

Requirements for a LADM Country Profile for Ghana

**Derick Boateng OKYERE, Ghana, Jaap ZEVENBERGEN and Christiaan LEMMEN,
The Netherlands**

Key words: System of Land Registration, CADASTRE 2014, Land Administration Domain Model, LADM, Province of Ontario Land information system (POLARIS), Customary Land Secretariat, Meridia.

SUMMARY

Access to land sits at the crust of all contemporary political goals like climate action, disaster management, spatial planning, gender equity and poverty eradication. Land administration when well organized ensures the security of people's rights to access land. Since it can ensure security of tenure, land rights for all and regarding all kinds of people to land relationships is important.

This paper looks at the land administration system of Ghana which is not completed yet, due to data redundancies and discrepancies as well as the analogue nature of the system. The new land law that supports eConveyancing together with recent projects to digitized land administration in Ghana has urged the need for a well-designed nationwide land administration infrastructure that can be implemented step by step. The basic form of a digital (distributed) database is a conceptual data model. The land administration domain model (LADM) is a conceptual data model certified by the international organization for standardization (ISO).

The land administration system in Ghana requires a conceptual data model that can integrate, standardize, and interoperate land tenure data from the title, deeds, customary and informal land registration systems while ensuring high data quality. The LADM provides the functionality to support the design of such a conceptual model.

This paper provides a requirements analysis needed to adapt the LADM to Ghana's context. This qualitative study used semi-structured interviews and document analysis to draw data requirements from nine areas in Ghana with diverse customary land tenure reflected in their respective customary land registration systems. The results were data requirements from Ghana on parties, documents, registers, rights, restrictions, responsibilities, spatial unit, surveying, and representation (core LADM packages) elicited, analysed, and presented. The ongoing deeds to title conversion process in Ghana is included in the analyses. Solutions to expedite based on lessons from a similar process in Ontario, Canada were analysed, and data requirements were elicited.

The paper concludes that these requirements can be used for development of an LADM country profile for Ghana.

Requirements for a LADM Country Profile for Ghana

**Derick Boateng OKYERE, Ghana, Jaap ZEVENBERGEN and Christiaan LEMMEN,
The Netherlands**

1. INTRODUCTION

Land is an important resource that mankind relies on to meet most of its vital needs. As such, access to land is crucial in our endeavour to tackle contemporary political goals including, poverty eradication, gender equality, indigenous land rights recognition, suitable housing, sustainable agriculture, food security, climate action, disaster management, spatial planning, and good governance (Lemmen, van Oosterom, & Bennett, 2015). However, what is the point of having access to land if one has the constant risk of losing one's investment in land? As without a good way to administer land, landholders stand the risk of losing it. Therefore, access to land is construed to relate to tenure security (Lemmen & van Oosterom, 2001). Tenure security here, merely indicates how clear and safe the access to land is (Simbizi, Bennett, & Zevenbergen, 2014).

Land Administration is defined as “*the process of determining, recording and disseminating information about the relationship between people and land*” (ISO, 2012, p.VI). This definition is based on UN ECE (1996). The ISO definition already identifies the main entities, or core classes, in land administration: parties, rights/restrictions/responsibilities (RRR) and spatial units. Therefore, land administration is synonymous to land recording per the ISO definition. Land administration or Land recording is a term used to reveal that land registry and cadastre are pieces of a system (Henssen & Williamson, 1990). These terminologies have other aliases like land registration system, system of land registration (Zevenbergen, 2002) and cadastral system (Silva & Stubkjær, 2002). System of land registration has a lot of usefulness to aid the provision tenure security.

In Ghana, the formal system of land registration consists of deeds, title and customary land registration systems integrated as one (Abubakari et al., 2018; Ayitio, 2019). These systems are outlined in section 80 of the new land law 2019. Also, other informal land registration systems operate outside this system hence not recognized legally. However, those systems should be considered as they record informal “de facto” tenures that impact tenures security (van Gelder, 2010). Having a space in the formal system to incorporate informal registration systems will aid in the easy administration, of these lands (like spatial units in slum areas), mostly registered in informal systems (UN-HABITAT, n.d).

The current system of land administration system is not yet succeeding to bring certainty to the object-right-subject in land-related activities like market and property taxation. (Ministry of Lands, 2003; Rickard, 2020). The underperforming system of land administration is partly attributed to data redundancies, inaccuracies, errors and inconsistencies originating from the multiple nature of the system of land administration as well as, the analogue nature of the

registered records (Abubakari, Richter, & Zevenbergen, 2018; Biitir, Nara, & Ameyaw, 2017; Ehwi & Asante, 2016; Safo-Katanka, 2012; Rickard, 2020).

One proper measure to resolve this is data integration (Gardner, 2005). And, phasing out the deeds system as planned. It is imperative to realise that the current conversion process from deeds to title system in Ghana is 35 years old. Several countries have already been through this conversion challenge. Subsequently, it is common-sense and prudent to draw knowledge from these countries. Lessons from the deeds to title conversion process of Canada (Ontario), will be used. This system has similarities with the land registration system of Ghana and it took them less 20 years to complete this process (Gainer, 2017; Murray, 2010).

The analogue nature of the land records means delays and increased corruption in the existing system (Safo-Katanka, 2012; Edwin, Glover, & Glover, 2020; Rickard, 2020; Williams-Miller, 2018). Section 110(3) of the new land law requires the title land register to be in a digital form in order to support electronic conveyance (section 73). The basic level of a land register in a digital form (digital database) is a conceptual data model: the LADM

The LADM is an international standard (ISO 19152:2012, IDT), that encapsulates the semantics of the land administration domain (Lemmen, 2012; Lemmen et al., 2015). The LADM can support the integration of all tenure types including customary, formal, and informal tenures like in Ghana (Lemmen et al., 2015). The LADM contains functionalities that upholds women's land rights (Lemmen, Unger, Lengoiboni, & Bennett, 2019). The LADM is a generic standard as such, it is flexible to be extended and adapted to capture local situations.

This paper provides requirements analysis needed to adapt LADM to Ghana's context. With additional requirements derived from streamlining the deeds to title conversion in Ghana with lessons from the Ontario conversion process.

Section 2 introduces the concept of the system of land registration and via Cadastre 2014 continue to introduce the LADM. Section 3 will explicate the methodology used in this study. Section 4 presents some examples of modelling requirements needed to adapt the LADM to the Ghanaian context.

2. SYSTEM OF LAND REGISTRATION

A system of land registration includes the complex process of adjudication, storing, updating and supplying information over the legal relationship between man and land (Zevenbergen, 2003). Concertedly, land registration and cadastre enable a system of land registration to contain the three interrelated entities party (natural or legal person), right, and spatial unit (which can be a parcel) (Zevenbergen, 2002). A system of land registration brings certainty in identifying these entities for land-related purposes like land transactions and land taxation. it helps in supplying security of tenure on land to all landholders (Zevenbergen, 2002). There are two systems of land registration practiced around the world (Zevenbergen, 1998). These are the system of land registration of deeds and system of registration of title.

A system of registration of title means “*that not the deed, describing for example the transfer of rights is registered but the legal consequence of that transaction thus, the right itself*” (Henssen & Williamson, 1990, p.6). This system records three entities (party, right and spatial unit (parcel)) and not a document that shows a transaction.

A title system follows the curtain, mirror, and guarantee principle (Zevenbergen, 1994). Also, title registration could be compulsory or voluntary, but collection of all title is compulsory by the registration authority for it to be potent (Zevenbergen, 1998). The system enables land deals because it lets land rights to pass from one party easily, quickly, cheaply, and safely to another (Palmer et al., 2008). Tenure security under the system can be dynamic or static security (Brennan, 2015). Title registration system with dynamic security are indefeasible (Cooke & O’connor 2004). This can be immediate or deferred indefeasibility (Palmer et al., 2008).

At the other side, the registration of deeds means “*the deed itself, being a document which describes an isolated transaction, is registered*” (Henssen et al., 1990, p. 6). The deed serves as evidence in the backing of the fact that conveyancing was made concerning a right. However, there is a contrary academic opinion that, this description of system of deeds is not entirely correct because a deed is used to convey a right and not just to evidence it (Lemmen & van Oosterom, 2001). An example of this is the improved deed system of the Netherlands (Zevenbergen, 2003).

Usually, a system of deeds registration is characterized by no guarantee for completeness, correctness and validity that the transfer of subject land actually occurred. (Zevenbergen, 1994). Furthermore, conveyancing under a system of deeds registration is complicated, burdensome and expensive (Palmer et al., 2008). Thus, there is a need to always probe “de novo” the chain of title for each land transaction (Palmer et al., 2008). Title system, a positive system, can be a solution to the defects in the deeds system (Palmer et al., 2008). Or a deeds system when improved can cover most aspects of the title system. (Zevenbergen, 1994; Lemmen & van Oosterom, 2001).

Countries can adopt a system or switch in between registration systems. The deeds to title conversion process can be purely voluntary, voluntary for existing properties, compulsory for new properties, compulsory on transactions and compulsory requirement by Government (Divithure & Tang, 2013)

Cadastre 2014 is ground-breaking set of statements present by a FIG working group on what an evolving concept like a cadastre would look like in the future. Cadastre 2014 shows the complete (legal) situation of land including public rights and restrictions. Cadastre 2014 is covered by the LADM (Stuedler, 2014.) .

The LADM is both a conceptual and descriptive standard, it is an ISO standard- Geographic information- Land Administration Domain Model (ISO 19152; 2012, IDT) in 2021 (Lemmen, 2014; Lemmen et al., 2015). LADM is a generic standard that can be adapted to unique local situations hence people to land relationships for most if not all are depicted (Lemmen et al., 2015). LADM is defined in Unified Modelling Language (UML) notations (Bydłosz, 2015). LADM is organized into three packages. They are the Party (people and organizations), Administrative (ownership rights) and Spatial Unit (parcels and legal space of building and utility networks) packages. There is one sub package, the Survey and Representation package

(geometry and topology). The main classes in the party package are LA_Party, LA_GroupParty, and LA_PartyMember. The main classes of the Administrative package are LA_BAUnit and LA_RRR which has specialized classes of LA_Right, LA_Restriction and LA_Responsibility. The main class of spatial unit package is LA_SpatialUnit. The main classes of surveying and representation package are LA_Point, LA_SpatialSource, LA_BoundaryFaceString and LA_BoundaryFace. LADM has a special class VersionedObject that manages and maintains historical data in the database (Lemmen et al., 2015).

Land Administration Domain Model



Figure 1 the LADM packages

3. METHODOLOGY

The selected study areas for requirements collection in Ghana were Kumasi Metro, Abuakwa South Municipal, Wasa Amenfi East Municipal, Techiman Municipal, Ga South Municipal, South Tongu district, Tamale metro, Bolgatanga Municipal, Aowin Municipal and Accra Metro. The study was conducted using semi structured interviews (Bryman, 2016), desktop literature review, personal experience and case study approach. The study used secondary data from literature, operation manuals and statutory documents.

Distinct interview guides were developed for each type of officer and organization in the formal and informal land administration system of Ghana. Thus, interviews were conducted with the surveyors, land registrars from the Lands Commission (Kumasi and Accra), the Customary land secretariats (CLS) in all the study areas above and Meridia (a social entrepreneurial company). These interviews, due to COVID-19 restrictions, were conducted virtually with the support of field assistants. They aided in the physical scheduling of the meetings with the respondents and conducting the interview. Also, an online interview was conducted with members from Ontario land administration organization who were part of the POLARIS project.

The data were analysed using conventional content analysis (Hsieh & Shannon, 2005). This paper introduces a few vital examples of requirements due to the word limit. These few

requirements have been presented on the LADM package basis. That is, requirements from each registration system have been categorized under a LADM package and presented in this paper.

4. MODELING REQUIREMENTS

Here we introduce an overview of the identified requirements based on the analysis described in section 3. We start with overarching requirements linked to the Constitution and then move to needs for the title registration system and different customary and informal registries. For each of those we distinguish the requirements per LADM package.

Requirements linked to the national territories

Basically, there is no explicit definition of a spatial unit that is subject to registration in the laws of Ghana. Notwithstanding, Article 4(1) of the 1992 constitution of Ghana defines the territory (spatial units) owned by Ghana, as “*the sovereign of Ghana is a unitary republic consisting of those territories comprised in the regions which immediately before the coming into force of this constitution existed in Ghana, including the territorial sea and the air*”. Thus, a 3D object.

Requirement 1: country profile applies to the territory of Ghana – including marine environment and space above and below the land.

Requirement 2: The profile should include option for 3D partition of space.

Requirements from System of registration of title by the Land title Registration Division.

The system of title registration in Ghana means, per Section 104 of the land law, the land registrar entering the following in the land register: name and other information of the proprietor name and other information of the person granting his or her interest (parties), the interest (RRR) and the information on the parcel (spatial unit).

Requirements for the party package of title registration are;

Requirement 1: the names (as it appears on the instrument) of the parties, the postal address, telephone number, age (no infants) and phone numbers.

Requirement 2: the identification (ID) cards of the parties it can be any national ID like voter ID, National health insurance ID, Passport ID, Driver’s licence and Ghana card.

Requirement 3: The email address of parties, the tax identification numbers, the digital address, the residential address if it is a company their registered office address, categorize if they are natural or non-natural person, citizenship, the picture of the parties, the reference of the party, the occupation of the party (see mortgage application form), the biometric details

Requirement 4: The marital status of the parties (section 97 (4) and (5) of the land law)

Requirement 5: The signatures and/or their stamp, seal, embossment or endorsement. Whether the parties are joints proprietors or proprietors in common

Requirement 6: A party can be single person or a group of persons. Where a party is a single person these are all the forms a party can be according to the land law (see code list)

Requirement 7: In addition to a party can be parcel example is the registration of easements

Requirement 8: Where a party is a group of persons the party could be (see code list)

Requirement 9:, the role or capacity of each party to the registration must be present for example see section 174(1) of land law. (see code list for party role types)

Requirement 10; the Lands Commission uses the family files, all persons with capacity to make grants list given by the CLS, family heads for the various stools and families that have clearly and properly been set up to assist them in identifying members of a group.

Requirement 11; with regards of the share of ownership of each party member in a group, the land officers must record the quantum of the shares. (see sections 4,5,6,7, 8 of PNDCL 111)

With regards to requirement for Administrative Package they are;

Land right and an interest in land mean the same here (ISO, 2012). The right types are (there is a comprehensive code list of land rights)

Requirement 1; it is possible to register just a new responsibility (see attached code list). This responsibility can be anything agreed by the parties and the responsibilities can be any number.

Requirement 2; Restrictions in land in Ghana could be grouped into 8 parts. Thus, statutory restriction originating from other laws aside the land law and the Act 925, planning restrictions imposed by Act, 925, restrictive covenants imposed by parties, customary taboos, easements, mortgages, profits and caveat. These restrictions originate from different laws however they are covered under the land law in some form (see code list for restriction types)

Requirement 3; For all the RRR mention above, they are all extracted from the source instrument submitted by the applicant the source document can be the following according to the land law (see code list for administrative source types in Ghana)

Requirement 4; in these source documents, these must be present; The consideration paid for the RRR. The consideration is paid in a specific annuity. An acknowledgement of the receipt of the consideration , the date of the instrument, the terms, covenants and conditions, whether the title is provisional or substantive, the term of the RRR, date on which the commencement, possession or occupation of the interest began, the description of spatial unit linked to the interest, the types of RRR, the amount of rent to be paid for the interest, the rent review term, the unexpired terms of the interest of the grantor to see if he is capable to make the grant, unique number given by the Land Valuation Division, for a grant on a stool or skin land the date when concurrence was given, and date and time of when the instrument was proved. In addition to these;

Requirement 5; For the case of only contractual license by the LC, it should be state the use of the land and the length of notice required to terminate the license.

Requirement 6; For only a certificate of allocation issued by the LC it should state use of land.

Requirement 7; in relation to caveat, it should provide the reasons for the caveat.

Requirement 8; With regards to a restriction by a court explain in section 191 in the land law, the term of restriction be for a given period of time, until the occurrence of a particular event or until the making of a further order in addition to the above

Requirement 9; for easement only, the instrument should specify the type of the easement. This could be express easement, prescriptive, implied or easement by necessity

Requirement 10; for profits, the nature of the profit, whether the profit is in gross or an appurtenance to any other land, whether the profit is enjoyed by the grantee exclusively or by the grantee in common with the grantor.

Requirement 11; for only mortgage, the amount of the loan, the interest rate of the loan, the repayment schedule of the mortgage and the amount of money paid.

Requirement 12; each registered interest has a volume number, a folio number, an entry number, a registration number and a land title certificate number.

Requirement 13; on each register or folio, it has the date of the instrument, nature of the instrument, date of registration, price paid, remarks on the entry, land title registry district name, Reservations, Data certificate was issued, serial number of the certificate, official notes, date of valuation, valuation amount, remarks on the valuation. On the encumbrance, lease charge etc affection land part, memorials, folio reference number back, folio reference number forward and remarks on the lease, charge encumbrance etc

In terms of requirement on spatial unit, surveying and representation package. They are

Requirement 1; the spatial units that are registrable in the title are a parcel and a building. The building type capable of registration are the floors of apartments, condominiums and multi-storey buildings. The attributes on these spatial units are present on a site plan, cadastral plans and strata plans. Each spatial unit has the Ghana Land Parcel Identification number (GLPIN).

Requirement 2; On the site plan each parcel has a unique street address, the locality, the district (MMDAs), and the region, the areas (in acre/hectares)

Requirement 3; Each point survey has accepted error of 0.02, type C pillar, The coordinates in Ghana War office, bearings and distances.

Requirement 3; On each cadastral plan prepared by a licence surveyor. The parcel has the regional or cadastral number, Survey and Mapping Division (SMD) lodgement file number, signature of licence surveyor and director of survey or his representative, the locality, district(MMDAs), region, the coordinates of each point at the parcel corners and identification numbers, the coordinates of the control point and its unique ID, the area, barcode, street address and date of the approve layout on which it was based

Requirement 4; On the cadastral plan produced by the SMD. Each parcel has the date of the cadastral plan, the regional number, reference number, CC number, Z number, the coordinates of the points in the parcel, the unique identification number of each point of the parcel, land title registration district number, the surveyed area of parcel in Acre and hectare.

Requirement 5; on a parcel plan, each parcel has, the section number, block number, parcel number, locality, district number, Region, Area in acres and hectors, parcel corner number (like 1,2 etc) with the prefix, Grid name, unit of measure, plan number, CC number, land title registration plan number, date of plan and registry map number

Requirement 6; The additional attributes for the building on a strata plan (same as a parcel plan) are; strata plan number, the parcel number of the parcel on which the subdivision is done, dimension of the building footprint, lot number, unit entitlement number, building block number, remarks, TS. Ref number and sheet number

Requirements 7; for the enterprise land information system (GELIS), each transaction has case number and job number.

In terms of future requirements.

Requirement 1; The LC plans to conduct a nationwide an aerial survey to produce ortho photos to assist in Title registration.

Requirement 2; there are plans to have a 3D casdastre

Requirements 3; plans to use mobile mapping apps and hardware to assist title registration.

Requirements for system of deeds registration in Ghana.

In Ghana, an instrument registered under the system of registration of deeds is a sufficient evidence in court to prove that an interest has passed from one party to the other without any additions. Unless the registered deed is proved to be a forgery per section 230 of the land law. Also, the transfer of a land rights in Ghana has no legal effect unless it is registered under the system of registration of deeds per the law.

Requirements for the party package are:

Requirement 1; On the instrument or deed, there should be, the name of parties, address, sometimes they take a nation ID card when the officer sees inconsistencies in the party's signature, the passport picture of the party. A deed is contract, hence only adult (18 years in Ghana) has the capacity to enter contracts, the citizenship status, signature, seal, initials, marking and thumbprint of the parties (see 217 of the land law). Whether the party is literate, or illiterate see section 209 (2) of the land law. A party type can, a party can be a single party or a group of parties (see code list of group party types). For groups like church companies the officers will require their certificate of registration and constitution to verify their authenticity and to identify the principal members of the group.

In terms of requirements on Administrative package, they are:

Requirement 1; The registrable deeds are: a conveyance, a vesting assent, a certificate of purchase issued by court, a certificate of purchase, under the borrowers and Lender Acts, 2008 (Act 777), a power of attorney, a caveat or a restriction, a statutory declaration and a court judgement. These instruments are used to register any RRR (see the code list).

Requirement 2; the date and time when the instrument is received, the appropriate party before whom the instrument shall be proved and the date and time when it was proved, or registration date is noted

Requirement 3; A correspondences file contains all deeds on a parcels, the minutes, letter and other documents generated by staff of the L C. It has the street address or plot number of the parcel, information on the movement of the file, the file number, and PROP. Number.

Requirement 4; The title file only contains registered instruments related to a parcel. The title file has a title file number (title number) and the plot number of the parcel.

Requirement 5; The deeds registry has only one register. They enter the document number, the registration number, the title file number (title number), the type of document, date and time of registration and a description of the parcel.

As to requirements for spatial unit, surveying and representation, they are

Requirement 1; The registrable spatial units under the deeds system are Parcel and building.

Requirement 2; the only accepted plans for deeds registration are the site plan and cadastral plan prepared by the license surveyor hence a spatial unit here has the attributes of spatial units on such plans. The parcel plotted on the Air sheet with its title number is indicated

As to future requirement for deeds registration in Ghana There are plans to migrate from the manual system to a digital system.

System of deeds to system of title conversion process in Ghana and Ontario

In Ghana, the mass conversion process of existing registered deeds to land titles are clearly outlined in Sections 11 and 13 of the old PNDCL 152 and sections 85, 97, 99 of the new land law. However, none of these mass conversions were done.

In Ontario, before Province of Ontario Land information system (POLARIS) project, the 'First Application' was used to convert deeds to title. (Gainer, 2017; Murray, 2010). As part of POLARIS, the province decided to convert all deeds to title in Ontario.

"it was actually shortly after the first of automation that we decided to switch from last registered owner [deeds system] to a certified owner [title system]" CPVSB ServiceOntario, January 2021.

Hence, they developed a quick way to convert the deeds to title. This administrative conversion process included: first, all the stakeholders came together and produced new huge sets of rules, procedures and business processes. Then, the scanning of the paper record to a picture format, entering data from the image into POLARIS, title analysis thus simply look for deeds produced from 3 different arm's length transaction within 10 years subject to conditions, if there was a problem with a deed to be converted to title, it was given a property identification number (PIN), and left in the registry, If there were no problems, it was given the PIN and the data would be entered into a spatial database. The titles produced from this process were called Land Titles Converted Qualified (LTCQ). As the project progressed several operational improvements were made (Gainer, 2017; Murray, 2010).

Undoubtedly, the deeds to title conversion process in Ghana now is similar to the slow 'First application' in Ontario which was abandoned during POLARIS for the administrative conversion process. Hence, if Ghana really wants to phase out the deeds system like Ontario did, the administrative conversion process is a lesson to that could be learnt from the deeds to title conversion process in Ontario.

However, to adopt this several other sub lessons could be learnt from the experience of Ontario. These are issues on integrity, corruption and informal tenure, unbound collaboration and participation of all stakeholders, working rules and legislations, to undertake the conversion process in a digital environment, knowing that the more money you throw at it the less time it would take and vice versa, existence of unwavering and sustained political commitment and finally, the administrative deeds to title conversion workflow itself, where there is no involvement of the party, no need for a plan, no initial money paid by the client, no objections and lengthily litigation and their innovative title analysis procedure.

In terms of Requirements from these lessons they are; .

Requirement 1; A party role could be a title analyst.

Requirement 2; A title for a RRR can be 'Qualified land title.'

Requirement 3; A 'Qualified land title' has a list of qualifiers.

Requirement 4; the date of administrative deeds to title must be stated

Requirements for Customary land registration systems in Ghana

Customarily, Ghana can be said to be a collection of completely different autonomous states like Asante, Dagbon, Wassa Amenfi, Akyem Abuakwa and others. 80% of all lands in Ghana are held under customary land tenure secured under customary laws of that specific customary area. Knowing what the customary laws are, gives an insight into the bases for the customary land governance and tenure of that area. Hence, the requirements for developing a LADM solution.

Requirement 1; the country is divided into various customary (traditional) areas. A customary area could be a continuous area or isolated areas which form one customary area

Requirements for the customary land registration system of Asanteman

The Asanteman is a one customary area. Lands here are called Stool (Rattray, 1929).

In terms of Requirements on party package.

Requirement 1; the names of the party as it appears on a national identification card (ID)

Requirement 2; the Age of the party. Thus, they do not register minors.

Requirement 3; A national ID from the party.

Requirement 4; the citizenship of the party. A party can be a citizen of any country

Requirement 5. A passport picture of the party

Requirement 6; The party's residential address, postal address and endorsement. This endorsement can be (Signature, marking, thumbprint or/and seal)

Requirement 7; the capacity or party role. A party role type (see code list for party role type).

The unique addition is the role of confirming party and Liaison officer.

Requirement 8; The party type of the party. (see code list for party type). The unique addition to Asante and affliet customary areas to Asante will be discussed later in this paper is the Ohemaa (Queen mother), Konti(re)hene, Omanhene (paramount chief), Birempon, Abusuahene, Twafohene, Adontenhene, Ankobeahene, Kyidomhene, Akwamuhene, Nifahene, Benkumhene, Okyeamehene, Gyasehene, Odikro, Abusuapanin and Asantehene. A party can be more than one party type.

Requirements for Administrative package.

Requirement 1; The land rights types are Allodial, customary freehold, common law freehold, leaseholds (assignment, Sublease, short term lease), Awowasie (customary pledges), customary tenancies and customary gifts. However, only leases (leasehold, assignment, sublease, short term lease) can be registered at the CLS since the rest are inferior rights. (Rattray, 1929).

Requirement 2; At the Manhyia CLS, there is one lease document format (with same attributes of a deed) depending on the use of the spatial unit related to the lease. it could be on land used for commercial, cultural, civic, light industrial, heavy industrial and residential purpose. Each document has referenced number and volume number (see code list for RRR types).

Requirements of for spatial unit, surveying and representation package.

Requirement 1; a parcel is the only registrable spatial units at the CLS for now. However, there is a protocol for registering buildings (condominium)

Requirement 2; the documents accepted to show the boundaries of the land parcel are cadastral plan prepared by a surveyor, site plan and architectural plans. Therefore, a land parcel here has the same attributes as a parcel on a site plan and cadastral plan prepared by a license.

Requirements on the customary land registration system of Dagbon

Dagbon was established by Yaa Naa Nyagse. Lands are called Skin lands (Staniland, 1975).

Requirements for Party package.

Requirement 1; The name of the party, residential address, mobile number and postal address

Requirement 2; whether the party is a natural or non-natural person.

Requirement 3; the CLS does not take the ID card of the party

Requirement 4; The capacity or party role of each party. (see code list for party Role type)

Requirement 5; The type of the party. The party type can be any of the type already stated. However, unique additions here are the Yaa Naa, Yaa Naa Nazugri, Yaa Naa Bihi, Yaa Naa Yaansi or a Tindaana.

Requirement 6. A Party can be a group of parties. The party members are identified by the names that appear on the land allocation document form 'A'. Again, the CLS knows all the chiefs that controls land in their area.

Requirement 7. The CLS does not indicate the share of each party member yet.

Requirements for Administrative package

Requirement 1. A right type here can be a use right (usufructuary right), Leasehold (assignment sublease and other leases), freehold (customary and common law) and allodial interest

Requirement 2; there is one lease format (with all the attributes of a deed) depending on the use of the spatial unit related to the lease could be on land use for commercial, cultural, civic, light industrial, heavy industrial and residential purpose. (see code list for RRR types)

Requirements of Spatial units

Requirement 1; the registrable spatial unit at the CLS is a Land parcel.

Requirement 2. The only way of know the boundaries is a cadastral plan prepared by a license surveyor and a site plan. A spatial unit has the attributes as a parcel on these plans.

Customary Land registration System of the people of Fieve (Ewe)

The Fieve customary area represent one clan of the Eve. Lands here are called Clan lands.

Requirement for party package

Requirement 1; The name, the location of the party, residential address, postal address, whether or not the party is an indigene, if not an indigene the hometown of the party and the endorsement of the parties.

Requirement 2; The role of each party. (see code list for party role types)

Requirement 3; the party Type. The party type can be any of the party (codelist for party type). The unique party types here are family head 'Fometatc' gate representative 'kpcnumetietiewo',

Requirement 4; A party can be a group of parties. These party group types (codelist party group type). The unique addition here is that a party group can be a gate 'kpcnu'.

Requirement 5; the share of each party member is not stated yet.

Requirement for administrative package

Requirement 1; the land right types in Fieve are Allodial interest 'etcnyenye', Leasehold, Possessory title 'Abledefe', customary license 'Amedzro', crop sharing or customary tenancy 'Nujcjc' and animal rearing business 'Deme'. Only leases can be registered.

Requirement 2; The RRR are in an indenture (one format depending on use). This is same a deed as such has the same attributes as a deed. Each has unique reference number, amount paid and the date the receipt was issued.

Requirement for spatial unit, surveying and representation.

Requirement 1; the registrable spatial unit is a parcel. a parcel in the system has the same attributes as a parcel on a cadastral plan prepared by a license surveyor and a site plan

Customary land registration System of Gbawe

The Gbawe Kwatey family is a family unit part of the Ga. Land here are called family lands.

Requirement for party package

Requirement 1: The name, postal address, residential address, digital address number, street name, hometown, email address, business registration number if the party is business entity, church registration number if the party is a church, GP address, passport picture of the party, a national ID, whether the party is a natural or non-natural person

Requirement 2: the CLS take the roles of each party. (see code list for party role). Unique thing here is that a party may be a land allocation committee member.

Requirement 3: the party type. The unique one here is that a party can be the family head 'Gyaastse'.

Requirement 3: a party can be a group of parties (see code list for party group types)

Requirement 4: the CLS use the certificate of incorporation collected from non-natural person to identify the principal stakeholders of that entity.

Requirements for Administrative package

Requirement 1: Only leaseholds can be registered at the CLS (see attached RRR code list)

Requirement 2: All the RRR are code in an indenture document. The indenture is the same as a lease or a deed and has the same attributes listed earlier. Each has a file number.

Requirement 3: The attributes that relates to only RRR entered in the register are Land commission registration number, land title certificate number, land valuation board registration number, document type, commencement date, date of payable (rent), year of revision (rent), annual rent, file number, lease period, rent payment schedule.

Requirements for spatial unit, surveying and representation package

Requirement 1: the spatial unit registrable is parcel and building. (see codelist building type)

Requirement 2: The CLS accept cadastral plan, site plan and block plan (architectural plan). hence a spatial unit here has the same attributes as spatial unit in these plans

Requirement 3. The CLS use the planning scheme as cadastre.

Future Requirements from Gbawe CLS

Requirement 1: The CLS plans to create a property ID in future with property ID number.

Customary land registration in Bolgatanga (Bolga)

Bolgatanga is a city in the upper east region in Ghana. In Bolga, the Tindaanas are the allodial title holders of lands in the Area. But a land here is not called Tindaana Land.

Requirements for party package

Requirement 1: the nationality, occupation, residential address, email address, the gender, name, telephone number and endorsement of the party.

Requirement 2: the role of the party (see code list for party role type). The unique thing here is that a party can be a land management committee member.

Requirement 3: The party type ((see code list for party type). The unique addition are a party can be the family head (Zudaana), Farm owner (Kuadaana), Tindaana and caretaker (Gu'urah)

Requirements for Administrative package

Requirement 1: the right type that could be registered at the CLS is Leasehold 'Boah'. Yet, land rights in the area can be allodial interest, customary freehold, customary tenancies and usufructuary rights. (see code list for RRR types)

Requirement 2: these RRR are in an indenture, same as a deed so has the same attributes

Requirement 3: the CLS enter these information land register; term of the lease, type of grant (use), date of commencement of the lease and expiring date of the lease, due date of the rent

Requirements for spatial unit, surveying and representation package

Requirement 1; The registrable in spatial unit at the area is land parcel. The CLS accepts cadastral plan prepared by a license surveyor and a site plan. hence a parcel here has the same attributes of a parcel in these plans aforesaid.

Future requirements in Bolga

Requirement 1; the CLS desires to have at least a point cadastral map in future. They believe this could help them in their operation.

Customary land registration system of Techiman.

The people of Techiman (Takyiman) are a unique ethnic group of people located in the middle party of Ghana. Lands here are called Stool lands.

Requirements for Party package

Requirement 1; the name, Postal address, residential address, a nation ID card, passport picture, the capacity of the party or the party role, a party can be a group of parties, the party type.

Requirement for administrative package

Requirement 1; The right types in Techiman are; allodial interest, customary freehold, common law freehold, usufructuary rights, leaseholds, gift, and tenancies. (see code list RRR types)

Requirement 2; these RRR are documented in an indenture same as a deed so has the same attributes. They also use Omanhene and caretaker chief allocation chit to document RRR.

Requirements for spatial unit surveying and representation packages

Requirement 1; The registrable in spatial unit at the CLS is land parcel. The CLS accepts cadastral plan prepared by a license surveyor and a site plan. hence a parcel here has the same attributes of a parcel in such plans aforesaid.

Customary registration System of the Wassa (Wassa Amenfi)

The Wassa is a homogenous people that are mostly in the south western part of Ghana.

Requirements for party package.

Requirement 1; the name, contact number, place of birth, date of birth, gender, passport picture, fingerprint, region of origin, residential address, house number, cell phone number, email address, age group, hometown., a national ID card, and nationality.

Requirement 2; The party role or capacity. The same as the party role types already listed. The unique addition here is a land allocation committee member.

Requirement 3; The type of party. (see code list for party type).

Requirement 4; A party can be a group of parties. The group type can be any of ones already listed. Party members are identified based on the documents they provide. This can be a business registration document or church document.

Requirement for administrative package

Requirement 1; All the land rights that exist in Wassa are registrable at the CLS. The right types are usufructuary rights, common law freehold, customary tenancies, leaseholds, the allodial title, customary freehold. (see code list for RRR type).

Requirement 2; the RRR are coded in lease document, share cropping documents, a receipt, customary law freehold (indigenes) for farmlands documents, plot allocation note, plot registration form, land application form.

Requirement 3: The information need with regards to RRR by the CLS are; Date acquired, the lodgment date, date registered at the CLS, type of acquisition (customary mortgage, purchase, gift, inheritance or customary tenancy) use of the land, the term of the RRR cost of the land, types of crops, tenancy type, commencement date, expiry date, drink money, renewal date, nature of interest, annual rent, valid date for development, file number, date of entry registered number and allocation note reference number

Requirements for spatial unit, surveying and representation.

Requirement 1: The registrable in spatial unit at the CLS is land parcel. The CLS accepts cadastral plan prepared by a license surveyor and a site plan. hence a parcel here has the same attributes of a parcel in such plans aforesaid

Customary land registration of the Akyem traditional area (Akyem Abuakwa).

The Akyem (Akyim) is a unique group of people located in south eastern part of Ghana

Requirements for the party package

Requirement 1; the name, age, occupation, a national ID card, residential address, Postal address passport picture and endorsement.

Requirement 2; The party type of the party. The unique addition to the party type listed previously is the Okyenhene. The party role, A party can be a group of parties

Requirements for the administrative package

Requirement 1; The right type in Akyim Abuakwa are Allodial, customary freehold, common law freehold, leaseholds, tenancies and usufructuary rights. (see RRR types code list)

Requirement 2; these RRR are coded in a deed of stool lease same as a deed and has the same attributes of a deed. upon registration the CLS keeps a copy. Each copy has a file number.

Requirement 3; The land tenure information is entered in the land register (a big noted book); the name of parties, size of land, location of land and date of the indenture.

Requirements on Spatial Units surveying and representation.

Requirement 1; The registrable in spatial unit at the CLS is land parcel. The CLS accepts only cadastral plan prepared by a license surveyor and a site plan. hence a parcel here has the same attributes of a parcel in such plans aforesaid

Requirements for Informal land registration systems in Ghana (Meridia)

In Ghana, there are various informal land registration (like Ghana Grounds by Innola solutions) used for various purposes but not utilized by the formal system. Also, informal land rights exist in Ghana. There are 78 slum settlements in only Accra. Not recognizing this fact does not make it go away but it only magnifies the harm to all parties involved. Information on who owns what and where could be useful in managing or mitigating such harm (UN-HABITAT, n.d). Again, the newly created middle point land rights like temporary occupation (see Section 272 of land law) is an avenue by which informal land rights could be formalized. All these has created the need for an informal registry for the existing informal land setting. Requirements for this were based on the system of Meridia, the leading player in documenting all land right types in Ghana

Requirements for Party Package

Requirement 1; Name (first names, middle names, Last name, Alias name), National ID card, Picture of the party holding a card with their full name written on it, gender, phone number, birthdays, hometown, marital status and education level.

Requirement 2: Residential address. This can be directions the house of the party, residential address, reference location of home or a geo-coded picture of the house of that party

Requirement 3: how many children, siblings, spouse, co-applicants, digital signatures, farm yield and income level

Requirement 4: The party's capacity and party types. The party type can be single applicant, two applicants, applicant is a family, applicant are siblings and applicant children.

Requirements on the Administrative package

Requirement 1: Meridia records any land right the client presents. Informal right types could be pavement dweller, a squatter tenant, squatter owner unregularized, tenant in unauthorised subdivision, squatter owner regularized, owner-unauthorized subdivision, legal owner unauthorised construction (Payne, 2001).

Requirement 2: Meridia records the root of title using oral history of the land rights of the applicant. They also record testimonials from neighbors

Requirement 3: Meridia records any restrictions and responsibilities in that area.

Requirement 4: the documents they issues is an indenture. Hence same attributes as those above.

Requirement 5: Meridia keeps two softcopies of any land indenture they produce. Each document has a unique number.

Requirement for spatial unit, surveying and representation.

Requirement 1: Meridia can register any spatial unit even trees. These spatial units if it is land has all the attributes of land on cadastral plan prepared by license surveyor and a site plan. The addition here is the parcel boundaries accuracy, parcel centroid, parcel altitude, locality, project name, area type.

5. FINAL REMARKS

In conclusion, this paper sought to present the requirements needed to adapt the LADM to the land administration system (LAS) of Ghana. This qualitative study used semi-structured interviews conducted with officers from land sector agencies in nine areas in Ghana. And literature review to obtain data. The data was analysis with conventional content analysis.

This paper has presented a set of requirements that could be translated into an LADM country profile for Ghana. This LADM profile would support organizational integration of, in the Ghanaian case, the LC, CLSs, Forestry Commission, Minerals Commission, fisheries and informal ones like Meridia. It would reconcile the silo databases kept by these organizations. The informal part of this country profile would support fit-for-purpose approaches that could be used to secure the valuable land rights of the poorest people in Ghanaian societies. Also, this profile would support emerging future needs of LAS like this new phenomenon, 3D spatial units that has started springing up in Ghana. All in all, this LADM country profile could support the transformation from the current paper-based system to a digital cadastral system that truly reflect per Cadastre 2014 what a future cadastre should look like.

Future studies could be on how these requirements could be continually developed to a LADM country profile. Also, on how this LADM country profile can be implemented in Ghana. Again, on how such digital infrastructure could be populated with the existing paper-based records and organizational business process modelling that would support this new data model.

REFERENCES

- Abubakari, Z., Richter, C., & Zevenbergen, J. (2018a). Exploring the “implementation gap” in land registration: How it happens that Ghana’s official registry contains mainly leaseholds. *Land Use Policy*, 78(March), 539–554.
<https://doi.org/10.1016/j.landusepol.2018.07.011>
- Abubakari, Z., Richter, C., & Zevenbergen, J. (2018b). Exploring the “implementation gap” in land registration: How it happens that Ghana’s official registry contains mainly leaseholds. *Land Use Policy*, 78, 539–554.
<https://doi.org/10.1016/j.landusepol.2018.07.011>
- Adad, M. A., Semlali, E. H., El-Ayachi, M., & Ibannain, F. (2020). Supporting land data integration and standardization through the LADM standard: Case of Morocco’s country profile MA-LADM. *Land Use Policy*, 97(March), 104762.
<https://doi.org/10.1016/j.landusepol.2020.104762>
- Agbosu, L. K. (2018). *Land Registration in Ghana : Past , Present and the Future Author (s) : L . K . Agbosu Source : Journal of African Law , Vol . 34 , No . 2 (Autumn , 1990) , pp . 104-127 Published by : School of Oriental and African Studies Stable URL :*
[https://www.jsto.34\(2\),104-127](https://www.jsto.34(2),104-127).
- Archer, L. (2019). Research methodology: A step-by-step guide for beginners (5th. ed.). *Journal of Latinos and Education*, 1–2. <https://doi.org/10.1080/15348431.2019.1661251>
- Asaaga, F. A., & Hirons, M. A. (2019). Windows of opportunity or windows of exclusion? Changing dynamics of tenurial relations in rural Ghana. *Land Use Policy*, 87, 104042.
<https://doi.org/10.1016/j.landusepol.2019.104042>
- Ayitio, J. (2019). Hybrid Land Governance and The Politics of Institutional Change in Ghana: Explaining Divergent Trajectories School of Real Estate and Planning
- Biitir, S. B., Nara, B. B., & Ameyaw, S. (2017). Integrating decentralised land administration systems with traditional land governance institutions in Ghana: Policy and praxis. *Land Use Policy*, 68(June), 402–414. <https://doi.org/10.1016/j.landusepol.2017.08.007>
- Brennan, G. (2015). The impact of eConveyancing on title registration: A risk assessment. In *The Impact of eConveyancing on Title Registration: A Risk Assessment*.
<https://doi.org/10.1007/978-3-319-10341-9>
- Bydłoz, J. (2015). The application of the Land Administration Domain Model in building a country profile for the Polish cadastre. *Land Use Policy*, 49, 598–605.
<https://doi.org/10.1016/j.landusepol.2015.02.011>
- Bryman, A. (2016). *Social research methods*. Oxford, Oxford University Press.
- Divithure, H., & Tang, C. (2013). Cadastral system migration from deeds registration to titles registration: Case study of Sri Lanka. *Survey Review*, 45(330), 220–228.
<https://doi.org/10.1179/1752270612Y.0000000020>
- Edwin, D. A., Glover, E. K., & Glover, E. K. (2020). When Tradition Meets Modernity in Land Registration: Evidence from Dagbon, Ghana. *Land*, 9(11), 416.
<https://doi.org/10.3390/land9110416>
- Ehwi, R. J., & Asante, L. A. (2016). Ex-Post Analysis of Land Title Registration in Ghana Since 2008 Merger: Accra Lands Commission in Perspective. *SAGE Open*, 6(2).
<https://doi.org/10.1177/2158244016643351>
- Gainer, M. (2017). Maya Gainer Innovations for Successful Societies. In *Breaking New*

- Ground: Pioneering Electronic Land Registration in Ontario, 1987-2010.
- Gardner, S. P. (2005). Ontologies and semantic data integration. *Drug Discovery Today*, 10(14), 1001-1007. doi: [http://dx.doi.org/10.1016/S1359-6446\(05\)03504-X](http://dx.doi.org/10.1016/S1359-6446(05)03504-X)
- Henssen, J., & Williamson, I. P. (1990). *Land registration, cadastre and its interaction; a world perspective*.
- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, 15(9), 1277–1288. <https://doi.org/10.1177/1049732305276687>
- ISO, 2012 Geographic information — Land Administration Domain Model (LADM) ISO19152: 2012(2012)
- Lemmen, Christiaan. (2012). *A Domain Model for Land Administration*. Retrieved from www.ncg.knaw.nl
- Lemmen, Christiaan. (2014). *A Domain Model for Land Administration A Domain Model for Land Administration Christiaan Lemmen*.
- Lemmen, Christiaan, Unger, E., Lengoiboni, M., & Bennett, R. M. (2019). *Exploring and assessing STDM and LADM for gender equitable land administration Exploring and assessing STDM and LADM for gender equitable land administration*. (September).
- Lemmen, Christiaan, van Oosterom, P., & Bennett, R. (2015). The Land Administration Domain Model. *Land Use Policy*, 49, 535–545. <https://doi.org/10.1016/j.landusepol.2015.01.014>
- Lemmen, Chrit, & van Oosterom, P. (2001). Cadastral Systems. *Computers, Environment and Urban Systems*, 25(4–5), 319–324. [https://doi.org/10.1016/s0198-9715\(00\)00043-0](https://doi.org/10.1016/s0198-9715(00)00043-0)
- McLaughlin, J. D., & Nichols, S. E. (1987). PARCEL-BASED LAND INFORMATION SYSTEMS. *Surveying and Mapping*, 47(1), 11–29.
- MINISTRY OF LANDS AND FORESTRY GHANA EMERGING LAND TENURE ISSUES ACCRA. (2003). Retrieved from http://www.hubrural.org/IMG/pdf/cilss_praia9_ghana_rapport_national.pdf
- Murray, K. (2010). AUTOMATED LAND TITLES RECORDS IN ONTARIO
- Nara, B. B., Mwingyine, D. T., Boamah, N. A., & Banleman Biitir, S. (2014). Enhancing Efficiency in Land Management through the Customary Land Secretariats (CLSs) in Upper West Region, Ghana. *Developing Country Studies*, 4(1), 24–31. Retrieved from www.iiste.org
- Palmer, D. (1996). *Incentive-based maintenance of land registration systems*. Florida: University of Florida, 1996.
- Palmer, G., Warren, Y., John, B., George, T., & Val, S. (2008). *Review of the Land Transfer Act 1952 Review of the Land Transfer Act 1952 In con ju nction with*. Wellington.
- Rattray Sutherland W. (1929). Ashanti Law and Constitution. *African Affairs*, XXVIII(CXI), 305–306. <https://doi.org/10.1093/oxfordjournals.afraf.a100422>
- Rickard, C. (2020, March 26). Chaotic land ownership records shock Ghana’s supreme court | African Legal Information Institute. Retrieved 24 October 2020, from <https://africanlii.org/article/20200326/chaotic-land-ownership-records-shock-ghanas-supreme-court>
- REPUBLIC OF GHANA Participatory Slum Upgrading Programme (PSUP) Financed by the European Commission PHASE II-OUTPUTS PROJECT CONCEPT NOTE 1) Land*

- titling for housing, youth employment, education, and alley pavement as well as toilet improvements.* (n.d.). Retrieved from http://www.unhabitat.org/pmss/pmss/electronic_books/2917_alt.pdf
- Safo-Kantanka, N.A. (2012). Records management in public sector agencies: A case study of the land registration division of the lands commission-accra (Unpublished BSc thesis). Department of Land Economy, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.
- Silva, M. A., & Stubkjær, E. (2002). A review of methodologies used in research on cadastral development. *Computers, Environment and Urban Systems*, 26(5), 403–423. [https://doi.org/10.1016/S0198-9715\(02\)00011-X](https://doi.org/10.1016/S0198-9715(02)00011-X)
- Simbizi, M. C. D., Bennett, R. M., & Zevenbergen, J. (2014). Land tenure security: Revisiting and refining the concept for Sub-Saharan Africa's rural poor. *Land Use Policy*, 36, 231–238. <https://doi.org/10.1016/j.landusepol.2013.08.006>
- Staniland, M. (1975). The Lions of Dagbon. In *The Lions of Dagbon*. <https://doi.org/10.1017/cbo9780511759543>
- Stuedler, D. (2014.). CADASTRE 2014 and Beyond.
- UN ECE (1996) Land Administration Guidelines, UN, New York and Geneva 1996
- van Gelder, J. L. (2010). What tenure security? The case for a tripartite view. *Land Use Policy*, 27(2), 449–456. <https://doi.org/10.1016/j.landusepol.2009.06.008>
- Williams Miller, A. (2018). *Land Registration Process Modelling for Complex Land Tenure System in Ghana*. 84. Retrieved from https://library.itc.utwente.nl/papers_2018/msc/la/miller.pdf
- Williamson, I., Enemark, S., Wallace, J., Rajabifard, A., Enemark, W., Rajabifard, W., & Press, E. (2010). *Land Administration for Sustainable Development*. Retrieved from www.esri.com ,
- Zevenbergen, J. (2001). A systems approach to land registration and cadastre. *System*, 1, 327.
- Zevenbergen, J. (2002). Systems of Land Registration. *Aspects and Effects*, (September), 15–199. Retrieved from <http://www.ncgeo.nl/phocadownload/51Zevenbergen.pdf>
- Zevenbergen, J. A. (1994). *Is title registration really the panacea for defective land administration in developing countries* (pp. 570–580). pp. 570–580. Retrieved from <https://research.utwente.nl/en/publications/is-title-registration-really-the-panacea-for-defective-land-admin>
- Zevenbergen, J. A. (1998). *Is title registration really the panacea for defective land administration in developing countries* (pp. 570–580). pp. 570–580. Retrieved from <https://research.utwente.nl/en/publications/is-title-registration-really-the-panacea-for-defective-land-admin>
- Zevenbergen, J. A. (2003). *The Dutch system of land registration, title registration with a privatized registrar*. Retrieved from <https://research.utwente.nl/en/publications/the-dutch-system-of-land-registration-title-registration-with-a-p>

BIOGRAPHICAL NOTES

Requirements for a LADM Country Profile for Ghana (11087)
 Derick Boateng Okyere, Jaap Zevenbergen and Chrit Lemmen (Netherlands)

FIG e-Working Week 2021
 Smart Surveyors for Land and Water Management - Challenges in a New Reality
 Virtually in the Netherlands, 21–25 June 2021

CONTACTS

Title Given name and family name: Mr. Derick Boateng Okyere

Organization; University of Twente

Address: Eikstraat 35

City: Enschede

COUNTRY: The NETHERLANDS

Tel. +31687910663

Email: okyerederick9999@gmail.com

Web site:

Title Given name and family name: prof. mr. dr. ir. Jaap Zevenbergen

Organization; University of Twente

Address: Department of Urban and Regional Planning and Geo-information Management (ITC-PGM), 3-118

City: Enschede

COUNTRY: The NETHERLANDS

Tel: +31 (0)53 487 4351

Email: j.a.zevenbergen@utwente.nl

Web site: <https://research.utwente.nl/en/persons/jaap-zevenbergen>

Title Given name and family name: prof.dr. Christiaan (Chrit) Lemmen

Organization; University of Twente

Address: Department of Urban and Regional Planning and Geo-information Management (ITC-PGM), 3-001

City: Enschede

COUNTRY: The NETHERLANDS

Tel: +31534897983

Email: c.h.j.lemmen@utwente.nl

Web site: <https://orcid.org/0000-0003-1514-8385>