

# **Securing Land Transactions in Ghana with biometric data**

## **Abstract**

There is a gap between land tenure and the physical land giving room for impersonation, multiple allocation, multiple sale of plots, loss of possession, land racketeering and fraud through forgery. There is therefore an urgent need to identify unambiguously parties involved in land transactions so that the root of title can always be traced. This paper explores innovative ways of filling the gap with biometric data to secure land transactions in Ghana. Information gathered from interviews was used to design a self-administered questionnaire with google forms and snowball sampling technique used to recruit participants across Ghana to assess their perception of what constitutes a secure land transaction. The researchers also assessed participants' knowledge of biometric systems and their acceptability in recording biological traits of grantors and grantees in land transactions. Most participants were conversant with the use of biometric systems and were optimistic that its use may bring sanity in land transactions and enhance security of tenure in Ghana.

## **Introduction**

Corruption in land deals adversely affects livelihoods, impedes development and it is a major cause of land tenure insecurity in Ghana. Lack of transparency, accountability, and stakeholder participation in official and traditional land administration are sources of corruption and a hindrance to good land governance. Again, there is a gap between land tenure and the physical land, giving room for impersonation, multiple allocation, multiple sale of plots, loss of possession, land racketeering and fraud through forgery. There is the need to uniquely identify parties involved in land transaction so that the root title can always be traced with certainty. This paper explores innovative means of filling this gap with the biometric system to secure land transactions in Ghana. The paper critically examines the use of specific data about unique biological traits to curtail indiscipline in land transactions in Ghana.

In Ghanaian most customary land records are scattered, orally recorded, uncoordinated and cannot be guaranteed to (Bentsi-Enchill, 1964). As such, most transaction histories are either lost or challenged with adverse claims when principal witnesses to the transactions pass on or boundary marks disappear. Customary land tenure therefore suffers security lapses and cannot protect the interest of potential owners of customary land.

Again, the laws governing the transfers of customary lands are not codified and lacks legal backing in case the land holder is challenged in court. These reasons make customary land transactions prone to fraud and litigation (Agbosu, 2000). Land holders of customary land are not guaranteed any secured tenures by the existing weakened land administration system (Abubakari, Richter, & Zevenbergen, 2018; Barry & Danso, 2014). Thus, the Ghanaian land market becomes defective and eventually weakens the land administration system. Landholders find it difficult to derive commensurable benefits from their lands by collateralizing them for loans and mortgages (Feder & Nishio, 1998).

Land use conflicts increase when demand for land becomes high in both urban and peri-urban areas. This abuse of physical planning laws are usually instigated by chiefs and family heads who want to take advantage of the opportunity to make more money by forcefully demarcating

public open spaces, conserved areas and recreational areas to building plots (Locke & Henley, 2016).

### **Land Rights in Ghana**

Land rights generally refer to an individual's ability to alienate, acquire and possess land at their free will without infringing on other individuals' rights (Adi, 2009). FAO, (2002) also categorises land rights into use rights (grazing, growing subsistence crops), control rights (right to decide what to plant, when to harvest etc.) and transfer rights (allodial rights). Land laws may grant a group of people equal access to own land but it takes land rights to provide social acceptance of this ownership (Hanstad, 2010). Thus, every individual's exclusive right to use, possess and transfer land must be protected by the land laws (Akrofi & Whittal, 2017).

Land right management is a preserve for four divisions of the Lands Commission namely; Public and Vested Lands Management Division, Survey and Mapping Division, Land Valuation Division and Land Registry Division. These four (4) divisions under the lands commission are by law (Act 767) expected to collaborate at the regional level to serve clients from one location. However, power play among them sometimes results in undue delays in their services. The Act 767 established the Lands Commission as a corporate entity to give it a more business outlook with an improved workflow for land services especially for government land, with oversight responsibility of customary land. Ghana's land administration system recognizes both customary and statutory tenure systems. There are laws that govern the acquisition of land under both systems.

### **Land acquisition in Ghana**

Ghana has a total land area of 238, 539 square kilometres out of which the customary sector (under control of chiefs, family heads and earth priest) accounts for almost 80% and public lands constitute 20% (Bugri, 2012; Gyamera, Duncan, Kuma, & Arko-Adjei, 2018). There are five (5) types of land recognized by Ghana's constitution; namely; Individual/private lands, stool/skin lands, family lands and state and stool vested lands. The process of acquiring any type of land largely depends on the buyer who has to do due diligence to verify the validity of the documents presented by vendor. Generally land acquisition process in Ghana include; site inspection, title search, negotiations, demarcation/survey, covenant/indenture preparation and registration; either deed registration or land title registration depending on the location of the land.

The intrinsic bureaucratic delays with the land title registration and the deed registration, high cost of registration and middle men fronting for staff of the lands commission deter people from dealing with the lands commission (Ekemode, Adegoke, & Aderibigbe, 2017).

### **Corrupt practices in the land sectors in Ghana**

The WordWeb defines corruption as the use of a position of trust for dishonest gain. This definition supports that of Transparency International which puts it as abuse of entrusted power for private gain. Research undertaken by Arial, Fagan, Zimmermann, & Hardoon, 2011 revealed that "there is a strong correlation between levels of corruption in the land sector and overall public sector corruption".

Reported corruption cases in land transactions globally are either administrative or political (Arial et al., 2011; Van der Molen & Tuladhar, 2007). Typically corruption in the land sector would involve the following:

- *“Grabbing of land by the elite in society and influencing land titling schemes*
- *Manipulating land records and influencing adjudication and dispute resolution in favour of influential people*
- *Falsifying land documents to obtain title to land*
- *Chiefs and family heads intimidating their subjects and abuse of power*
- *Multiple allocations”* (Arial et al., 2011).

Even though there are laws governing land acquisition in Ghana either by the deed registration system or the land title registration system, the inherent weaknesses in both systems of registration open the door for lots of indiscipline in the land administration systems (Van der Molen & Tuladhar, 2007). The deed registration system is challenged with inaccurate site plans, multiple sales of lands, insecure ownership leading to several forms of land disputes (Gyamera et al., 2018; Sittie, 2006). Thus, the deed registration system is prone to fraud through forgery, impersonation and parallel registration for the same plot of land. The land title registration system is impeded by scattered land records, inadequate storage process, snail pace processing of application, lack of coordination among agencies involved in the land title registration process etc. (Ehwi & Asante, 2016).

These challenges result in bureaucratic delays, loss of trust, rent-seeking behaviour of some staff of the commission and middlemen fronting for some leaders to charge clients higher fees (Arial et al., 2011; Ehwi & Asante, 2016; Shipley & Pyman, 2018). There are instances where farm owners illegally demarcated their farms to residential plots when land values appreciated (Locke & Henley, 2016). State lands are also demarcated by quack/unethical surveyors hired by chiefs and family heads who claim they were not compensated by the government when the lands were compulsorily acquired from their progenitors. In view of the above corruption opportunities discussed above, it is very crucial to protect the interests of the poor and the vulnerable in land transaction through the use of innovative technologies (Koeva et al., 2017; Lemmens, 2011; Yomralioglu & Mc Laughlin, 2017; Zevenbergen, Augustinus, Antonio, & Bennett, 2013).

### **Biometric Systems**

A biometric system is a technological system that uses information about a person to identify that person (Lemmen & Van Oosterom, 2011; Stoltzfus, 2017). When there is the need to uniquely identify people in banks, airports and security installations, biometric passwords are effective. In Ghana, passwords, signatures, fingerprint, Social Security and National Insurance Trust (SSNIT) numbers, mobile phone numbers are used to identify persons in many transactions undertaken with corporate entities and even government institutions of which the lands commission is no exception. Most of these options have not proven to be strong enough to protect the persons involved in the transaction against security breaches. These interventions have not yielded much benefits to the citizens, government and the private sector in securing transactions against fraud that occur through impersonation. Biometric passwords are the innovative way of protecting data, securing transaction and so on (US 6,317,834 B1, 2001; Tallman, Santner, & Miller, 2006). Human biological traits captured through fingerprint data, iris scan, voice recognition and facial features are encrypted and

stored as templates for purposes of authentication (Nandakumar, Jain, & Nagar, 2008; Phillips, Martin, Wilson, & Przybocki, 2000).

Fingerprint biometric password has been used in Ghana to access passport, driving license, national health insurance services and even in the national elections. Hence if biometric passwords are used to identify the grantors and grantees in any legal land transactions, enough tenure security is given to the new landholder. This security is achieved by making the transaction unique and exclusively held for the new landholder at the point of registration with the biometric details of the two parties. Most biometric systems go through encryption and decryption when there is a need to authenticate a transaction or authorize a user. Jaiswal, Bhadauria, & Jadon, 2011 postulate that most biometric systems consist of enrollment, template and matching.

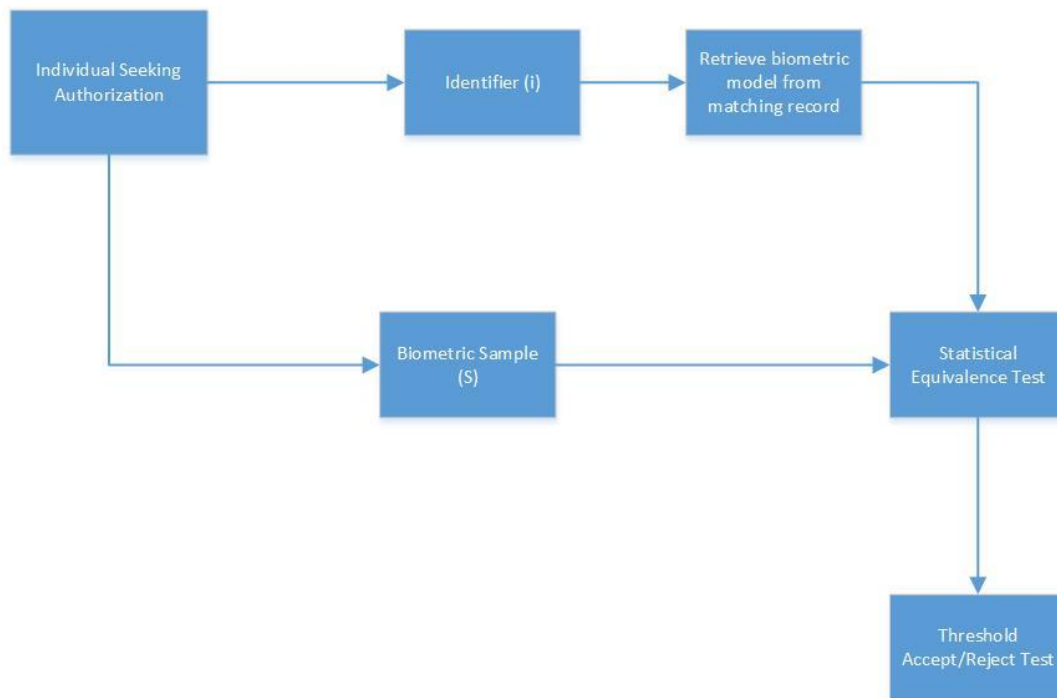


Figure 1 the interaction between users and a biometric system.

Source:(US 6,317,834 B1, 2001)

### Security Implication for Biometric Systems

The use of biometric passwords is gaining roots in most security installations globally, overtaking alphanumeric passwords and personal identification number (PIN) within financial services, computer security, education etc. (Jaiswal et al., 2011; Phillips et al., 2000). This is done to restrict access, authorize processes and identify users with the stored biometric template belonging to the user (Yang, Wang, Hu, Zheng, & Valli, 2019). When a user wants to access the system, biometric scanner or system undertakes a matching test of the stored data and either grants or refuses access (Anonymous, 2016; Kumar & Walia, 2011). The biometric security system can be breached when the template is spoofed (Yang et al., 2019). The matching event of the biometric system is prone to errors such as failure to enrol rate (FER) and failure to acquire rate (FTA). The FER is caused by insufficient training, environmental conditions and ergonomics (Stan Z & Anil, 2009). FTA is caused by the biometric device's

inability to extract data from the individual i.e. failed facial recognition of the biometric system (ibid).

### **Biometric Device Selection**

According to Thakkar 2017, biometric devices are selected based on the following considerations:

- Dot Per Inch (DPI) – It indicates the amount of information available within an inch of space within the image
- Liveness detection – it is the ability of the device to check spoofing
- FAR and FRR- False acceptance rate (FAR) and false rejection rate (FRR) which determine the accuracy of the fingerprint-based biometric device.

Apart from these attributes of the device, there are other physical conditions that affect the performance of the biometric device such as temperature, humidity, dust/sand particles, population size and hygiene issues (Thakkar, 2017).

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### **Materials and Methods**

A descriptive research approach was adopted for this study. Personal interviews were conducted by the researchers to solicit for information from people who encountered disputes while developing their lands, those who have lost possession through fraud, impersonation, misrepresentation, forgery, etc. The researchers also inquired about how the interviewees entered into the transactions, their experience after the fraud or dispute and any lessons learnt. The information gathered from the interviews was used to design a self-administered questionnaire with google forms for the purpose of the research. The snowball technique of sampling was used to recruit participants across Ghana to assess their perception of what constitutes a secure land transaction. The researchers also assessed participants' knowledge of biometric systems and their acceptability in recording biological traits of grantors and grantees in land transactions.

The sample size for the research was then determined with the Cochran's formula using the following parameters:

- Estimated population of 17million of Voters on the electoral roll of Ghana (Anonymous, 2019; Mahama, 2016). This gives the approximate number of eligible people who can register land in Ghana. Minors cannot register land.
- Estimated proportion of the population  $p= 10\%$  or 0.10
- The confidence level of 95% where  $z= 1.96$
- The margin of error of 5%

$$n = \frac{\frac{1.96^2 \times 0.1(1 - 0.10)}{0.05^2}}{1 + \frac{1.96^2 \times 0.1(1 - 0.1)}{0.05^2 \times 1,700,000}} \approx 138 \text{ participants}$$

n= 138 participants

The researchers were expecting 138 responses from the self- administered questionnaires but only 124 were received and analyzed with the IBM SPSS Version 23.

## Results and Discussions

Table 1: Gender of Respondents

**Gender of Respondent**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	88	71.0	71.0	71.0
	Female	36	29.0	29.0	100.0
	Total	124	100.0	100.0	

From the responses obtained in Table 1, 88 (71%) of the research participants were males and 36 (29%) were female.

Table 2: Level of Education of respondents

**Education Level**

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Basic Education	1	.8	.8	.8
	Technical / Vocational / Secondary	2	1.6	1.6	2.4
	Tertiary	121	97.6	97.6	100.0
	Total	124	100.0	100.0	

Majority of the respondents i.e. 97.6% ,had attained a tertiary level of education and the rest had attained basic and second cycle education, as shown in Table 2.

Table 3: Marital Status of respondents

		<b>Marital status</b>			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	71	57.3	57.3	57.3
	Separated	2	1.6	1.6	58.9
	Divorced	3	2.4	2.4	61.3
	Never Married	48	38.7	38.7	100.0
	Total	124	100.0	100.0	

The results also showed that 71 (57.3%) were married, 48 (38.7%) never married, two were separated from their spouses and 3 were divorcees.

Descriptive Statistics of research variables

The researchers conducted descriptive statistics with the results obtained. Cross-tabulation of the research variables was done to ascertain their dependence on each other through a chi-square test and nominal confirmatory test with Lambda. The details are shown in Table 4

Table 4: Descriptive statistics of research variables

S/n	Item	Chi-square	Lambda	Interpretation
1	Cross-tabulation of gender against land ownership	P=0.473	0.000	No relationship between the variables & no association between gender and land ownership
2	Cross-tabulation of the level of education against land ownership	P=0.437	0.000	No relationship between the variables & no association between level of education and land ownership
3	Cross-tabulation of marital status against land ownership	P=0.05	0.113	A significant relationship between the variables & moderate association, marital status is dependent on land ownership
4	Cross-tabulation of the method of acquisition of land against challenges encountered after the acquisition	P=0.289	0.123	No relationship between the variables. However, a moderate association exists. "Challenges encountered after acquisition" is dependent on the method of acquisition
5	Cross-tabulation of "documents received from the acquisition" against "challenges encountered after the acquisition"	P=0.292	0.158	No relationship between the variables. However moderate association exist between, "challenges encountered after acquisition" dependent on

				documents received from the acquisition”.
6	Cross-tabulation of “preventive measures” against “challenges encountered after acquisition”	P=0.142	0.193	No relationship between the variables. However moderate association exist between “challenges encountered after acquisition” dependent on “preventive measures”

Source: Field survey data analysis

The results further revealed significant cases where respondents agreed that they encountered multiple allocations (27), multiple sales (25), impersonation (24) and forgery (20) which are unknown personal identification related. When participants were asked about steps to take to avert future occurrence of transaction challenges, 72 (58%) indicated that they would conduct a search on ownership before paying for the land. How fast can one search for rightful ownership of land in the Land Commission Offices across the country without influencing the staff?

Twenty three (23) indicated hiring experts to deal with land documentation but this will definitely come with extra cost to the client and eventually increase the cost of registration. Twelve (12) would acquire only leased or registered land; but how many building plots in Ghana are registered or leased? Hence the need for a quick and efficient way of identifying persons is suggested by the researchers as a biometric system to be made part of land transactions in Ghana which received massive support of the participants 120 (96%). Almost all the respondents are familiar or have experienced a biometric application in Ghana (voter registration-36, National Health Insurance Registration- 5, Passport acquisition-8 and all the three (3) ie. (Voter registration, National Health Insurance Registration and Passport acquisition) - 75.

### **Relative Importance Index (RII) ranking of variables assessing the reason for the use of biometric data**

$$\text{Relative Importance Index} = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

Variable 4 (V4) = Biometric data brings certainty in identifying a person

Let Variable 1 (V1) = I use biometric data because the data cannot be stolen

Variable 2 (V2) = Biometric documents cannot be used by another person

Variable 3 (V3) = Biometric data transaction is unique and secured

n5= strongly agree, n4= agree, n3= undecided n2=disagree, n1=strongly disagree

n5= 5, n4=4, n3=3, n2=2, n1=1

$$\text{RII of V1} = \frac{\sum w}{AN} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{5N}$$

$$\text{RII of V1} = \frac{\sum w}{AN} = \frac{5(94) + 4(15) + 3(10) + 2(2) + 1(3)}{5(124)} = 0.915$$



s/n	Variable	RII	Rank
1	Biometric data brings certainty in identifying a person	0.926	1st
2	I use biometric data because the data cannot be stolen	0.915	2nd
3	Biometric data transaction is unique and secured	0.910	3rd
4	Biometric documents cannot be used by another person	0.908	4th

Relative importance index of the variables assessing the ranking of importance for the biometric system in a land transaction in Ghana

V1= land cannot be transferred by another person who is not part of the transaction

V2= land cannot be registered by another person

V3= ownership can be verified easily

V4= land transfer history can be traced easily

$$\text{RII of V1} = \frac{\sum w}{AN} = \frac{5(97) + 4(16) + 3(7) + 2(2) + 1(1)}{5(123)} = 0.935$$

$$\text{RII of V2} = \frac{\sum w}{AN} = \frac{5(82) + 4(23) + 3(12) + 2(4) + 1(1)}{5(122)} = 0.887$$

$$\text{RII of V3} = \frac{\sum w}{AN} = \frac{5(92) + 4(22) + 3(5) + 2(0) + 1(3)}{5(122)} = 0.928$$

$$\text{RII of V4} = \frac{\sum w}{AN} = \frac{5(96) + 4(19) + 3(5) + 2(0) + 1(2)}{5(122)} = 0.940$$

s/n	Variable	RII	Rank
1	land transfer history can be traced easily	0.940	1st
2	land cannot be transferred by another person who is not part of the transaction	0.935	2nd
3	ownership can be verified easily	0.928	3rd
4	land cannot be registered by another person	0.887	4th

## Conclusions

The current system of land transactions in Ghana is not foolproof in verifying the identity of persons undertaking land transfers in checking impersonation and easily tracking transaction history. Thus land transactions in Ghana irrespective of the method of acquisition or documents supplied by the vendor are still prone to multiple sales, multiple allocations, forgery and protracted land disputes that hinge on ownership verification. Level of education of grantee notwithstanding, land transaction challenges can still occur since the identity of the grantor can be problematic. A current search of ownership in various Lands Commission Offices are shrouded in secret with many uncertainties; the biometric system comes in handy to deal with this gap. Biometric system of land transfers will come with the following benefits in order of importance:

- land transfer history can be traced easily
- land cannot be transferred by another person who is not part of the transaction
- ownership can be verified easily

- land cannot be registered by another person

Biometric system of transfer will eventually improve tenure security in Ghana if the biological traits of the grantor and grantees are captured and stored with other details of the transaction to make the transaction uniquely linked to them. Ghana has a huge potential when it comes to its implementation as the majority of adults in Ghana have gone through national elections, national health insurance and other government services to the citizenry. There will be personnel to train the lands commission staff locally and the experience from two national biometric verification elections will be helpful.

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