

GEOSPATIAL TECHNOLOGY INNOVATIONS FOR LAND TENURE SECURITY IN EAST AFRICA - GETTING NEEDS

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Abstract

Sub-Saharan Africa has an immense challenge to rapidly and cheaply map millions of unrecognized land rights. Current recording and mapping approaches did not succeed to meet the promising expectations: disputes abound, investment is impeded, and the community's poorest lose out. In order to cope with these challenges a research project called 'its4land' is carried out. Its4land is a European Commission Horizon 2020 project aiming to develop an innovative suite of land tenure recording tools for three East African countries (Ethiopia, Kenya, Rwanda). These land tenure tools are inspired by geo-information technologies, including smart sketchmaps, UAV's, automated feature extraction and geocloud services. For each African country two specific case locations are selected. The six case locations are Bahir Dar city (Ethiopia), Robit Bata rural Kebele (Ethiopia), Kisumu County (Kenya), Kajiado County (Kenya), Musanze City (Rwanda) and Busogo (Rwanda). In order to reach this overarching research goal, a fundamental first step is to "get needs", i.e. capture the specific needs, readiness, market opportunities of end-users in the domain of land tenure information recording. Therefore, this paper aims to elaborate the research design responding to these fundamental first step. This includes actor and case-specific data collection and other methods like Actor Network Theory, Multi-Actor Multi-Criteria Analysis and Market Gap Analysis. An integrated design is also proposed to facilitate a coordinated approach to the complicated data collection and analysis requirements. This way, the diverse nature of the actors of interest with regards to readiness and potential impact on the project is taken into account.

Keywords: capturing needs, land administration, land tenure security

1. INTRODUCTION

Land tenure information recording is important for tackling sustainable development and poverty reduction issues. It helps to deliver tenure security, reduce property disputes, improve investment opportunities, and support good governance (FAO, 2002). Existing recording and mapping approaches have failed: disputes abound, investment is impeded, and the community's poorest lose out. Although land tenure recording is a well-established tool in developed countries, it remains a challenge for many developing countries (Bennett, 2013).

This paper focuses on Sub Saharan Africa, specifically the countries of Ethiopia, Kenya and Rwanda, which has an immense challenge to rapidly and cheaply map millions of unrecognized land rights in the region for recording in formal land administration systems (Ordnance Survey, 2015). A new project funded by the European Union (EU), the its4land Horizon 2020 project, aims to develop an innovative suite of land tenure recording tools using one, or a combination of, four low-cost geo-information technologies, namely: sketchmaps, small Unmanned Airborne Vehicles (UAVs), automated feature extraction and geocloud services. The project seeks to respond to end-user needs and market opportunities in sub Saharan Africa, and to reinforce an existing strategic collaboration between the EU and East Africa. This project is a collaboration between three European universities (University Twente, Westfälische Wilhelms-Universität Münster and KU Leuven), three East African universities (INES-Ruhengeri, Bahir Dar University and Technical University Kenya) and two private organizations (Hansa Luftbild AG, Esri Rwanda Ltd) and will utilize existing partnerships between consortium members at regional, national, and local levels – across multiple sectors.

To reach the overarching research goal of the its4land project, a fundamental first step is to “get needs”, i.e. capture the specific needs, market opportunities, and readiness of end-users in the domain of land tenure information recording. This aim can be decomposed into a series of four research questions, namely:

- R1. What are stakeholders' needs relevant to land tenure information recordation, and how do these affect other stakeholders' needs along the land tenure information value system?
- R2. How might the proposed geospatial technologies meet stakeholders' land tenure information recordation needs?
- R3. Where the proposed technologies can better support stakeholders' needs, how ready are stakeholders to adopt these new technologies?
- R4. What are the potential market opportunities associated with: 1) the introduction and adoption of these new technologies; and 2) more current and complete land tenure information?

The aim of this paper is to elaborate the research design for responding to these research questions. The structure of the paper is as follows: first the different case locations and their specific settings are summarized. This is followed by an in-depth explanation of the proposed research design and methods and how these will be integrated and applied in the case studies. The paper concludes with a short summary of the major findings and intentions regarding the research design.

2. ETHIOPIA, KENYA AND RWANDA IN PERSPECTIVE

The measurement of the needs, readiness and market opportunities will take place in the three different countries and the selected case study areas. For all three sub-Saharan African countries two specific case locations are selected. Taken together, the case studies are intended to illustrate the range of typical land tenure recording situations across most of sub Saharan Africa; however, the final choices are also determined by a range of criteria including:

- project relevance – allowance to develop a suite of land tenure recording tools that responds to the end-user needs and market opportunities in Sub Saharan Africa
- applicability of the geospatial technologies (sketchmaps, uav, automated feature extraction)
- accessibility – areas should not be located in too remote places (i.e. no more than 1.5 days drive from a capital city)
- availability of key spatial datasets, such as orthophotos, land cover/use maps
- safety – unsafe areas are avoided
- size – not too large as the research has to be manageable.

Based on the above-mentioned conditions and criteria, six use case areas have been selected. These areas are our best estimates for the case locations at this stage – but are amenable to change if circumstances dictate (e.g. due to politics, conflicts, weather extremes, land hazards, etc.). Table 1 presents an overview of the six case areas selected. Each of the selected use case areas is briefly introduced in the next pages.

Table 1. Use case areas

<i>Number</i>	<i>Country</i>	<i>Name</i>
1	Ethiopia	Peri-urban areas of Bahir Dar city
2	Ethiopia	Robit Bata rural kebele
3	Kenya	Kisumu County – Riat Hill
4	Kenya	Kajiado County – Mailua sub-location
5	Rwanda	Musanze District – Musanze City
6	Rwanda	Musanze District - Busogo

2.1. Ethiopia

Ethiopia is a country with a basic cadastre and land acquisition system. A complete and up-to-date cadastre is still missing (Bennett, 2013). The locations selected are the peri-urban region of Bahir Dar, and the rural region of Robit Bata. Bahir Dar is one of the fastest growing cities of Ethiopia and the demarcation between rural and urban areas in Ethiopia is not always sharply defined physically or administratively. Much of the

contemporary growth, where high levels of human-to-land interactions exist, is clearly taking place in peri-urban areas in all directions of the city. The urban administration considers this part of the city as part of rural land administration and proclamation, whereas, the rural administration considers it as part of urban administration and policy. In this context, these areas can be described as institutional 'vacuum' zones. Because of this, land administration problems such as the high level of informality and land tenure insecurity appear to be enduring problems and present ongoing challenges for sustainable urban development (Adam, 2014).

Robit Bata kebele is a rural area, which is facing land degradation and fragmentation problems (Binggeli and Desissa, 2003). In order to tackle these problems, land tenure information is vital as input information for land consolidation purposes. Recent orthophotos are available to be used for land certification. Other strengths of this selected kebele are that it is topographically rather undulating and rural.

2.2. Kenya

The national cadastre in Kenya is largely incomplete and can be described as a patchwork of isolated and inconsistent cadastres (Siriba and Mulaku, 2011). The selected locations, Kisumu and Kajiado, have different problems regarding land administration. Kisumu is facing a rapid conversion from rural to urban area. The main problem here is that rural general boundaries cannot be maintained and secondly, the properties are increasing in value and are now in need of better boundary descriptions.

On the other hand, Kajiado County is still dominated by nomadic pastoralism. The land tenure system is characterized by group ranches without adequate survey control and without proper land use planning. In the process of subdividing and registering private land, pastoralists' migration routes and their needs to access important resources such as water points are often overlooked. In the meantime, pastoralists continue to practice open range grazing and moving from place to place in search of pastures and water, based on their traditional animal husbandry practices. Therefore, the area is experiencing increased conflicts between nomadic pastoralism with communal grazing areas and private property regimes like crop farmers and investors in search for land for settlement, agriculture or tourism industry. Therefore, conflicts between pastoralists and crop farmers and pastoralism and the tourism industry are common in the area (Bennett, 2013).

2.3. Rwanda

Unlike Ethiopia and Kenya, Rwanda does not have a long land administration or national cadastre history. Nevertheless, the efforts of the past decade paid off. The results and prospects look very promising in terms of the implementation of a complete cadastre system. However, the current system is not yet adapted to upcoming sustainable development and land use challenges (Bennett, 2013). These problems will be investigated in the Musanze district, which is subdivided into 15 sectors, among which three are urban (Muhoza, Musanze and Cyuve). Despite the high population density, Musanze district is predominantly rural with rather small parcel sizes. As such, Musanze District is an excellent use case area to study the suitability of the suite of land tenure recording tools for urban and rural smallholders.

Musanze city is one of the six secondary cities of the country (after Kigali City, the capital of Rwanda) developed to support Kigali to alleviate and decentralise stress from people looking for jobs and a better quality of life. After the land tenure regulation program was completed in 2013, some sectors became urbanized at a rapid pace. Busogo sector is located approximately 10 kilometres west of Musanze City and is more rural. The rural areas are made of small plots with very fertile soils because of the volcanoes surrounding them but a large part of the agricultural land and forest are being transformed into built up areas. Both locations are located south of the Volcanoes National Park, safe and easily accessible.

In summary, the Ethiopian cases focus on peri-urban and rural land certification, the Kenyan cases address pastoralist land rights registration in the context of subdividing group ranches into private holdings – and associated land disputes with other land uses, and the Rwandese cases focus on urban and rural smallholders' registration.

3. METHODOLOGY

To respond to the research questions, the following methodologies are proposed:

1. To capture stakeholders' needs, we propose the use of the **Multi-Actor Multi-Criteria Approach – MAMCA** (Macharis, 2005). This method will address R1 as well as R2 and will provide input into other research questions.
2. To understand and map the current state and interactions of stakeholders along the land tenure information value chain, we propose the use of **Social Network Analysis**. The use of this method and its outcomes will feed into all research questions R1-4.

3. To assess stakeholder readiness, we propose the development of a **Readiness Assessment** approach that integrates a survey with actor network analysis. This will draw on outcomes from the actor network analysis and from literature on change management and technological innovation in land administration. This method will address R3 and provide input for R4.
4. To identify market opportunities, outcomes from previous methods will be used to frame current and desired states to undertake a **market gap analysis** as endorsed by Change Theory (Beckhard and Harris, 1987). More detailed data will be derived from interviews with commercial stakeholders. This method will address R4.

These instruments will be integrated in an overarching research design. In general, we anticipate questionnaires, semi-structured interviews and/or focus group discussion sessions to provide the basis for empirical data collection. In addition, these research instruments will take into account the specificities of each of the four innovative technologies as well as the unique context of each of the different case study areas.

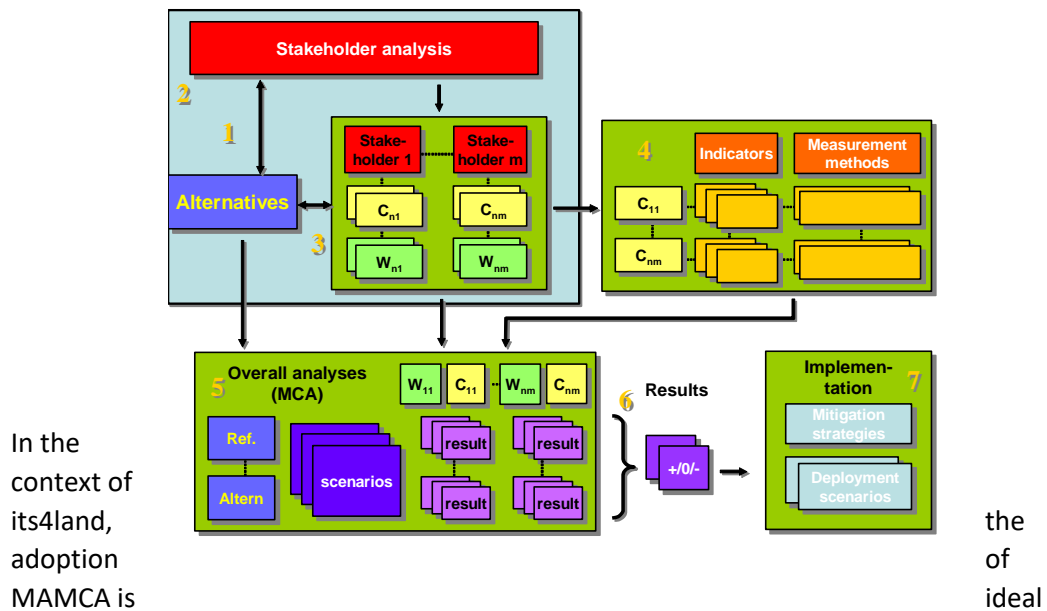
3.1. User Needs Assessment: Multi-Actor Multi-Criteria Analysis

The objective of applying Multi-Actor Multi-Criteria Analysis (MAMCA) is to identify the needs of different groups of stakeholders relevant to land tenure information recording technologies. Stakeholders' needs are defined here to be those practical information requirements and transaction processes necessary to support their individual/organizational aims relative to land tenure information recording and/or use.

MAMCA is an extension of existing multi-criteria analysis (MCA) methods (Laarabi et al, 1996). The MAMCA methodology allows researchers to evaluate different alternatives (policy measures, scenarios, technologies, etc.) about the objectives of different stakeholder groups that are involved in the decision-making process. This methodology is particularly useful as it explicitly includes stakeholders and uncovers their points of view. The methodology was developed by Macharis (2005) and has been used in many projects with different contexts, such as transport decision-making (Macharis et al., 2009) as well as the evaluation of different scenarios for implementing spatial data infrastructures (Macharis and Cromptvoets, 2014).

MAMCA consists of two phases (Macharis et al., 2009). The first phase is mainly analytical (problem definition, objectives, identification of evaluation criteria and weights) and includes the gathering of all the necessary information. The second phase is the synthetic or exploitation phase and consists of the actual analysis (evaluation of alternatives and implementation). This is shown in Figure 1.

Figure 1. The MAMCA methodology (Source: Macharis et al., 2005).



as it supports firstly, a way to construct the problem definition regarding land tenure recording as experienced by stakeholders; secondly, it enables stakeholders themselves to collectively determine a set of possible alternatives regarding the use of the proposed geospatial technologies as aligned with their organizational objectives pertaining to land tenure information recording.

In MAMCA, it is essential to determine the relevant stakeholders in order to incorporate their views in the study. It provides both reliability and validity to the outcomes of the analysis when the eventual decision is made. In MAMCA, a stakeholder (for the purposes of the project) is defined as a group of individuals/organizations that share a common set of objectives regarding the applicability of the different alternatives (being the different geospatial innovative technologies). The following main stakeholder groups

were defined: Public Sector entities, non-statutory entities, Private Sector entities, NGOs/Not-for-Profit / Donors / Development partners, and Research & Development entities. From these stakeholders groups a set of relevant stakeholders and representatives will be determined, likely by experts. The final definition of the objectives of the stakeholders will likely be an iterative process with multiple reviews and adaptations due to frequent contact with the stakeholders themselves and meetings with experts in the field of land tenure recording. The key stakeholders will be determined based on their relevance and common objectives.

The objectives are then translated into criteria for each stakeholder (step 3), which need to be weighted. Different strategies are valid when determining these criteria. In this study, a combination of different approaches are used to inductively and deductively determine a specific set of criteria per stakeholder group as well as their respective weights. These include in-depth interviews with key representatives of each stakeholder group as well as literature review. The resulting preliminary list is then validated by a number of experts in land tenure recording in each specific country and/or use case area, such as land registration/administration offices, etc. The feedback of these players result in a final set of criteria per stakeholder. Weights (between 0 and 1) will be assigned to these criteria by different members of each stakeholder group by using the Analytical Hierarchy Process (AHP) method (Saaty, 1988). This MCA technique uses pairwise comparisons to generate a ranking of the different criteria. Each criterion is evaluated with regard to the others by using a 1–9 comparison scale. From each stakeholder group, a to-be-determined number of representatives will evaluate ‘their’ set of criteria about the stakeholder group’s objectives. Based on the 9-point scale, the AHP method uses eigenvectors and eigenvalues to determine the weight of each criterion (Saaty, 1980; 1988).

In the fourth step, one or more relevant measurable indicators are formulated and linked to each criterion partly based on a literature study. They allow evaluating the performance of each alternative with regards to a given criterion and are either quantitative or qualitative, depending on the criterion.

The fifth step aggregates all the information from the previous steps into an evaluation matrix. Like the weight assignation in step 3, the AHP method is used to obtain the final ranking. These pairwise comparisons are compiled in a matrix using the 1–9 scale by Saaty (1988) and this aggregation needs strong support of experts and stakeholders to argue the pairwise comparisons.

The scoring results of each alternative and each stakeholder group are calculated in step 6. They are generated through MCA using the weights of the criteria obtained in step 2

and the pairwise comparisons of step 5. The strengths and weakness of each alternative for each stakeholder group is visualized in a graph chart. At this stage, a sensitivity analysis, exploring the effects of a change of the weights on the ranking, can be performed.

3.2. Readiness Assessment: Actor Network Analysis

The successful and sustainable adoption of the geospatial technologies in the different case countries will be determined by stakeholders' readiness for innovation. The intention is to develop a readiness assessment tool for innovation in land information recordation. For each of the case area, a quantitative and qualitative description of readiness to adopt innovative land tenure recordation tools will be established.

Of the multiple possible approaches to assess readiness, a holistic conceptualization is used. A working definition of readiness proposed for this project is: readiness involves both social (cultural, organisational and regulatory) as well as technical abilities and capacities for the adoption of innovative land information recordation tools. In contrast to e.g. the e-government or ICT literature, where a plurality of readiness assessment tools circulates (Alaaraj and Ibrahim, 2014), no such measurement instrument is readily available for the adoption of land information recordation tools in developing countries. Therefore, the following activities will be undertaken. Although analytically distinguished, most activities will run in parallel.

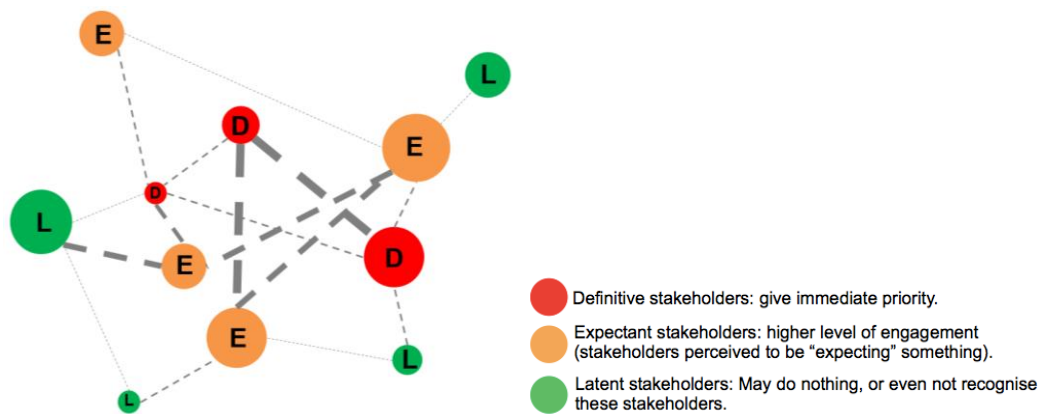
3.2.1. Identifying the network of actors in a particular case site.

An important prerequisite for the actual readiness assessment is to identify the network of actors that have a stake in land recordation in a particular case site. The concept of a network is useful to reflect the dynamic and heterogeneous interactions between many parties (Vancauwenberghe et al., 2011). A land information recordation network captures the organizations that are involved in land recordation, or that will be involved in the implementation of one of the geospatial tools. In addition, it captures the flows and nature of the interaction that exist between these stakeholders and tools.

Latour's (2005) Actor Network Theory (ANT) is an approach used to support understanding of stakeholders' interactions with others and their spheres of influence. A major strength of this method is that the analysed network does not merely consider people and organizations, but also non-human participants like geospatial tools. Furthermore, the interactions and relations between the different actors are clearly visualized. ANT will facilitate an actor network analysis (ANA) for each case location.

In ANA, stakeholders are represented as nodes; links or relations between stakeholders regarding land tenure recording activities are expressed as lines connecting these nodes. The characterization of these lines (e.g. thickness, weight, etc.) will reflect the nature of the relationship among segments of the network. This enables a holistic visualization of the land recordation network in a particular country and/or use case. Figure 3 below illustrates how such visualization might look like.

Figure 3: Hypothetical example of land recordation network visualization via ANA.



3.2.2. *Literature review of readiness definitions and readiness assessment tools*

Parallel to the ANA, a conceptualization of readiness and corresponding readiness assessment tools will be provided. This will be done with attention to the indicators that different scholars/organizations have put forward as important to consider. In the absence of instantly available measurement tools for the adoption of innovative land information recordation tools, we will apply insights from literature on e-government and ICT, and consider criteria in well-known IT governance and management frameworks that also assume a holistic approach, such as Control Objectives for Information and related Technology (COBIT) (ISACA, 2016).

3.2.3. *Refined conceptualization of readiness and list of readiness indicators*

Based on the literature review, the readiness working definition will be fine-tuned and a list of relevant indicators will be developed, that together, will provide a valid picture of stakeholders' readiness for the adoption of innovative land information recordation tools in the three countries. The following group indicators are expected as they are

either present in most readiness assessment frameworks (Alaaraj and Fatimah, 2014), or in reviews of challenges to ICT and e-government in developing countries (e.g. Gil-Garcia and Pardo, 2005; Lainhart, 2000):

1. Stakeholders' competencies, skills and attitudes
2. Information and data
3. Infrastructure and technology
4. Legal and regulatory framework
5. Institutional and environmental framework.

As it appears from the tentative list of dimensions, the readiness assessment will concern dimensions (and indicators) that relate to different aspects of the actor network: some will concern the level of individual actors, whereas others will concern the attributes of the network in general or the chain of interactions. The different dimensions are strongly related to each other.

3.2.4. *Quantitative and qualitative readiness assessment in particular cases areas*

For each of the above readiness dimensions, and the associated indicators, a quantitative score index will be subsequently developed allowing to systematically measure to what extent stakeholders of a case area are ready to adopt innovative land recordation tools. Having a score also enables us to compare case areas within and across countries. The quantitative scores will be complemented with qualitative narrative information that helps to interpret scores. The final output of the readiness assessment will resemble the following table:

Table 2: Example of potential outcomes of proposed readiness assessment tool.

READINESS DIMENSIONS	INDICATORS	SCORE PER INDICATOR	SCORE PER DIMENSION	QUALIFICATION & INTERPRETATION
1. Stakeholders' competencies, skills and attitudes	- Indicator a - Indicator b	- Score indicator a - Score indicator b	Readiness assessment dimension 1	Ready? ++/+/+/-/--
2. Information and data	- Indicator c - Indicator d	- Score indicator c - Score indicator d	Readiness assessment dimension 2	Ready? ++/+/+/-/--
3. Infrastructure and technology	- Indicator e - Indicator f	- Score indicator e - Score indicator f	Readiness assessment dimension 3	Ready? ++/+/+/-/--

4.	Legal and regulatory framework	- Indicator g - Indicator h	- Score indicator g - Score indicator h	Readiness assessment dimension 4	Ready? ++/+/+/-/--
5.	Institutional and environmental framework	- Indicator i - Indicator j	- Score indicator i - Score indicator j	Readiness assessment dimension 5	Ready? ++/+/+/-/--

This assessment will be based on a variety of data collection methods including questionnaires/surveys, semi-structured interviews, workshops and human observations. Finally, an overall readiness assessment will be developed by combining the scores of the different dimensions.

3.3. Market Opportunities: Change Theory

Market opportunities are identified as gaps in product and service provision in the land tenure sector, and relate to specific land tenure recording issues in East Africa. Therefore, this research will provide a current state on the market and market's needs, and then, by comparing it with the desired state, identify the present gaps, so that solutions and recommendations can be formulated in this respect. Inherently, a market gap analysis is often a key strategy endorsed in change theory to determine readiness (Beckhard and Harris, 1987); therefore, this research activity is closely associated with the previous one.

Analysis of outputs from previous questionnaires, the actor network analysis and MAMCA inputs and outcomes will support the definition of both current and desired states. This will provide the foundation for in-depth interviews particularly focused on private and commercial actors.

3.3.1. *Establishing the current state*

To build a base level understanding of the current context and market situation pertaining to land tenure information recordation and use in each of the three countries (focusing on the case areas), the outcomes of the data collection and analysis for MAMCA and ANA will be leveraged to identify and quantify market characteristics. The aim here is to provide a broad but comparable analysis of each of the country contexts.

The ANA described in the previous sub-section will serve to map and visualize current characteristics of the relationships between stakeholders. This will identify transaction flows between parts of the value system, make explicit organizational dependencies and highlight significant sections of the value system (e.g. in transforming land tenure

information to other types of products and services. Similarly, outcomes of MAMCA steps 1 to 3 will serve to provide qualitative characteristics of the current land tenure recording system.

3.3.2. Establishing the desired state

Outputs from MAMCA will also serve to make explicit desired/ideal states relevant to groups of stakeholders who have similar objectives. This data will be augmented by in-depth interviews conducted with private and commercial stakeholders to obtain their perspective on potential products and services. Factors of success for change to evolve from current to desired states will be explored with experts and stakeholders in workshops. Here, the intention is to identify several indicators of progress and to define key factors of change.

Data collected will be then be analysed respective to current market conditions to provide recommendations around potential market opportunities, and potentially help to provide input into a country level implementation roadmap.

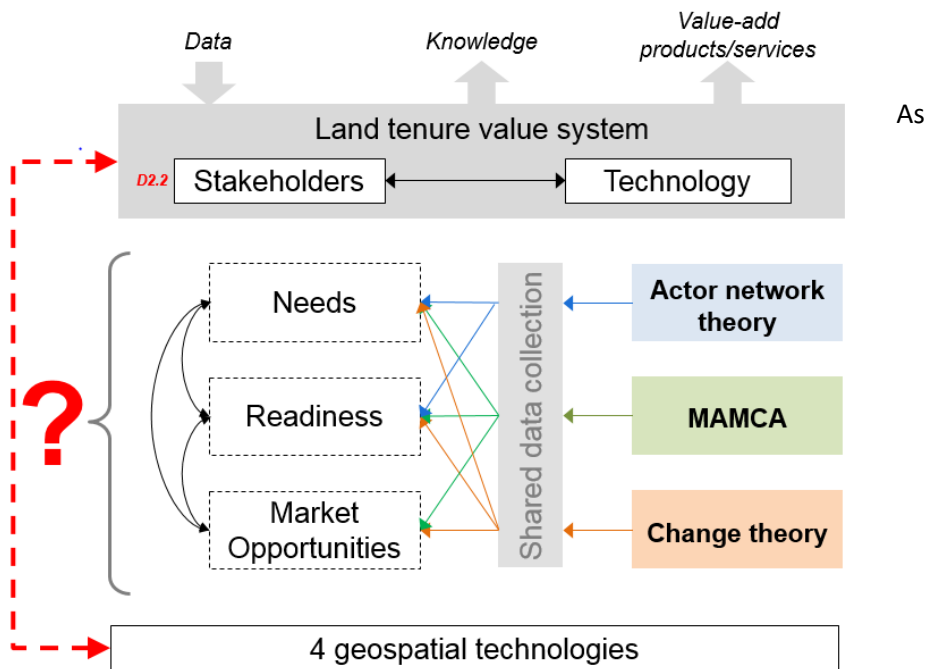
4. INTEGRATED DESIGN

The various research methodologies will be integrated (applied in parallel, and at times iteratively) to respond to the main aim of the research. As can be read in the former section, there is indeed some overlap; to avoid multiplication of questionnaires and to ensure a coordinated approach of data collection, the integrated design is pivotal. Figure 4 illustrates this integration.

Firstly, a broad-based literature review, as well as ones specific to the relevant countries will be undertaken. The main characteristics of each country's current state will be defined through data collection activities associated with needs analysis (MAMCA) and readiness assessment (ANA) via questionnaires, interviews and workshops.

Data collection for both user needs and readiness analyses will identify the key characteristics of the stakeholders, relationships between stakeholders, dependencies, information and/or resource flows between nodes in the network, reveal significant sections of the network, etc. on one hand, while also elucidating stakeholder-specific problems and objectives. This analysis will support the definition of the respective countries' current state and relevant market situation, a necessary precursor for identifying market opportunities.

Figure 4. Integrated research design.



described in Section 2, steps 1-4 of the MAMCA methodology will elucidate

stakeholders' needs specifically as problem definition, possible alternatives for using the proposed technologies and objectives. Objectives are then translated into criteria, which are weighted, before one or more measurable indicators are linked to each criterion. These will then be analysed in Steps 5-6, which will support the identification of the "ideal state" in terms of using these technologies in response to needs.

In parallel, deduced information about the current state and the ideal state will inform the readiness assessment of each case area/country, of which key will be a visualized network derived from ANA. This will support an aggregated perspective of readiness of groups of stakeholders in adopting these technologies; as well, further ANA can be used to support the visualization of various idealized actor-networks to support stakeholders' determination of the future state. This will also provide some measure of input in the development of an implementation roadmap.

Finally, outputs from the preceding research activities will provide input into identifying market opportunities through gap analysis and interviews. The gap analysis will more specifically elucidate current lack of abilities or services pertaining to processes, technologies, skills, etc. Analysing these in relation to country/case area specific market characteristics would identify potential market opportunities for product and service providers. In parallel, interviews with the private sector will further refine these recommendations.

5. APPLICATION OF THE RESEARCH DESIGN

The above methods description presents the ideal research design. Yet, from the case study locations it is obvious that they differ in characteristics and complexity. It will therefore be necessary to determine how exactly the different research methods will be applied in the different case locations in a way that is feasible, integrated, valid and consistent. Therefore, for the successful application, the following conditions and prerequisites should be met.

First, depending on the case study, it will be necessary to delineate the number of stakeholders to be interviewed per stage in the research design (needs; readiness; market opportunities). It is likely that certain categories of stakeholders will be more vital for the data collection in certain areas than in others. Likewise, the number of participants per category might differ as well. While operationalizing the data collection, the decision will be made per case study location as to who and for what purpose a stakeholder will be questioned, interviewed or registered as participant at a group discussion.

Second, while the previous paragraphs explicated the background of the data collection, the application might differ slightly from the logical order presented there. It is obvious that the methods presented form the scientific and methodological background of the data collection. However, measuring needs, readiness and market opportunities will to a large extent proceed simultaneously in order to avoid questioning the same stakeholders multiple times. Where a stakeholder might have relevance for one or more areas of interest, all effort will be made to coordinate field data collection exercises to minimize the impact on stakeholders.

Third, though MAMCA, Readiness Analysis and gap analysis are presented as separate vehicles to measure and analyse needs, readiness and market opportunities, the integrated design reveals that there is indeed some overlap. This makes sense, because needs, readiness and opportunities are of course interrelated. During the operationalization of the research design, we will explore the feasibility and practicality of extending each of the three frameworks to support data collection and analysis. Such a mixed-method perspective will also serve to underpin to validity of the outcomes (Creswell, 2009; Tashakkori & Teddlie, 1998).

Fourth, two case areas per three countries makes six in total. While preparing the operationalization, it will be necessary to determine which and how data should be collected per case study. It is possible that the same method will be used per country, but it is equally possible that a different method will be necessary per case study. This must be determined in collaboration with the other consortium members during the course of the field data collection.

6. SHORT SUMMARY

Its4land delivers an innovative suite of land tenure recording tools that responds to sub-Saharan Africa's immense challenge to rapidly and cheaply map millions of unrecognized land rights in the region. ICT innovation will play a key role. Existing

approaches have failed: disputes abound, investment is impeded, and the community's poorest lose out. Its4land reinforces strategic collaboration between the EU and East Africa via a scalable and transferrable ICT solution. Established local, national, and international partnerships drive the project results beyond R&D into the commercial realm. its4land combines an innovation process with emerging geospatial technologies, including smart sketchmaps, UAVs, automated feature extraction, and geocloud services.

This paper provided the research design of the user-oriented part of the 'its4land'-project. It aims to capture stakeholders' needs, readiness, and the market opportunities regarding the application of the four geospatial innovative technologies by making use of the Actor Network Theory, Multi-Actor Multi-Criteria Analysis and Change Theory. An integrated design is also proposed to facilitate a coordinated approach to the complicated data collection and analysis requirements.

This paper tried to elaborate the research design, which will be implemented during the next stage. Based on the implementation findings, evaluations and related adjustments will take place at a later phase of the research.

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