



Source: (IFC, 2017)

10-2. Smart contracts explained



Source: (BlockGeeks, 2018)

APPENDIX B – MICRODATA

10-3. Is this land registered

A81 Is this land registered	Freq.	Percent	Cum.
yes	260	8,68	8,68
no	2734	91,32	100
total	2994	100.00	

10-4. Disputes over land

A6a Have you ever had a dispute with anyone over this land	Freq.	Percent	Cum.
0	1	0.05	0.05
Yes	76	3.62	3.67
No	2,020	96.33	100.00
Total	2,097	100.00	

10-5. Number of disputes over land

A6b How many disputes have you had since you started using this land	Freq.	Percent	Cum.
1	97	69,29	69,29
2	19	13,57	82,86
3	12	8,57	91,43
4	4	2,86	94,29
5	4	2,86	97,14
10	4	2,86	100,00
Total	140	100,00	

10-6. Knowledge of land registration possibilities

A76 Have you heard about a program to register land in this area	Freq.	Percent	Cum.
Yes	632	25,97	25,97
No	1802	74,03	100,00
Total	2434	100,00	

10-7. Fear of losing land tenure

A3 If you were to leave this land empty for several months are you worried that you lose the land?	Freq.	Percent	Cum.
Yes	1114	31,75	31,75
No	2395	68,25	100,00
Total	3509	100,00	

APPENDIX C - OTHER

10-8: list of land-legislation and its provisions

Parameter	Relevant legislation	Specific provisions
1. Types and duration of land rights afforded to investors	• Land Title Registration Law 1986 • Constitution 1992	• Only leasehold titles for a period of up to 50 years for foreign investors and 99 years for domestic investors • Leases are renewable for the same period
2. Provisions to protect customary rights	• Land Title Registration Law 1986 • Administration of Lands Act 1962 • Constitution 1992	• Customary tenure is recognised and governed by customary law • The Traditional Council has to approve the alienation of customary land and has fiduciary duties
3. Mechanisms for guiding land allocation	• Wildlife Reserves Regulations 1971 • Forest Ordinance 1927 • Ghana Investment Promotion Act 1994 • Savannah Accelerated Development Authority (SADA) Act 2010	• Forest and wildlife reserves cannot be developed for agriculture • The GIPC can provide assistance and guidance to enterprise during project establishment • The Savannah Accelerated Development Authority (SADA) should assist agribusinesses in acquiring land
4. Participation of customary land users	• Environmental Assessment Regulations 1999 • (National Land Policy 1999)	• A public hearing may be required if concerns are raised over the content of the EIA before an environmental permit is issued • (No interest in land belonging to an individual or family can be disposed of without consultation)
5. Mechanisms for local representation	• Constitution 1992	• Besides deciding on the alienation, the Traditional Council is mandated to represent its constituents in negotiations, having fiduciary duties to administer land in a manner beneficial to its constituency
6. The role of intermediaries	• Constitution 1992 • Land Commission Act 2008	• The Lands Commission is required to approve that the development is consistent with existing development plans before titling
7. Compensation mechanisms	• State Lands Act 1962 • Constitution 1992 • (National Land Policy 1999)	• Only legislated for land acquisitions by the state, which should enable the replacement of land of equal value and suitability and 'cover the cost of disturbance' • Land revenues should be shared between the Traditional Council, Stool and District Assembly according to a constitutional formula • (For all types of land acquisitions, 'provisions should be made for persons displaced')
8. Impact mitigation requirements	• Environmental Assessment Regulations 1999	• Aside from the above compensation mechanisms, impact mitigation requirements apply only to environmental issues and should be included in the EMP
9. Monitoring	• Environmental Protection Agency Act 1994 • Environmental Assessment Regulations 1999	• The EPA is charged with ensuring 'compliance with any laid down environmental impact assessment procedures in the planning and execution of development projects' • Project proponents must produce an EMP to guide 'self-regulation' and submit an annual environmental report

(*continued*)

Parameter	Relevant legislation	Specific provisions
10. Dispute resolution	• Environmental Assessment Regulations 1999 • Land Title Registration Regulation 1986 • Chieftaincy Act 2008	• Aggrieved persons can issue complaints with: ° the EPA over issuance of environmental permits; ° with the Lands Commission over issuance of leasehold titles; ° and the House of Chiefs over chiefly misconduct
11. Changes in the status or classification of customary land	• Constitution 1992 • State Lands Act 1962	• Customary land cannot be sold • It can only be reclassified to state land when acquired through the right to eminent domain

Note: Policies have, in contrast to the acts and regulations, no statutory force. They are distinguished by use of brackets.

Source: (Paaga, 2013)

10-9: Full list of CLS' functions

- Customary Land Secretariats are decentralised land administration units owned by land owning communities

Functions:

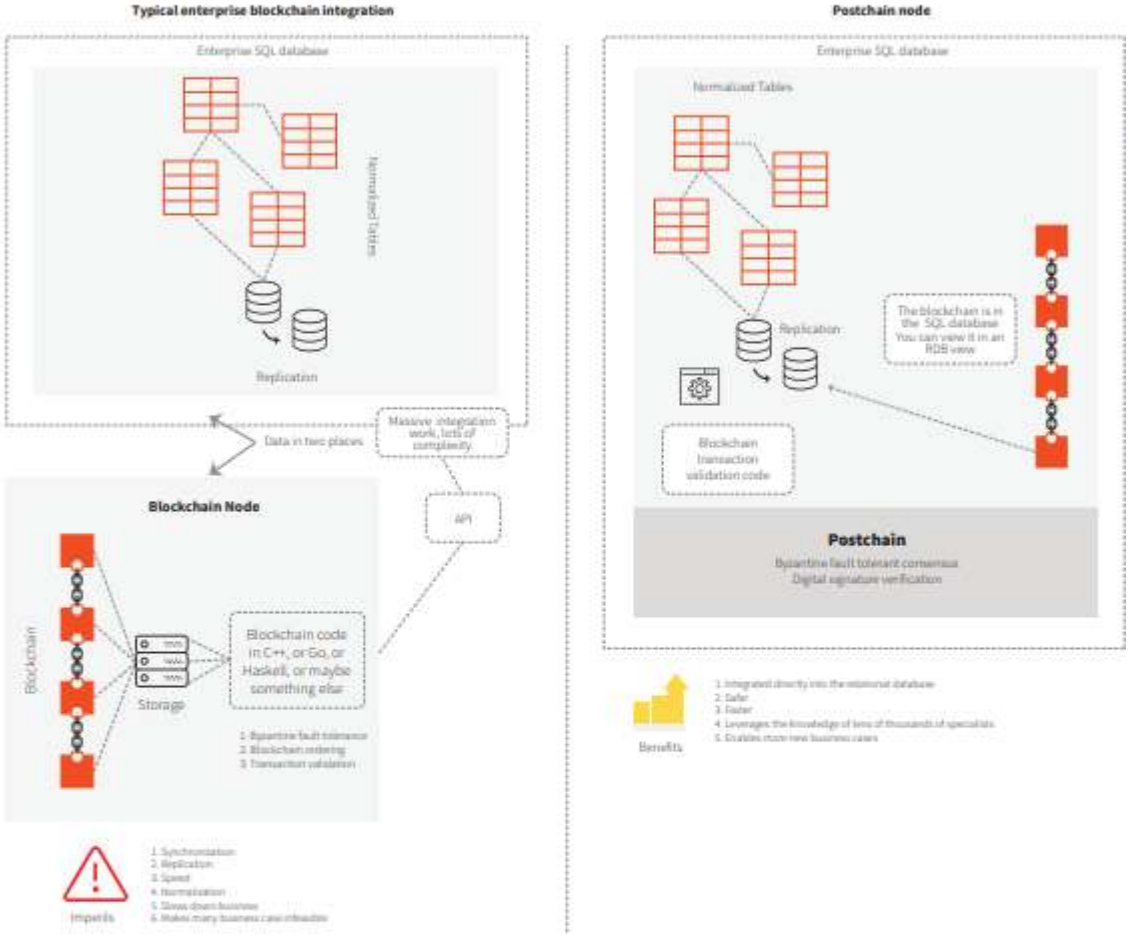
- Keeping and maintaining accurate and up to date land records.
- Provision of information about the land-owning community to the public.
- Provision of land information to the public – ownership, rights, use, availability, etc.
- Keeping records of all fees and charges associated with land grants.
- Liaising with Town Development Committees to ensure that development conforms to planning schemes.
- Receiving all correspondence on behalf of the Land Management Committee.
- Serve as the link between the land-owning community and the public sector land agencies, District/Municipal/Metropolitan Assemblies, Environmental Protection Agency, etc.
- Serving as the link between an applicant and the Land Management Committee.
- Preparing accounts of all income and expenditure.
- Preparing periodic reports on all activities of the Secretariat.
- Promote ADR and keep records on land related disputes settled at the local level through ADR.

Source: (Kakraba-Ampeh, 2008)

10-11: Postchain and the solution to block size limits

Architecture Comparison

Some private blockchains are starting to incorporate some kind of backing database, to enable them to store and transact more complex kinds of data. Postchain is built from the ground up to offer total integration between block-chain and database management system. The difference between these two approaches is illustrated below.



Performance

Due to being built directly on relational database technology, Postchain inherits the performance benefits and the reliability of these thoroughly tested systems. Some overhead is introduced because of the cryptographic signing, validation and consensus which secures the system.

Network/Cluster performance

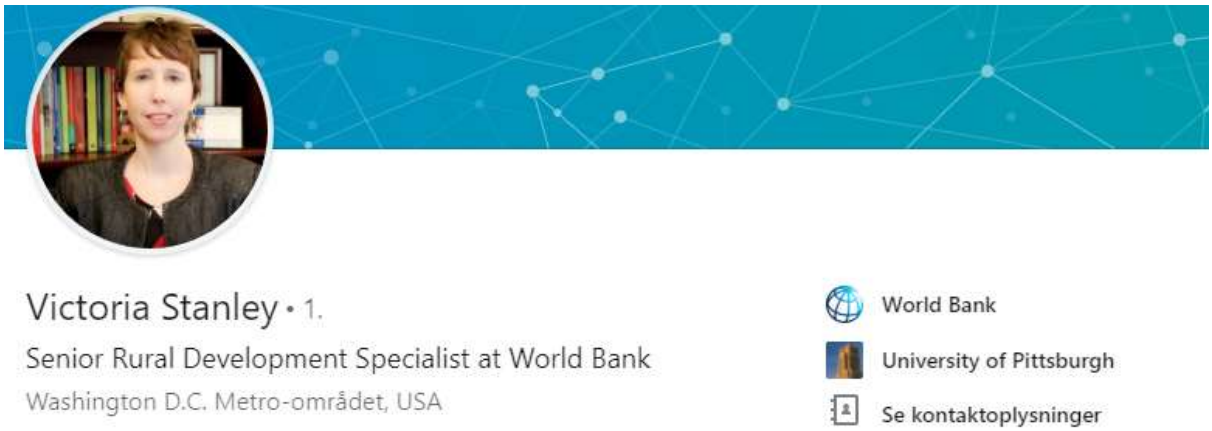
On a fast network, with standard Google cloud servers currently Postchain can validate 160 transactions per second, each one signed by two parties. This number can be estimated to scale up to 500-1000 transactions per second, with optimizations and matching hardware. Do also note that a cluster should be distributed out on different hosting options, not for performance, but for for added security.

Source: (ChromaWay, 2017)

APPENDIX D – INTERVIEW TRANSCRIPTS

10-12. Interview – Ms. Victoria Stanley

- Interview date: 19-06-18
- Duration: 26 minutes



Source: (LinkedIn - Victoria Stanley, 2018)

Very briefly in what stage of the implementation phase of the land registration practice are you currently in?

- we were supposed to be finished already the project was supposed to be closed almost one year ago but has been extended for 2 years and even further because the government wanted to extent and increase the loan for the project. So at this point, the project is just a continuation of the funding proposal.

Which issues do see in the LAP project upon till the stage?

- the 2nd part of the project was designed in 2010 as a 70-million-dollar Project but because of changes to the donors and due to Exchange ratio issues the project was looking at a financing gap of $20-25 mill. much of this gap did not materialize. Much of the things we wanted to do with the project, was never realized because of this financing gap. Including photo mapping of the entire country, scaling up customer section and implementing the Ghana Enterprise land administration system with Airbus as the overall implementing partner and a Slovenian firm who did the actual programming.

How about your mapping Project? Can you elaborate on that?

- That was actually never included in this project, this project was only meant for the land administration system and setting this up (ed. It was two separate projects). The mapping project was meant to demarcate land such that it could be plotted basically with the ultimate goal of registering land.

Why was the LAP restructuring aimed at decentralizing services? did you expect more autonomy of chiefs in land administration?

- Its wasn't about decentralizing the services - they were already decentralized - but instead realizing the de-facto reality and trying to provide more support to those decentralized secretariats to better manage the land resources they hold for the good of the whole community.
- the idea of the customary land registry was just structure and systematize land, so the customary authorities would have better overview of the land they managed and was better equipped to distribute land rights.

The national house of chiefs - are they in charge of the customary local secretariat's?

- Yes, the customary authorities which reside the House of Chiefs owns the land, and this has never been broken. Pretty much all land in Ghana is owned by customer authorities. most of accra is owned by customary authorities (clans, stool, chiefs) are the allodial title holders allocate, can freely lease or rent it out short term. The house of chiefs are like a representative body that have political power in the rural areas.

Does the government have any control over the processes of registering deeds, recording land and such, in rural areas of Ghana?

No, only very little Control over what the customary authorities are doing. and I'm not really sure what they are entitled in giving the circumstances of the customary authorities.

Could you elaborate on that?

- Well, customary authorities and by that I mean often the local community heads, obey to customs and traditional law which often does not translate into written contractual agreements of tenure. This poses a problem to entitlement because documents are not filed according to formal practices.

What role does the government play in this then?

- There is some land that is within two formal system. But deeds are not recognized into formal system if they are issued by the customary authorities. It must go through the secretariats (ed. = Customary Local Secretariats (CLS)) to become binding. The role of the government is therefore to push that such steps are taken.

Is there trust within these administrative parts (the government and the customary authorities?

- Only very little, it's hard to say how much.

What about the corruption aspects? Both in government and by customary authorities?

The Government cannot expropriate land, it is at least very difficult. The idea of the customary land secretariat is also ideally to bring more transparency in the process of entitling land and to bring services closer to the citizen. But in terms of Petty corruption there are a lot in regard to getting your registration processed. Furthermore, many of the deeds being registered are not connected to a parcel or orthophoto map, which means they are worthless.

the political situation: Is there a will to push on with the LAP both from the government but also from the customary authorities still willing to do this?

- Yes, there's a huge willingness and the recognition that this is important. With the customary authorities it's a mixed bag because some of them are interested, and some are not. so, we are working with the ones interested of course.

(Self-reflecting question): How would you manage the registration process? well the problem with the registry is that it is a registry of documents and doesn't necessarily provide any tenure security and whether that deed for the specific parcel is legally binding. I need photo mapping, is important to be able to start providing information about what people actually are trying to entitle.

How is documentation stored in the registry system?

- it is all in paper.

is there a will/plan to digitize them?

- Yes, but the records need to be organized first. I mean, there are piles of paper everywhere and no one knows who they belong to and what it represents. Some of this paper is even rotting.

Open discussion:

- When I put together a list of what Ghana needs blockchain is not on top of that list. I know there are lot of potential and I know there are few organizations working with blockchain in regard to documentation and I documentation maintenance (Benben lands). Right now, we keep trying to get the IT system that we already have, rolled out to the offices and to get the documentation they have, organized and systematized and eventually digitized to begin and reap some of the benefits of this project.
- There are so many other things that are needed and much more quickly. blockchain is a technology that would not solve all problems involved by land Registry. The customary authorities are much stronger than any other country in Africa which give them a much larger role in land administration.

It seems like there are many steps before blockchain technology can even become a topic would in land administration?

- Just think about the countries that are progressing with blockchain we talking about well developed economies with well-developed institutions and the administration systems do further also have a very good service delivery system and not a problem that rural parcels has never been registered. Georgia is moving to blockchain but doesn't solve the fundamental problem that parcels have not been systematically registered. Blockchain is a nice security technology but cannot help in solving the problem with several hundred and thousand parcels not been registered. This can only be done in the systematic process that involves both people and technology.
- We're talking about a country that don't even have reasonable connectivity. we can’ guarantee they have internet access and we can't guarantee that they have power within the offices. In regard to the Lands Commission, even organizing a paper-based system would be a step forward. Moving into a digital environment is involved with a lot of problems because there are a lot of other infrastructural things needed to make things work.

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10-13. Interview – Mr. Raymond B. Kaniu

- Interview date: 19-06-18
- Duration: 52 minutes

Source: (LinkedIn - Raymond B. Kaniu , 2018)

What is Land Layby Ltd. key objective in Ghana?

- Our key objective is to bring innovation to land problems. We began as a company that wanted to sell land. We found out there were issues present that we could address - One was inclusion. We created a solution that included people into the house market by letting them register their land so that it could be used for collateral.

How is your organization approaching the issue of entitling land?

- Isaac is our guy in Ghana. Isaac highlighted the possibility of applying our approach from Kenya to Ghana. He set up a team in May and was soon after operational. We believed the land registry system present in Ghana and Kenya is not trustworthy. By allowing the blockchain technology in such systems give the same kind of effects as in African diaspora.

How do you perceive your progress so far? Are your services an alternative to the official record-keeping of deeds/titles?

- We have a minimal viable product. We have the platform that can be accessed already now. It has features on how people can interact with the platform and use tokens. We have everything setup, but we need to begin the process of putting things on the chain. But first, we have to do the ICO. We have some properties at hand for testing and will now put all land information including the titles.

Are you operating independently from the government in the two countries?

- We tried speaking with the authorities and explain them our vision. On the first meeting they had not clue what the technology was. They had no clue. After a recess and further information, they raised questions relating to securities which wasn't point of the blockchain system.
- Second: the regulation framework. The government approached the IBM (Hyperledger framework for Linux). Our initiative was to work together with the government and IBM in creating a joint registry. This however did not materialize into an agreement with the government.

Will you incorporate the current titles into your platform? How will you deal with the paper-form titles?

- Most countries in SSA have two systems: namely customary and statutory. We try to incorporate both in Ghana. The solution for the digitized relative to paper form titles will be much easier as we only need to verify that the title is in effect – we have advocates to do that.
- In regard to the customary tenure system: we simply have to approach them. The elders held this information and don't need records according to the community. They become verifiers of information in a very tacit way. We will set up hotspots in the community to figure out who these people are and will further try to verify this information though it will be a more difficult task (since not all are in writing). However, the only mechanism to verify that this specific land belongs to this person, it the community itself. We will therefore be working closely with the communities to establish cooperation. We will then bring it into the formal system and entitlement can be secured.
- We see the huge potential of pooling the titles together, especially in a blockchain, because the information can be easily and readily used by other organization (including the government) and will provide security through immutability.

Customary Land Secretariats - how do you tackle chiefs and convincing them?

- Customs (ed. as in culture) are definitely are problem. There are roughly 52 tribes in Ghana, many have their own customs. A handshake might be a handshake, but gender roles are quite different. If its just putting the information on the platform, convincing them will be easy. Inheritage aspects are though more difficult. Inheritance firstly goes to the firstborn male, which brings a lot of issues in regard to heritage because women cannot own property in customary communities. If we look at it singularly, we just want to put the land information

on the blockchain; and the individual will be entitled. Over time the title will be verified by people for example through disputes. We only provide a platform to make the informal, formal. Just as google, they started as a search engine but developed way beyond this point. We see our own development like this, that we through time can become more established and bring tenure security to the local communities.

How about the situations where chiefs are unwilling to register it? Because they have choices they otherwise would not have if the land was registered? Like selling of land and such.

- The issue you raised in an issue we dealt with. We try to have the community to pressure the chiefs. There are so many stakeholders, not just the chiefs. Anyone who uses the land will pressure to implement this. Especially people whose land has been grabbed or have been alienated by the community heads. Furthermore, what if community leaders get killed during violence regarding land disputes? No one would be able to validate their heritage of the land and this will be in the mind of the vast majority of people in the communities and the chiefs themselves. These are some of the strategies to convince both leaders and community at large because this is not everlasting: you wont be here forever. By registering the land, it takes the responsibility away from chiefs to make sure that information is passed on through generations, and I believe that they probably want that. Although people fight the transformation (challenge status quo) the transformation will be irresistible at some point. The pressure will come from within. Ghana has one of the highest working age populations in the world. Im within that statistic. All of us want to see this happen.
- Another thing is understanding the customs. Speaking the language and knowing their traditions make it much easier to convince people. The process has begun, but we are still learning how to better handle it. If you have a majority to go on this platform, it will automatically move minds to do so aswell.

The Harambe Token: Please explain how consensus will be achieved by issuing Harambe tokens as proof-of-stake (optional question)

- Our platform and profit model will work by people spending tokens to gain certain information. The information will thus be bought on the platform for Harambe tokens. Harambe Tokens will also be used to drive the consensus mechanism as an incentive for forgers to validate transactions.

How will the Harambe token work as a consensus protocol in registering land?

- A membership is 20 tokens. It can be seen as the price of access. For anyone who wants to access, whether you're a buyer or seller or a company, will have to access the platform itself through the Harambe token. The Harambe is a cryptocurrency which will need to be introduced to the market through an ICO (ed. Initial Coin Offering) before being viable as an incentive for people to validate transactions.

What role will GIS (geographic information systems) play in land recording?

- Longitude/latitude coordinates will be put onto the platform. Fx. when a mapper needs to find a parcel of plot of land, they can get the overview.

How do you believe your registry will be used by the ones having land registered?

- Ghana is one of the richest countries in the world in natural resources, yet the population is some of the poorest in the world. How can that be? Because access to information is very limited. Information is equivalent to better terms for many, because they can use this information in transactions and in raising the value of their land. If you place such an empowerment tool in the hands of the citizens, it is up to them to decide how information is being used and not the government or the chiefs.

Your solution is a public blockchain structure with a proof-of-stake consensus protocol. If you were to cooperate more with the government and its institutions in registering land, they must also be part of the validation process, quite possibly through a private blockchain structure. How is your view on that?

- First, its private by virtue. You need to purchase token to get access. But it is also public because all people can buy tokens.
- A good example: the govt tried to digitize the land title and deeds (ed. In Kenya): LIMS. they launched on April 1, but the process was halted by law society of Kenya. They argued that by digitizing land records, the conveyance fees of actors within the land administration would vanish. These conveyance fees that they have become accustomed to was very important for the functioning of the system. So this is again about money. Once the government creates their own, whether it be digitized or with a blockchain structure, fees will still find their way into the system. The question is then, whether people want to pay token to access the information they need or go through the government system that has multiple fees.
- And who looks more credible? People place more trust in businesses than the government to help them. We have a better chance of serving the people because they are more inclined to trust us.

At some point, surely you can register a title on your blockchain. But if a dispute over land arises, and you want to use the title as evidence, the courts must acknowledge whether your information on the blockchain can be used as proof? And how about the need for professionals in demarcating land? Some sort of coordination must be in place with the government and their institutions, in particular the legal institutions, if you want your registry to be legally recognized?

- We do also have some coordination with the government, namely through advocates that ensure that registration of land on our blockchain happens by obeying to the law and regulations and correct processes set out by the government and legal entities. This ensures that once a dispute goes to court, we have very trustworthy information of who owns that piece of land.

Is there a consensus from the government to make use of Land Layby's registry in resolving land disputes?

- Not at this point, no.

Legal compliance:

- We have to abide by law. We have to work in conjunction with the government, the ministries and the ones that wield power over land. By empowering someone, he or she can anything they want wit the land. It can be for good use and for bad uses. We could easily be dubbed as an instrument of nefarious acts and a tool for exploiting land. And we will see some of this. A lot of Chinese immigrants in Ghana buy land and by opening the land market through formal recognition of land ownership we are actually making it easier, in particular the chiefs, to sell the land to foreign entities and thus for people to purchase land. You can zone in on the people, the land and the information which in turn will enable people to easier find new land to acquire and easier for people to sell it.

- We believe that this is up to the government to secure, that land is not being sold to foreigners without any repercussions. And they are already doing that, for example by restricting access of foreigners in owning full enterprises in Ghana (ed. Foreigners can't own majority stake) or that foreigner can only lease land in xx years before the leasehold is terminated

The people living in the community, will they be the verifiers that information is correct?

- Yes, they will be rewarded by Harambe tokens.

How will Land Layby cope with electricity outages?

- It won't be a problem, since the information is distributed. There is no single point of failure.

Which primary implemental challenges do you perceive as the most difficult to overcome?

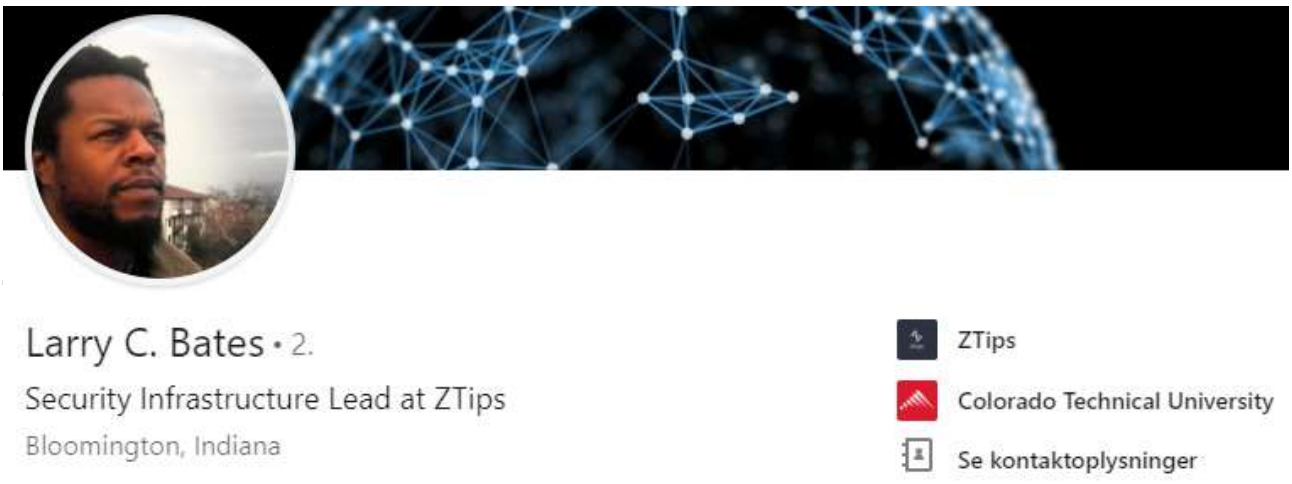
- In implementing this, our key impediment is educating the masses. If the capital market authorities are not aware of this technology, then imagine educating the public about this! Its is very difficult to explain such technology to persons that don't have a technical background. Almost everyone in Kenya is in diaspora, which means that the people we are trying to sell this product to, does not know about it (?). Since we realized this, we started blockchain masterclasses where we invite people to teach them about the technology. Once you understand the technology, you understand its applications, in terms of land registries or car or vehicle registries.

So training in all aspects and enlightening people about the technology is the main challenge? How about internet connection?

- Yes. Electricity to power Wi-Fi is also an issue, though is being improved as we speak. Another implementation aspect is reaching out to the communities. If they have to travel all the way to the cities to let them know of our mission, we cannot reach the people we try to influence.
- This is also a learning process for us. I think by doing all this, we'll be able to understand exactly this impact it will have. We have a vision but getting to the destination will be troublesome.

10.14. Interview – Mr. Larry C. Bates

- Interview date: 19-06-18
- Duration: 35 minutes



CSO at Bitland Global (2015-now)

Source: (LinkedIn - Larry C. Bates, 2018)

Which difficulties did you have when you first began operating in Ghana and in the consecutive years?

- Electricity and access to the internet was an issue because it diminished our potential in reaching the rural areas.

How much do you see internet connection and electricity as being important for the technology to work?

- Internet is more important than the blockchain. Electricity is more important than the internet; Without good structure, blockchain technology is barely useless. It is a common mistake to neglect that places like Ghana don't have functioning internet structures. You can't solve these blockchain problems without the internet. Text messaging is not internet dependent but is also not blockchain (ed. -Compatible). phone lines have been used to send documents but has not been proven to function with blockchain technology.

In your White paper, Bitland states it has been pushing solar powered Wi-Fi hubs for the Bitland network. - Is this what is meant by the next step of bitlands plan: the infrastructural plan?

- Yes, hubs are being built in local towns. Transparency international gave a grant to develop these. We made more progress outside of Ghana because of the hurdles of having the government working against us inside the large cities of Ghana.

What is your relationship with the government? Are you cooperating and have an agreement?

- We got to do a pilot, but what HAPPENED is that they also started their own pilot and used the government-power together with the World Bank. We therefore established connections with the local community of Ghana, since we didn't see the government progressing and further believed their corrupt intensions would deteriorate a relationship with customary authorities. Bitland is although not making as much progress either because some state actors don't want a system implemented. We are therefore involved with the customary authorities to stifle this progress.

Is there distrust between Bitland and customary authorities?

- No, only 100 percent trust. That's the reason we're around. The original founder is Ghanaian, which helps a lot. Without the support of the community the Ghanaian government had already pushed out the Bitland Project. We put our intentions up front so that the community sees that our intentions are good.

But they don't see an exploitative issue of registering land without the government?

- Any system could be used equally for good and bad. We're not 'blockchain-can-save-the-world-people'. We don't have to fight through the stigma that people think we're trying to bring them some magic technology. They experienced exploitation for centuries and know all the tricks in the book. It is easy for them to recognize whether our intentions are good simply because they instantly can see our intentions are good. We take the time to explain the technical aspects to our community. We're trying to include people in modern technology, some of which was for example neglected during the internet boom which excluded some from profiting from the technology.

How do you know the person that tries to register the property is the legal owner?

- We're not a government entity, only public entities can produce a legal title. Blockchain cannot solve disputes, it can only represent a tool to provide immutable evidence in a court case that would be over a dispute. As part of our protocol, we're trying to inform about land title disputes of property that has no ownership. There is absolutely nothing to do as a private organization to secure these rights. What Bitland nation is trying to do, is to make a ledger that is separate from the government although you can't have a ledger that is separate from

the government and still be legal. The priority for us is to entitle people such that they can use land as collateral to obtain financial loans.

How can your land registration affect access to credits? Do you see it happen in the near future?

- Absolutely, but the institutions have special interest in keeping status quo where they still control and influence the large amount of capital being generated. Getting technology implemented in places where corruption is lower, is the best solution. It gradually pushes the neighbor-communities to seek similar options and thus pushes the government to take similar steps. When you have technology that pushes transaction for transparency and less corruption, it causes ripple effects in other organization because they begin fearing their position and whether they are able to withstand the pressure. When the house of cards starts to collapse, the people who built it start turning on each other.

When will this effect start to have an effect?

- Within the next 5 years. The government will be able to offer their own services at some point. and once smaller governments start using governments services a snowball effect will happen. Only 10 % of the land registry has been digitized as of now so access to credits are still miles from the average Ghanaian.