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FLEXIBLE LAND INFORMATION SYSTEM AS DRIVER FOR CHANGE, PEACE AND DEVELOPMENT: THE CASE OF POST CONFLICT DRC

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Abstract

In post-conflict situation such as Eastern DRC, where large numbers of internally displaced people and refugees are waiting to return to their places of origin ridden with disputes over scarcely available land, the testing of innovative systems for land administration ought to be championed. The current post-conflict situation increasingly recognizes land as a key driver and sustaining factor of conflict with the majority of the population facing evictions, tenure insecurity, and loss of life in the eastern region. Hence, access to land and related services especially for the poor, women and vulnerable are not guaranteed. As a result, flexible land information system may address such issues by catalyzing innovation in the land administration in order to addresses institutional gaps, promote tenure security and delivery of land services in a sustainable manner. Also, the process of building LIS (Land Information System) in DRC demonstrates real potential of mitigating conflicts through improved land governance, land use planning and transparency, thus creating a conducive environment to improve service delivery, accountability and foster investments in land and natural resources.

Key Words: Land information, fit for purpose, land policy, post conflict, land reform



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List of Acronyms and Abbreviations

CLUP	Community Participatory Land Use Planning
DRC	Democratic Republic of Congo
GPS	Global Position System
FFP LA	Fit For Purpose Land Administration
FLOSS	Free and Open Source Software for Land Administration
ICT	Information Communication Technology
LADM	Land Administration Domain Model
LIS	Land Information System
ODK	Open Data Collection Kit
STDM	Social Tenure Domain Model
UCBC	Université Chrétienne Bilingue du Congo



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1. Introduction

In post-conflict situations such as in the Eastern Democratic Republic of Congo, many internally displaced people and refugees are waiting return to their places of origin ridden with disputes over scarcely available land. At present, the government and other organizations are implementing sectoral projects aimed at improving peace and stability and unlocking the potential of land for social economic development particularly in the eastern region of Democratic Republic of Congo (Huggins, 2010; Mathys & Vlassenroot, 2016). This will ultimately contribute to fair access to land, public participation in land administration and improvement of land use planning processes. Currently, land administration service delivery is constrained by lack of information to the public and poor relationship between traditional and formal systems resulting to lack of transparency and complex procedures for land registrations.

An appropriate land information system that can support integration and resettlement efforts using participatory and inclusive methodologies that foster peace building in the process is urgently required. As such, fit-for-Purpose land administration (FFP LA) should be embraced in the development of a national strategy for holistic land tenure assessment and identification of low-cost solutions to support inclusive and sustainable land administration for the country (Cadaster/GLTN 2016). The overall aim of flexible land information system is to provide a unified framework for recording a broad range of data in a consultative manner in support of an integrated land use planning and land management system (Houser et.al, 2005; Kumar et.al, 2006; Hallett et.al 2017).

Thus, issues relating to planning, service provision and conflict resolutions can be identified with the community for inclusion in the land information system design (Houser et.al, 2005). The more stakeholders are consulted during the process, the better the design as it may actually be designed in such a way that it integrates the data requirements from various sources and users and ensure interoperability (Miskowiak, 2004; Verplanke, 2016). Design of such system also needs to be built on ‘collect once, use by many’ concept (Kraak & Ormeling, 2013).

More importantly, the participatory and inclusive elements from a wide array of actors promotes cohesiveness and facilitate faster decision-making mechanism which are critical at influencing policy and other development pillars (Verplanke, 2016). Thus, land governances’ structures can be operationalized through fit-for-purpose principles while driven by the local demands and actions of the people in improving land administration processes (Huggies and Flosina, 2016). However, these efforts have barely been successful especially in developing countries due to a multitude of factors such as lack of transparency,



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political instability, ethnic conflicts and weak institutions framework. This paper will demonstrate that building participatory and flexible land information system catalyzes innovation in land administration towards addressing institutional gaps, fostering collaboration, and improving service delivery in a transparent and sustainable manner. Hence the rights of women, poor and vulnerable groups can be recorded and protected using low cost technologies through informed and consultative process.

The need for Good land administration

Access to land mechanism need to provide just and equitable processes for ownership, transfer, valuation, land use among others (LGAF, 2012, FAO 2012). Long term investment in land is more likely where access to land is guaranteed which in turn leads to economic growth. The Sustainable Development Goals (SDGs) aims to end poverty and zero hunger and malnutrition by 2030 for majority of population especially children and the more vulnerable by having access to food. According to UN Economic Commission for Africa, the foundation for food security is depended on proper governance of land tenure (UNECA, 2004). Essentially, agriculture dependent societies in developing countries are at risk of starvation and burgeoning poverty levels if the unequal access to land is not effectively addressed (Al et al, 2011). Accordingly, the cost of food is rising and the demand to feed the rising population especially in urban areas is threatened by changing climatic conditions, drought and poor markets thus threatening the ability of many poor communities in meeting their basic needs. In order to mitigate these challenges, a review of the institutions, legal and technical framework for land administration is needed to respond to good land governance, land use planning and service delivery (Cadaster/GLTN 2016).

Additionally, land and its resources hold strong linkages to the social and cultural aspects of people and this affects the way they relate to it. (OECD, 2005). The current wave of large-scale land-based investment, especially in sub-Sahara Africa is threatening access to land for the poor and ultimately food security. The key beneficiaries of these projects are politicians and the elite because of the weak negotiation framework which deprives the local communities' rights to land through evictions and unfair compensation. Moreover, use of productive land for bio fuel and other non-food products is straining food sufficiency and endangering the community's potential to secure their livelihood. Effective land administration systems are needed to counter these weaknesses in the land sector through participatory and inclusive decision making supported by laws and institutional processes that promote secure land tenure in an equitable manner (Huggins, 2010; Leeuwen & van der Haar, 2014; UNECA, 2014).



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Drivers of innovation in land sector

The Sustainable Development Goals and the New Urban Agenda have, through their narrative and common goals brought unprecedented potential for innovation and transformative change for economic prosperity and growth. Some of those goals may just require effectiveness on collaboration to strengthen positive impacts and commitment. Land administration cannot reform the land sector alone and therefore support is necessary in the achievement of the goals as mentioned in SDG target 1.4 and in the Indicator 1.4.2 and 5.a.1 that seek to promote legally recognized documentation of land tenure and as well as advocating for other forms of perceived tenure such as the Continuum of Land Rights approach and gender disaggregated data on tenure security. The New Urban Agenda advocates in a similar way on the need for inclusive land tenure recordation as well as state providing security and safeguard measures for their protection. Essentially, there is need for recognition of all forms of tenure beyond the legally recognized to perceive approaches for inclusive development and growth. The conventional systems for land administration cannot delivery on this mandate

Equally, disruptive technological innovations are accelerating the potential to transform and scale solutions in land sector in an affordable way (Huggins and Frosina, 2017; Apostolopoulos et.al, 2018). Open Standards, Big data in geoinformation and FLOSS are accelerating implementation of operable and affordable solutions, hence, becoming popular in land administration. Their applications are providing a range of opportunities for inclusive tenure recordation in a multisectoral approach such as low cost, multipurpose cadaster (Ting, 2001, Steudler et.al 2010; Kussul et.al, 2015). Furthermore, data analytics and machine learning technologies are gaining ground in areas such as automated feature detection and data mining to support quick establishment of scalable land information system solutions (Houser et.al, 2005).

In short, integrated approaches to land administration is therefore needed to support better land use planning, environmental and land conflict management especially in post conflict countries (Augustinus, & Barry 2006). The conventional approaches to land administration are said to take decades to respond to a country's demand. They are expensive and slow. Hence, the application of ICT is essential in addressing the gap while providing a range of services in a holistic manner (Williamson et.al, 2010). The global standards such as Land Administration Domain Model (LADM, ISO, 19152) provides conceptual guidelines for adopting innovative systems at country (Lemmen, 2012). LADM emphasis standards and collaboration for homogenous data generation and sharing across many departments such taxation, land use, valuation, cadastre both at national and sub national level.



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At the local level, Fit-for-Purpose principles and the Social Tenure Domain Model (STDM) are more flexible, and context based, hence, championed for building bottom up systems in specific contexts. In the recent past, their application has become popular with the availability of high resolutions Imagery and Orthophotos supporting quick establishment of low-cost cadaster to cover the land recordation gap (FIG 2010). The information can be updated using simple handheld GPS devices and smartphones. The processes embrace participation of land owners and neighbors during the demarcation of parcels. The information can therefore be validated by all before recording in a land information system. Cadaster built in similar fashion have the potential to address land recording gap, such as customary land with huge potential of transforming land governance because they are accurate, verifiable and reliable (Lee & Kang 2015).

Moreover, Satellite data is being recorded frequently and the cost of such data are becoming extremely cheap. The potential applications in land use is enormous especially in evaluating changes in land cover, migration patterns, crop health, water quality and predicting weather (Houser et.al, 2005; Kumar et.al, 2006). LIS can record and store many datasets on these topics as layers in a single database. Thus, various land use data and land tenure typologies can be collected and validated at the local level and recorded with the existing framework of land information system.

The Context of Democratic Republic of Congo (DRC)

Located in Central Africa, the Democratic Republic of Congo (DRC) is the second largest country in Africa with a total area of 2,345,409 km². Since the 1990s, the Democratic Republic of Congo (DRC) and particularly the eastern provinces North Kivu, South Kivu and Ituri have been shattered by one of the deadliest conflicts in the world. In this post-conflict situation in Eastern DRC, where large numbers of internally displaced people and refugees are waiting return to their places of origin, disputes over scarcely available land has the potential to generate new outbreak of large-scale conflicts.

At the end of 2018, over 700, 000 people were recorded to have fled from DRC due to escalating conflicts¹ while half a million others are internally displaced (UNHCR, 2018). In 2017, USAID² estimated that about 7.7 Million people faced acute food shortage of which 4.6 million were children. Continuous political instability and decade long conflicts have affected many sectors as well as country development. The majority of these conflicts are linked to land resources due to isolated and sectoral management practices.

¹

<https://reliefweb.int/sites/reliefweb.int/files/resources/2018%20DRC%20Regional%20Refugee%20Response%20PIan%20-%20Jan-Dec%202018%20%28March%202018%29.pdf>

² USAID's Office of Food for Peace (USAID/FFP)



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As a result, many groups seeking to secure and protect their resources have resulted to conflicts and consequently fighting causing loss of life and many displaced people especially in the eastern region (UNHCR, 2015). Amidst these conflicts, access to land and related services especially for the poor and vulnerable groups remain a big challenge (Leeuwen & van der Haar, 2014). The situation is worsened by lack of a functional land administration to support and guarantee the rights to land for the communities.

Surprisingly, the Democratic Republic of Congo (DRC) is the leading target country in the current global rush of land-based investment according to land transactional deals in the Land Matrix³ (Land Matrix, 2019). The investment continues against the escalating food prices due to poor markets and challenges in accessibility. This could be attributed to the weak system of land governance in the conversion of productive land to nonagricultural uses, destruction of natural resources and climate change. Unfortunately, majority of these investment especially those linked to biofuels are negatively impacting land rights and food security concerns (Von Braun & Meinzen-Dick, 2009; Huggins, 2010; Havnevik et al., 2011; Reisinger, 2012).

Status of land administration

The dominant challenge that remains to date is lack of innovation in land administration. The institutions have therefore remained ineffective and weak lacking capacity to delivery due to lack of skilled human resources, infrastructure and technology use. Therefore, land tenure and property rights have deteriorated with the absence of strong frameworks of laws and a land policy to guide peace and reconciliation efforts.

A small survey conducted with land administrators in three territories within three provinces (North Kivu, South Kivu and Ituri provinces) shows that the biggest challenge is lack of capacity. According to the survey, about 90% of land administration staff are casual employees with about less than 5% of government staff on salary. The casual employee survives by asking for exorbitant fees to deliver services to clients. Hence, the cost of land administration service is very high such that to register a piece of land could cost one about 500 USD. Additionally, only about 1% have the necessary technical skills such as the use laptops and GPS devices. Normally, its common application to use tape measures and traditional landmarks to identify parcel limits. According to the Chief land Administrator in Rutshuru territory, the current cadastral coverage for the urban area in North Kivu province is less than 3%. However, in this province alone, there are a total of 9 autonomous land administration units each managing its own land administration area (land unit).

³ <https://landmatrix.org/en/get-the-detail/by-target-country/democratic-republic-of-the-congo/>



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Table 1: Performance of Land Administration per month in two provinces: Source, Author

Land Administration office per Territory (Territory- Equivalent of district)	Total staffs	Number of governments Surveyors	Total staff with Computer skills	Cadastral Survey per Week	Urban area coverage
RUTSHURU North Kivu province	105	5	10	5	2%
KELEHE South Kivu province	104	6	0	1	-
DJUGU Ituri Province	52	6	7	5	-

Land administration answers directly to secretary general of survey at national level. There is no intermediate level at the province with the provincial land minister acting on behalf of the national land minister in land governance and political issues. Land records are stored at the local level within land the administration unit. Where a land certificate is issued, a duplicated copy is deposited at the general secretary’s office. Unfortunately, land administration does not have proper infrastructure and yet they are entrusted with very sensitive information on property rights and records. Additionally, filling system is manual and unsecure with no cabinets and lockers for safety. The situation is even worse at the customary system.

2. Land conflicts and land tenure challenges

Lands conflict in Congo started in the way past. In 1885, King Leopold of Belgium declared all “vacant land” in DR Congo as the property of the Congo Free State without considering the complex ways Congolese used and conceptualized land at that time. In doing so, Kind Leopold catalyzed two systems of land management in DR Congo: one system administered by the colonial authorities and the other established through the practices of local people, usually mediated through customary chiefs. Additionally, between 1928 and 1956, the Belgians forcefully relocated Rwandans to North Kivu in order to provide labor for European-owned projects. These two colonial land interventions set the foundation for land conflict in modern DR Congo. During the recent DRC’s wars (96-97 and 98-2003) land conflict and weak land laws continue to be an important source of insecurity, antagonisms, and an impediment for economic development in the eastern DRC.



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Unfortunately, the current land law fails to recognize the customary system that manages over 70% of land. Traditionally, chiefs are the custodian of the land on behalf of the community but without official recognition of their role, their functions are not accountable in land administration processes. Therefore, the weakness of the customary system escalates land conflicts due to lack of documentations, and transactional records referencing allocation, transfer and lease. Additionally, the competing interest from foreign investment has transformed the traditional view of land to a transactional nature escalating overlapping claims, multiple ownership, evictions, threats and conflicting land use patterns. Land transactions are made through the authority of the chiefs without any form of documentation in some cases. This has complicated the dispute resolution process with the poor losing their land in the process.

Land administration has not been able to put in place all the instruments required to give a consequent mastery of the land situation over the entire national territory. This has resulted to arduous and lengthy procedures for granting securities, as well as the diversification of informal costs; (ii) the proliferation of anarchic settlements that do not rely on any planning instrument; (iii) the multiplicity and persistence of land conflicts, leading to insecurity over land rights, which in many situations are not legally verifiable, uncertain, and therefore potentially explosive. This bleak picture of land administration requires answers suited to the diagnosis of the national land policy.

The need for flexible land information systems

Eastern DR Congo is comprised of three key provinces of North Kivu, South Kivu and Ituri. These provinces are the most affected by such conflicts due to their huge resource potential and historical context of large concessions for instance in North Kivu that cover over 80% of rural land in Rutshuru territory. Hence, there is animosity among the ethnic communities who are seeking protection from armed groups or land grabbers in resource potential areas by the elites that use violence as means for expansion. (Mathys & Vlassenroot, 2016). The political influence in the land administration has worsened service delivery with unscrupulous dealing in land, corruption and illegal documentation on land . As a result, the transaction value of land in the three provinces is very high which prohibits access by the vulnerable and poor.

There are also socio-cultural constraints in the administration of land and securing of land rights. DRC is still recording, in cultural terms, customary practices organizing access to land from various local traditions. In such a multicultural environment, marked by the plurality of customary tenure systems, Land Administration is constantly challenged whenever land deals are considered in rural and peri-urban areas. Indeed, as already mentioned above, certain practices enshrined in local traditions remain incompatible with the rules and procedures of the Land Administration, sometimes creating, at the local level, situations



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of tension and recurrent shocks between the customary and the land administration. The land policy should take as one of its priorities the need to ensure the integration of procedures from traditional systems, to minimize the gap between the provisions of the law and the socio-cultural realities of the systems (Long, 2011).

The dominant land governance challenge

As the region is rich with resources, it attracts huge investment from individual to big companies. Artisanal mining is also thriving in the absence of strict regulation through the exploitation and sharing of resources. The mode of doing business is largely informal with contracts being done at the local level with chiefs and other sectoral bodies. The lack of due diligence in the analysis of the interdependence of land use and local communities in the exploitation of local resources deprives them the rights to decision making on land use.

Also, many cases of fraudulent contracts and corruption are a major issue, which leads to wastage of resources and government revenue. Amidst, these issues, public servants are precariously engaged in unfair practices in a bid to survive because of the low pay thus escalating the culture of corruption and kickbacks in the projects. The most affected are the local communities that are at risk of evictions and displacement being turned to casual labours on their land as a result (Long, 2011).

Indeed, the plight of land administration in the DRC can be summed up in the desire to create conducive conditions for land governance which implies rules of law is articulated to the economic imperatives, adapted to the social contexts, more particularly recognition of continuum of land rights in the traditional practices and administrative processes or implementation of the systems that guarantees access, use and security of tenure. Thus, the structures to be implemented should embrace transparency, participation and accountability; equitable management of competing land interests and the conflicts raised from preservation of ecological balances.

Unsustainable sectoral reforms

In a bid to address the institutional gaps and absence of effective legal frameworks, several sectoral reforms have been enacted to improve resource governance and land use management practices especially in the forest and agricultural sector. These reforms are mostly operational at provincial level around sustainable forest use management, protection of conservation areas as well as good agricultural practices for food security measures. For instance, the recent community forestry legislation and the 2014 law on nature conservation, is a positive change in language, recognizing that community land rights exist, and the role communities could play in nature conservation. Their adoption has mainly depended on the political



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support, presence of strong actors and effective resource mobilization by global community. In other context, these efforts have failed because of conflicts and vested interests by powerful individuals in protecting their economic benefits. Unfortunately, the land sector has not been involved or consulted and remains isolated in the ongoing reforms. It is therefore difficult to provide a systematic recordation of land rights and land use without a proper system for land recordation and protection of the existing rights.

In view of this situation, a new programmatic framework for development 2019-2050 called the "National Strategic Development Program" (PNSD) was established. It has the vision of boosting economic and social development of the country by building solid foundations to accelerate economic growth and stabilizing the land sector. With its 135 million hectares of arable land, representing about 34% of the country's total land area and its extensive river systems (the largest in Africa), the DRC alone could have an important part to play in responding to global land issues as outlined above. But the absence of an up-to-date national land policy and the anachronism of the current land tenure system stemming from the law of 20 July 1973 have not allowed the country to use its important land capital (Long, 2011).

The role of fit for purpose land administration

Despite all these bottlenecks, new innovations and concepts that have potential to transform institutions and technical processes for land administration are being tested to provide experiences and potential for change. Concepts such as fit-for-purpose land administration (Cadaster/GLTN 2016), the Social Tenure Domain Model (FIG/GLTN 2014) and responsible land administration practices (Zevenbergen et.al, 2015) have championed new visions for land administration system that are participatory, inclusive and affordable. Thus, through their application, local impacts on land use, participatory land demarcation and conflict resolutions can be embedded in the system to support transparent land administration and management approaches. Thanks to the interoperability of data and data formats that is enabling integration of spatial and non-spatial information.

The Flexible land administration system in this context was unveiled by UN Habitat country office in close collaboration with the Government of the Democratic Republic of Congo through a program called the "Community Participatory Land Use Planning Programme" (CLUP). The Programme has brought together national and provincial authorities, civil society organizations, women, youth groups, community and customary leaders together into one vision of integrated land use planning at community scale to mitigate the risk of land disputes while unlocking the potential for increased socioeconomic development in the three provinces of North Kivu, South Kivu and Ituri. The program was funded by DFID. CLUP aims at bringing relevance of access to land and land use planning in conflict mitigation and stabilization work.



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The project covered three provinces with several villages in each province being chosen as pilot sites. They included; Rutshuru territory in North Kivu, Kalehe in South Kivu and Pimbo in Ituri. The flexible land information system was proposed to be installed and tested within the land administration offices to provide a model for future land systems in support of sustainable process for land reform and as practical evidence for the direction of the land policy. Additionally, the pilot experiences will provide a benchmark for the discussion on land reform towards addressing the gaps in the land recordation especially towards a broader framework that recognizes the continuum of land rights approach and also the rights of women and youth that are currently affected especially in traditional systems.

Additionally, the fit-for-purpose approach will eventually provide a strategy for the national application of low-cost flexible land information system in response to a sustainable land administration for the DR Congo. This will be done through replication of the experiences and capacity development based on the proposed strategy. The vision of fit-for-purpose is to provide a gradual process towards reforming institutions in applying low cost and practical solutions that has an impact on the improvement of land tenure governance and transparency. The flexible system as advocated for by Fit-for-Purpose Land Administration is guided by several principles (UN Habitat/ GLTN 2016; UN Habitat/ GLTN 2018):

- A flexible framework designed along administrative rather than judicial lines
- A continuum of tenure rather than just individual ownership
- Flexible recordation rather than only on register
- Ensuring gender equity for land and property rights
- Good land governance rather than bureaucratic barriers
- Integrated institutional framework rather than sectorial silos
- Flexible Information and Communication Technology (ICT) approach rather than high-end technology solutions
- Transparent land information with easy and affordable access for all



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3. Flexible land information system design

Understanding the business process

The best practices for building a spatial data framework for land administration entails a comprehensive system that serves the complete organization needs from data generation through to analysis, storage and dissemination of products and services (Dale & Mclaughlin, 1988; FIG, 1995, Williamson et.al, 2010). Therefore, in the development of the flexible system, the motivation was to conceptualize and embed the system into the bigger business process within land administration organization. The vision of this approach was that it would support land administration with technology to manage land records efficiently and thus contributing to better service delivery that will eventually improve on its functions and possibly tax collection. Also, it would improve transparency and land governance thus positively transforming tenure security for communities in both formal and informal land sector.

Accordingly, land information systems ought to be very clear in the processes with regard to functions and service delivery to both public and private sector participation (Tuladhar, 2002). The foundation of such system is usually cadastre which is a record of interest in land. Therefore, the cadastral data should be verifiable and complete to ascertain proper recordation of land tenure. In doing so, laws and regulations governing such process must be followed to guide implementation of flexible system in recording cadastre, social economic and land use data.

Therefore, it was rather important to consider all approaches currently applicable in the context of the formal and customary land registration while developing the flexible land information system. Customary system allocates land with some documentation which varies from one region to another. Likewise, the documentation in the formal system is complex and unsystematic for all the regions. Unfortunately, there are no clear standards to explain the documentation process which have evolved over time. Therefore, the project considered case by case borrowing from other context such as fit-for-purpose land administration in Nepal (UN Habitat/ GLTN 2018) and application of STDM in Kenya and Zambia to support establishment of land information for land tenure governance (GLTN 2017)

Mobilization process

The flexible land information system was conceived as part of large Community Participatory Land Use Planning (CLUP) that had several components of intervention ranging from transparency in land administration, good land governance and role of women and youth in land. These interventions were done through consultation meetings and workshops with pertinent stakeholders in land and the community. Community persons were also exposed to several trainings to create awareness around their role in land



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governance and gender issues which had an impact on their participation in the CLUP. The process was also keen to identify champions at the community level. The activities were led by UN Habitat team and Global Land Tools Network partner in DRC- Université Chrétienne Bilingue du Congo.

Requirement and analysis

An assessment study on the current processes for land administration process was conducted by GLTN, UCBC and UN Habitat to provide design requirements for the proposed land administration system. Also, the community and local chiefs as well as other stakeholders were consulted on the issues relating to the current processes to understand the key concerns and expectations. The study found that there are no guidelines for surveying and basically the practice relies on tape measurements in the field. That means, the existing spatial data was not coherent for integration with the digital processes that required basic consideration such as spatial reference systems, coordinate system and geodetic controls. Other critical gaps were duplication of roles, low human resource capacity and lack of infrastructure.

To raise awareness with land administrators, several trainings were done on the existing technologies. These included providing them with possible use cases, design options and implications of each. What was clear in the discussion was the need to provide complete transparency between formal and customary land administration processes. Currently, there is no interface between the two systems which serves as a major source of conflict between the two in land administration processes. Therefore, the proposed design needed to provide clear transition from the customary to the formal without creating conflicts or data duplication.



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Designing of the system

The choice of design focused on digitizing the entire land administration processes that should reflect a standard workflow system to serve a range of user's requirements within and outside the organization. The motivation was to provide a robust system that is able to serve several departments such as taxation, valuation, land use and urban planning. Elsewhere, such systems are built on more advanced multi cadaster platform (Cadastre, 2014) and technologically advanced land information system (Houser et.al, 2005). In this context, the design needed to inform the long-term needs of the organization and service delivery to serve both the public and private sector. A three-tier system was therefore proposed that considered administration, cadastral workflows, human resource and archiving practices.

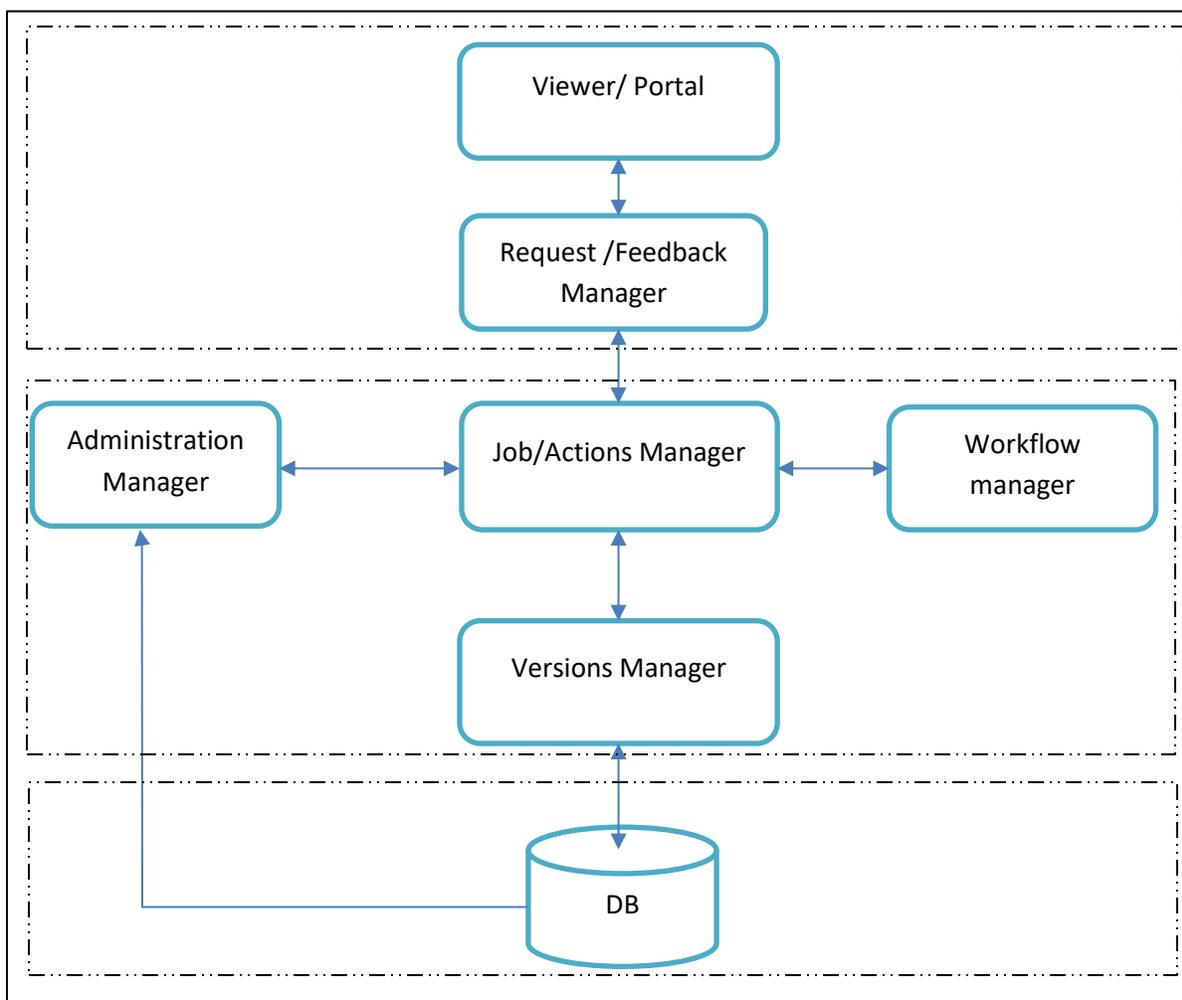


Figure 1: Three tier Structure for the Land administration business process design, Author



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The user requirements were analyzed for every department in land administration and modelled using the Unified Modelling Language (Dhindsa, & Aggarwal, 2011). The new design proposed and recommended a complete structure that included auxiliary department such as Information Technology support which are required in robust technological processes. This implied additional staff to manage issues such as network infrastructure, servers and backup systems translating to additional space and budget. However, the design considered these in the long term as part of the continuous process improvement.

Strategy for the technology adoption

Lack of infrastructure in land administration was a challenge for the implementation of the new system. Therefore, the design of the new department could not be implemented in the three provinces especially South Kivu and Ituri. These territories have no physical infrastructure for land administration. The services are rendered in rented building which barely accommodate the staffs. Luckily, Rutshuru has a new land administration office building that was built in 2018. The existing office spaces are not enough for the staff despite being relatively small to accommodate the busy office work. Setting LIS in that environment meant taking off some staffs to install equipment but this could not happen without proper organization review.

Additionally, the current land law of 1973 is also silent on the adoption of technology within the land sector. Therefore, there was need to further strategize on the visions for land administration in the future by designing a proper business process but also a scaled down approach for incremental improvement towards the set visions. Likewise, priority departments were identified that could be the starting point in the digitization process. Cadastral department and documentation office were given precedence since spatial data quality was priority. The advantage of this was in the improvement of the surveying methods from tape and rope to handheld GPS and smartphones.

Land survey data collection

Data collection was supported by the local community in conjunction with land administration. Initially, a training on the use of GPS and smartphone was conducted to capacitate them on their applications in land survey. Land administrators used GPS devices to collect spatial data for the plots and farmland while community members used Open Data Collection Kit (ODK) application for smartphones to collect social economic survey at household level. The two groups worked together for each parcel of land in the presence of land owners and the local chief accompanying them. The Chief supported the team in settling of disputes among neighbors especially regarding boundaries.



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The land survey data was overlaid on Satellite Imagery and Google maps for validation in the evening and at the end of the week. To address the issues of access and boundary protection, the communities were sensitized on the need for the protection of temporary marking using plants, poles and rebars on the plots. These were marked conspicuously on every plot surveyed in presence of land owners. Introduction of boundary marking necessitated proper planning of access routes and roads. This was also negotiated with communities for those affected to grant small portion of their land for demarcation of access and easements. Over 500 parcels were demarcated with very few cases of conflicts that were eventually resolved.

Land use data was collected using Google Maps and digitization from Satellite Imagery. The data was to inform on the planning gaps in the settlement especially where communities had settled illegally. Several land use types such agricultural, protection zones, water bodies and concessions were digitized and verified using 50cm resolution. This was done by digitizing with selected community representative demonstrating the extent of the land use on the map. Land administration officers supported the exercise by providing existing maps and supporting data as previously recorded during the colonial and post-colonial period.

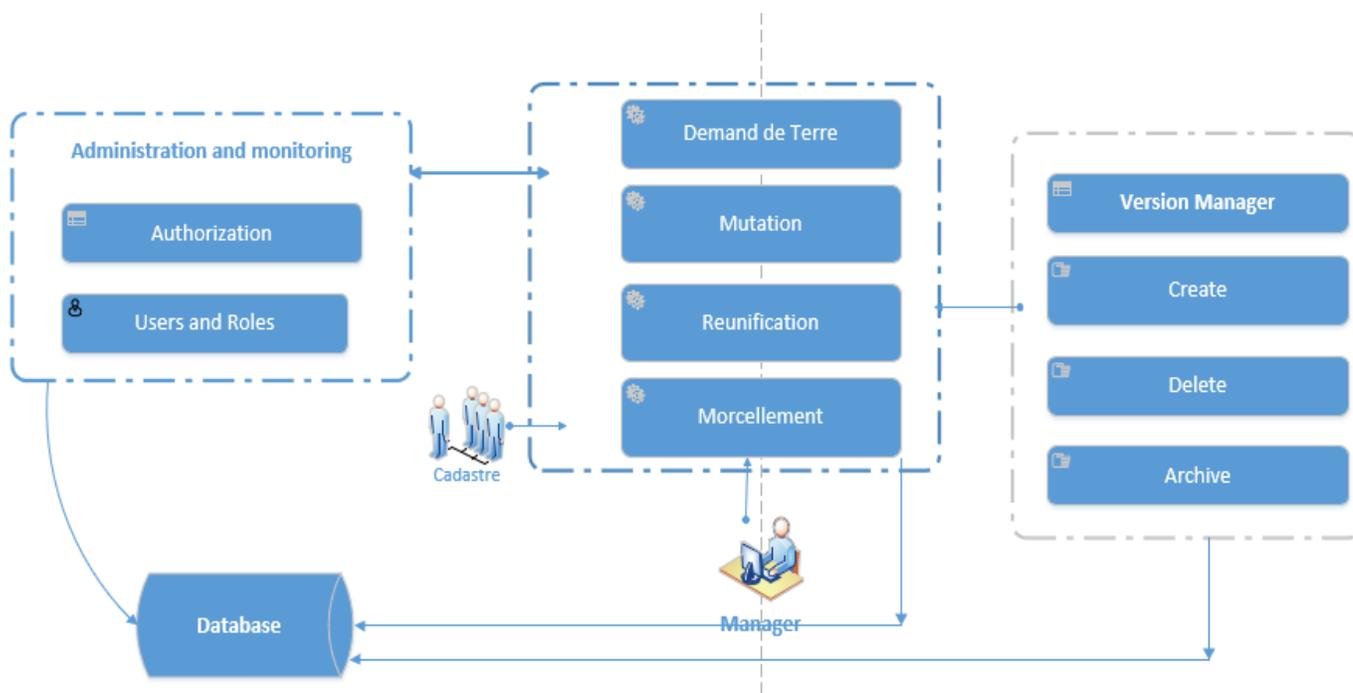


Figure 2: Workflow design for the cadastral office



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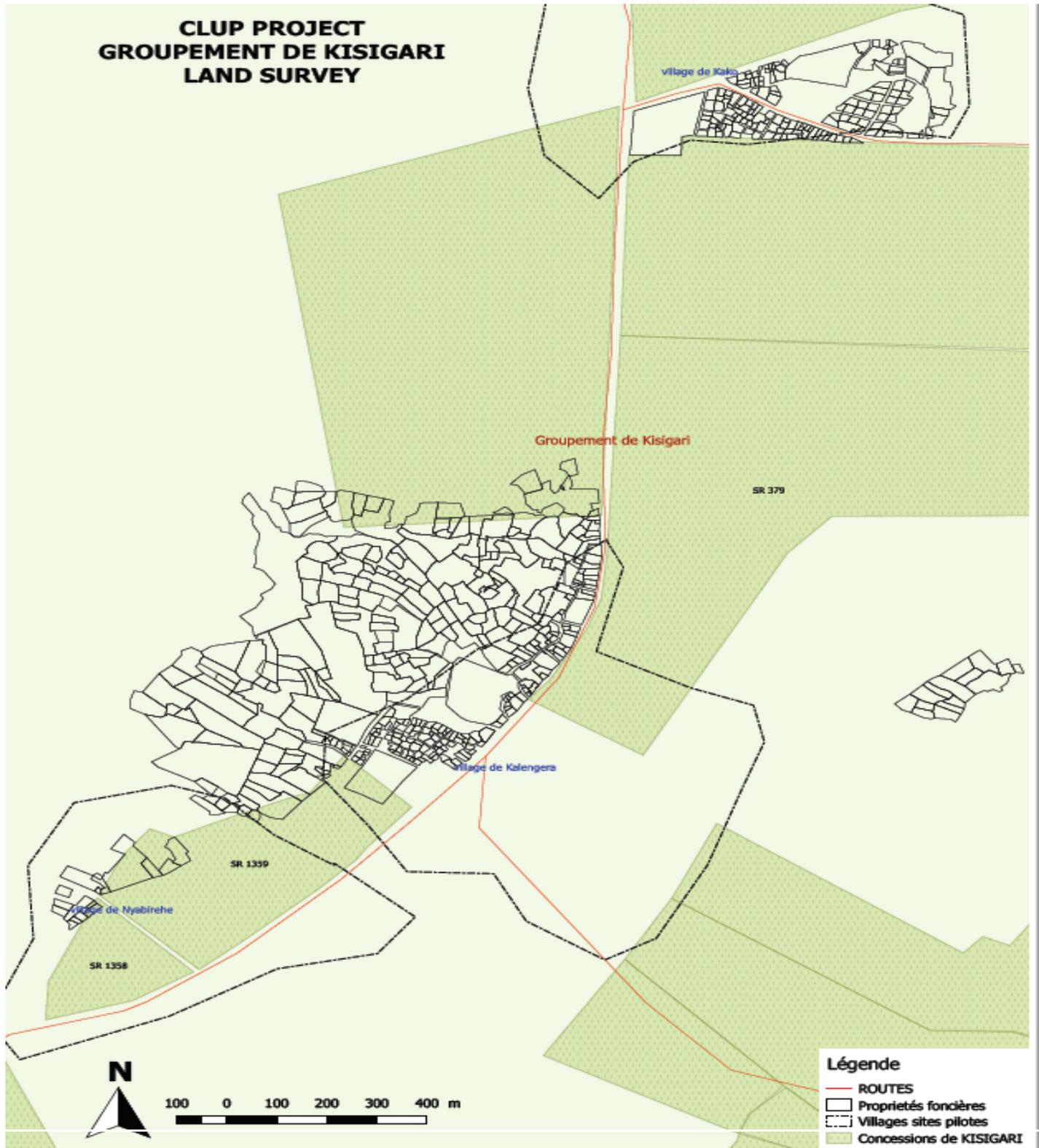


Figure 3: Land Survey map produced for the LIS system in Rutshuru, North Kivu



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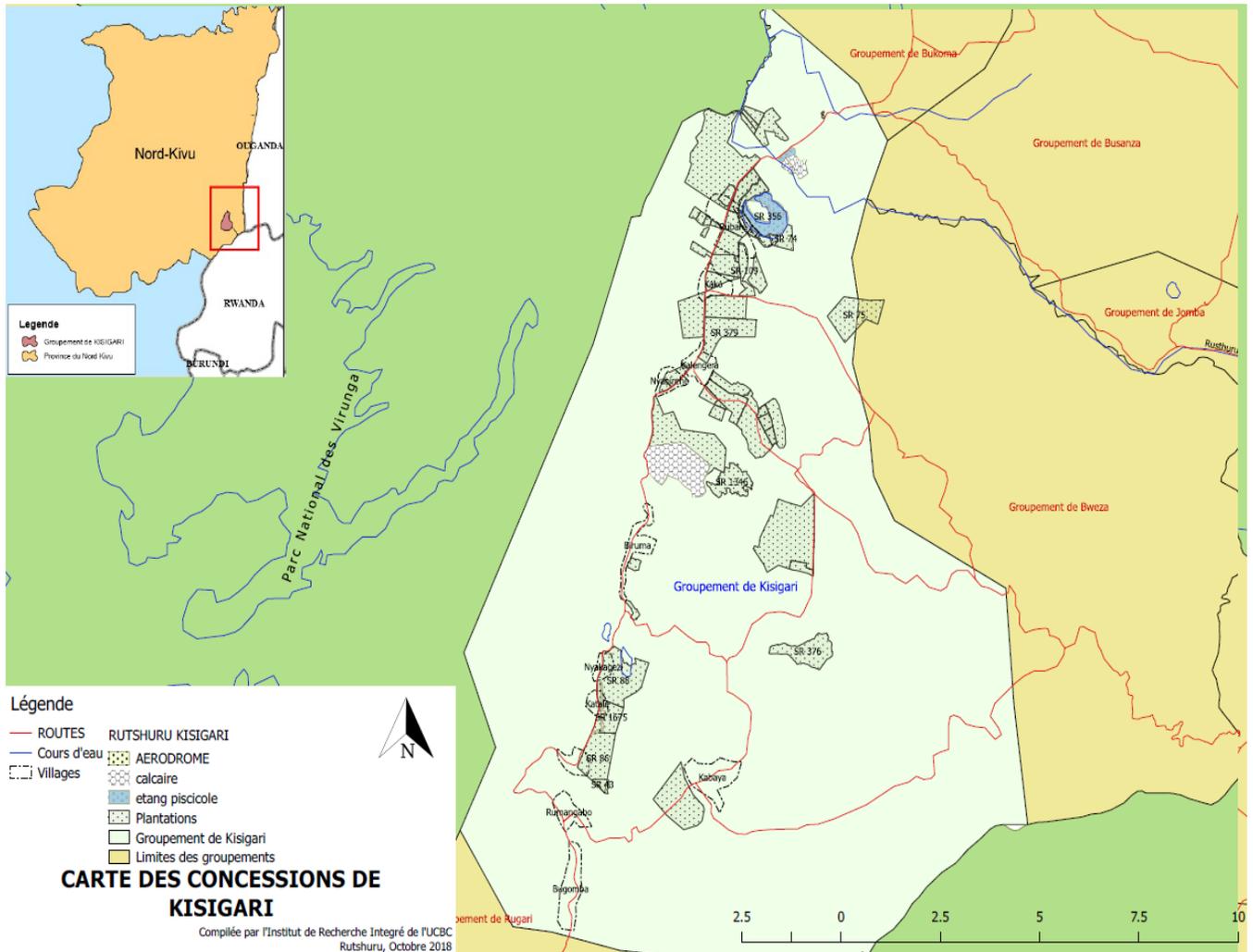


Figure 4: Land use map from land information system in Rutshuru

STDM customization and LIS testing

GLTN partner in DRC-UCBC were conversant with the STDM development environment and therefore championed the process of customization and translation of the STDM tool to reflect the needs of the land administration. The team adapted the database model for recording spatial and non-spatial data based on the conceptual model of STDM. This included identification of key data component for STDM including the social tenure relationships, parties and spatial unit in consultation with the land administration. The customized model was tested with the collected data. Land administration staff were given on site applied skills on the use of the customized LIS.



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Initial impacts of the process

Improved data collection and storage: The use of handheld GPS coupled with Satellite Imagery was greatly appreciated by the provincial and territorial land administration. For the first time the surveyors could provide a map with coordinates system and complete parcel boundary for an entire village. This was a remarkable progress from the manual production of sketch plans. A digital copy and hardcopy of the data for each parcel was also available. This also meant that storage was efficient and easy thus enabling fast retrieval and updating when necessary.

Improved capacity of the land administration: The exposure to the technology and its application in the field provided a platform for the surveyors to gain better skills and train their fellow land administrators on their application. Initially, only a few were trained, but the skills transfer among the colleagues has really improved. The surveyors can now carry out field survey work with GPS and process the data in the computers without any external help. They can also use computers without assistance for their activities in the office including producing digital maps, plans and reports.

Improved collaboration between land office and customary chiefs: During this field work exercise, the chief and the land administrators worked together in what was a difficult relationship in the past. The chiefs facilitated gathering of the community for sensitization meetings. The relationship has continued to grow with the chief supporting in dispute resolutions. This is a positive development towards land tenure security and land governance where customary and government systems for land administration are collaborating to better address the land administration challenge.

Improve transparency and reduced conflicts: Before the application of these technologies, the surveyors have always been treated negatively by communities as they were considered to cause land conflicts. Through these interventions, land administration got the opportunity to address the community and demonstrate the procedure for land demarcation to the land owners with great appreciation. The transparent process allowed neighbors to resolve boundary issues in the presence of the chief and the final boundary marked by the surveyor. It was agreed that the community would be responsible for those marking thus ensuring trust among the neighbors. This has contributed to reduced conflicts and an improved relationship with the land office.

Better land use planning: While the participatory process allowed for the identification of the boundaries and easements through consultation with the community and land owners. This allowed for proper demarcation of access routes in accordance to the planning regulations. Strict adherence to the minimum



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size for agricultural and commercial plots was observed with those affected being sensitized on the possible alternatives. A few cases emerged where the minimum commercial plots could not be registered and further negotiation with neighbors were to be carried out for joint registration.

Transparent process contributing to better land governance: The consultative process has facilitated good communication between the traditional and formal systems. For instance, the land administration agreed to share a copy of the cadastral map and a register of the members during the transition period to formal registration process. This will enable chiefs to identify those who have no formal documentation as well those without land for consideration in the allocation. It will also help in addressing land conflicts because the map will be used as reference in such cases. Ideally, the role of the chief will be more transparent to the authorities especially on land management issues such land use planning and taxation and development.

Challenges and recommendation

Infrastructure: Initial expectation was that the three provinces would benefit with installation of equipment, capacity development and establishment of LIS. Unfortunately, we could not setup the LIS in Ituri and South Kivu provinces because there is no existing physical land office. However, we continued to build capacity of land administration on the use of technology for data collection, testing their application and finally data collection in the selected pilot areas of Pimbo and Kalehe respectively. The project hopes that the commitment by the Provincial minister of land affairs towards finding a quick and temporary building will be concluded soon.

Security and conflicts: This was a real challenge especially in Ituri where two communities in the pilot areas clashed over land disputes resulting to loss of lives. This contributed to delay of the project delivery until the situation quelled. Finally, the team was able to demarcate the plots in the communities peacefully. We hope that the results will be produced once the land office building is available in order to host LIS and the production of hard copy maps can be done for the entire area.

Politics and vested interest: While it was imperative to demarcate the entire pilot areas in Rutshuru, the project experienced resistance from some communities which have settled illegally on concession areas. This was political, and the community demanded their rights to be recorded as land owners while the concessionaires were not consulted nor did agree to donate the piece of land. This led to confrontation whereby the survey team on the ground were given threats to either comply or stop the entire exercise in the region. With the intervention of the chief and the chief land administrator, the tensions were addressed,



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and it was agreed that the due process of negotiation must be followed between the community and the concessionaire who lived outside Congo before any demarcation could be done. This is yet to happen.

Legal and institutional issues: Currently, the land law in DR Congo recognizes only the formal and registrable interest in land. The rights that lie within the Continuum or Land Rights could not be recognized or recorded by land surveyors because they cannot be processed as they don't fit in the current law. Hence, an innovate and interim arrangement was to record the owner of the land and the rest of family members as beneficiaries on the land with full social economic data of the household attached to the parcel and the information transferred onto the LIS system. The STDM process recognizes the relationship to land for every household member and this was recorded in the social economic survey. It is the hope of the project that the current land reform debate will be informed by these experiences towards broadening the framework of land tenure recordation.

Capacity: this is a dire challenge facing land administration where the majority of the officers have no capacity to understand their role, application of tools and technology as well as exposure to the current trends. The project had to conduct initial basic introduction to computer and other concepts such as basic GIS concepts and tools. The capacity was rather central in the success of the project and the current positive impacts demonstrated the potential of addressing these gaps in improving land administration service delivery.

Way forward

The participatory process of land demarcation has set the pace for the inclusive decision-making process. The next stage of project will benefit from these experiences in advancing the participatory land use mapping and planning at the territorial level. This will lead to production of a guidelines for land use management thus informing the public and private sector alike on the opportunities for investment in the land sector. Eventually, the best practice guide on land use and functional land administration will influence good development through investment on land for livelihood and social economic development.



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Conclusion

The participatory process of building the land information system has enabled joint consultation among the land institutions and other stakeholders at different levels. The collaboration has also brought together customary chiefs, territorial and provincial authorities to a common vision of addressing the land tenure gap and ending the long-standing disputes through the assistance of the flexible LIS system. Given the context of DRC, this is a landmark achievement for the institutions to have a common vision in addressing the fragmented and uncoordinated land management processes that have ensued for decades and to provide a more effective and reliable data and service provision across other agencies of the country and also for public consumption. In the process, the traditional leaders have facilitated community meeting acting as champions and change agents. The experiences and lessons from the processes are being shared at the national level for feedback towards the ongoing efforts of the land reform. The established LIS is setup at land administration office and the copy of the data is shared with the traditional leaders to support transition from customary to formal systems, hence improving the relationship and trust but also improving the needed services for both authorities. The results of the process will also provide the necessary evidence to inform legal review and policy formulation in DRC to improve on the legal, policy and institutional framework.



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