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EVALUATION, RESEARCH AND COMMUNICATION (ERC)

Mobile Application to Secure Tenure (MAST)

Lessons Learned Report

JUNE 2016

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ACRONYMS AND ABBREVIATIONS

BRN	Big Results Now
CCRO	Certificates of Customary Rights of Occupancy
DfID	Department for International Development
DLO	District Land Office
ERC	Evaluation, Research, and Communication
GOT	Government of Tanzania
GPS	Global Positioning System
LAC	Land Adjudication Committee
MAST	Mobile Application to Secure Tenure
MOL	Ministry of Lands, Housing and Human Settlements Development
NGO	Non-Government Organization
NLUPC	National Land Use Planning Commission
NORC	NORC at the University of Chicago
PELUM	Participatory Ecological Land Use Management Tanzania
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
STARR	Strengthening Tenure and Resource Rights
STDm	Social Tenure Domain Model
TAGRODE	Tanzania Grass Roots Oriented Development
TI	Trusted Intermediary
USAID	United States Agency for International Development
USG	United States Government
VC	Village Chairman
VEO	Village Executive Officer
VLA	Village Land Act

I.0 INTRODUCTION AND BACKGROUND

I.1 BACKGROUND

The Mobile Application to Secure Tenure (MAST) pilot project (2014-2016) was originally designed to test a concept: ***can a participatory or crowdsourced approach to capturing land rights information using mobile technology be deployed and used effectively to create an inventory of land rights?*** Over the course of the pilot, the focus of efforts expanded from testing a concept to actually delivering formalized documentation of land rights in collaboration with the Government of Tanzania (GOT).

As the goals of the pilot have shifted over the past 15 months, the project has worked closely with the District Land Office in Iringa Rural District (DLO), the Iringa Rural District Government, the National Land Use Planning Commission (NLUPC) and the Ministry of Lands, Housing and Human Settlements Development (MOL) on the following:

- Developing an easy-to-use mobile application that meets the requirements for delivery of Certificates of Customary Rights of Occupancy (CCROs) to villagers; and
- Developing a participatory methodology for securing land rights, that meets the requirements of Tanzania's land laws, provides focused training on women's land rights and engages with villagers – called Trusted Intermediaries - in the land mapping and documentation process.

The pilot grew out of an idea proposed in a paper entitled “*Crowdsourcing Support of Land Administration - a new, collaborative partnership between citizens and land professionals.*”¹ This seminal paper presented an innovative approach to addressing the land tenure gap and focused on the possibility of “crowdsourcing” property information by working with local people. It challenged land professionals to re-conceive how land administration services might be managed and delivered. The paper outlined a new citizen-centered collaborative model for land administration that would be more responsive to the needs of the disadvantaged and vulnerable, increase access to land markets, reduce costs associated with formalizing land rights and, as a result, increase security.

The MAST pilot activity was designed to test the hypotheses presented in this paper and to support USAID development objectives, particularly the use of science and technology to resolve development problems. Nearing the end of its life, the pilot is also able to provide field-based insights into the following:

1. Citizens' and communities' reaction to and engagement with the approach and its impact on perception of tenure security;
2. The ability of the surveying profession / land professionals to support efforts to crowdsource land rights information in a collaborative manner with citizens;

¹ See [RICS:http://www.rics.org/site/scripts/download_info.aspx?downloadID=8083&fileID=10840](http://www.rics.org/site/scripts/download_info.aspx?downloadID=8083&fileID=10840)

3. The characteristics of a good ‘Trusted Intermediary’ (TI) to support the capture and maintenance of land rights information;
4. Identify what land rights information must be captured to meet the legal requirements of the Government of Tanzania;
5. Test a range of technology tools available and identifying the most affordable and appropriate to support the approach;
6. Establish approaches for sustaining the maintenance and security of land right information after the pilot and expanding its use; and
7. Explore how the results from the pilot can be shared and the lessons and practical applications expanded, replicated and scaled for USAID and others.

The MAST pilot provided an opportunity for USAID, in partnership with the GOT, to design, develop and deliver a new approach to securing land rights in a context where demands for land are rising, conflict over land is wide-spread, and social norms limit the ability of women to exercise their legal rights to land.

1.2 PROJECT CONTEXT

USAID selected Tanzania as the test site for the MAST pilot. The objectives of the pilot align with the needs of the Government of Tanzania to demarcate and secure rural land rights, to identify methods to help improve the delivery of land administration services to citizens, and to stimulate economic development, particularly by promoting large-scale investment in agriculture.

During the past decade, Tanzania has experienced high rates of economic growth, due in large part to sound economic reforms. As part of its development agenda, Tanzania has encouraged large scale investments in agriculture, both domestic and foreign, recognizing the role that investment in key sectors of the economy can play in fostering domestic growth.

In 2009, a strategy called ‘*Kilimo Kwanza*’, meaning ‘Agriculture First’ or “Priority to Agriculture” was designed to attract investment in agriculture and underscored the critical importance of the private sector participating actively in agricultural production (Tenga, W. and Kironde, L. 2012). The Southern Agricultural Growth Corridor of Tanzania (SAGCOT) was launched in 2010 to operationalize Kilimo Kwanza. Subsequently, in 2013, the GOT’s Big Results Now (BRN) initiative, which aims to support the improvement of commercial agriculture in partnership with the private sector and smallholder farmers, was also launched. BRN aligns with the Government’s Vision 2025 goals of increasing food security and reducing poverty across the country.

However, investments in the agriculture sector have been hampered by weaknesses in the land administration system. Given that the vast majority of claims to property are undocumented, the GOT and investors do not always have a clear understanding of which lands are available for commercial development. Smallholders who lack documented land rights may be more vulnerable to lose land or lose of access to critical resources. For women, social norms often prevent them from fully exercising rights to land they hold under the law. These constraints may limit investments needed to improve agricultural productivity.

Previous land registration projects introduced various methodologies and provided practical field experience for the formalization of property rights under the existing legal framework. These previous interventions often required large upfront investments (i.e. GPS equipment, GIS software and computer investments) and required sustained technical assistance and/or material resources, which were not always available. The results and impact, therefore, have been limited.

MAST was designed to capture land rights information in a manner that is consistent with the requirements of the Village Land Act of 1999, but that can be implemented in a more efficient and cost-effective manner than previous projects. MAST supports decentralized land administration service delivery and thus presents an opportunity to help the GOT provide an efficient and participatory registration process at the village level to secure and protect property rights.

1.3 PILOT LOCATIONS

The MAST pilot operated in two phases: an initial “test” phase, which worked in one village in Iringa Region, and a second “scale” phase, which worked in two additional villages, also in Iringa Region. Iringa falls in the important SAGCOT region, a zone of interest for both the Government of Tanzania and USAID. The three pilot villages were chosen in consultation with the DLO, the NLUPC and the MOL.

The first phase of the MAST pilot took place in a relatively small village, Ilalasimba, which is located in Iringa Rural District of the Iringa Region. Ilalasimba village was chosen for the first “test” phase of the pilot because it is fairly representative of the average Tanzanian village. Most of the economic activities within the village are focused on agriculture. Maize is the predominant crop, and several secondary cash crops are grown by inhabitants (tomatoes, sunflower and tobacco). It has an estimated area of 64.9 sq. km and a small population of 325 households. On average, each household occupies 2 or 3 parcels. Parcel sizes range from 5 to 10 acres and larger holdings are farmed in peripheral areas of the village. In addition, there was not much land-based conflict evident in Ilalasimba: a benefit during a phase when the pilot was focused on testing technology and methodology.

The second phase of the pilot represented a modest scaling effort, in two additional villages in Iringa Region: Itagutwa and Kitayawa.

Itagutwa village is 30 km northeast of Iringa city. It has an area of 75.18 sq. km. and has a population of approximately 1,672 persons, and roughly 441 households. Itagutwa was the largest of the three villages. On average, each household occupies or farms approximately 3 parcels, resulting in approximately 1,300 parcels in the village. Almost all of the villagers depend on agriculture for their subsistence, with maize, sunflower, beans, and tobacco being the principal crops. The village has a number of pastoralists, but most have settled and pursue farming or are engaged in pastoral farming or herding. There was a very modest amount of land-based conflict in the village.

The final village in which the MAST project worked is Kitayawa. Kitayawa village is 22 km south of Iringa city and is located in the Kilolo District of Iringa, Tanzania. It has an area of 46 sq. km. and a population of approximately 2,118 persons, or roughly 546 households. On average, each household occupies or farms 3 parcels, yielding approximately 1,600 parcels in the village. Like in the other villages, almost all of the villagers depend on agriculture for their subsistence, with maize, sunflower, beans, and tomato being the principal crops however, some crops are produced for national markets.

In order to begin the pilot activities, each village needed to have an up-to-date and approved Village Land Use Plan (VLUP), which was acquired and put in place with the help of the NLUPC. Village

governance institutions including the Village Council also need to be in place. In all villages, a Land Adjudication Committee (LAC) needed to be formed, and a local registry office needed to be built or renovated in order to provide safe storage for land documents.

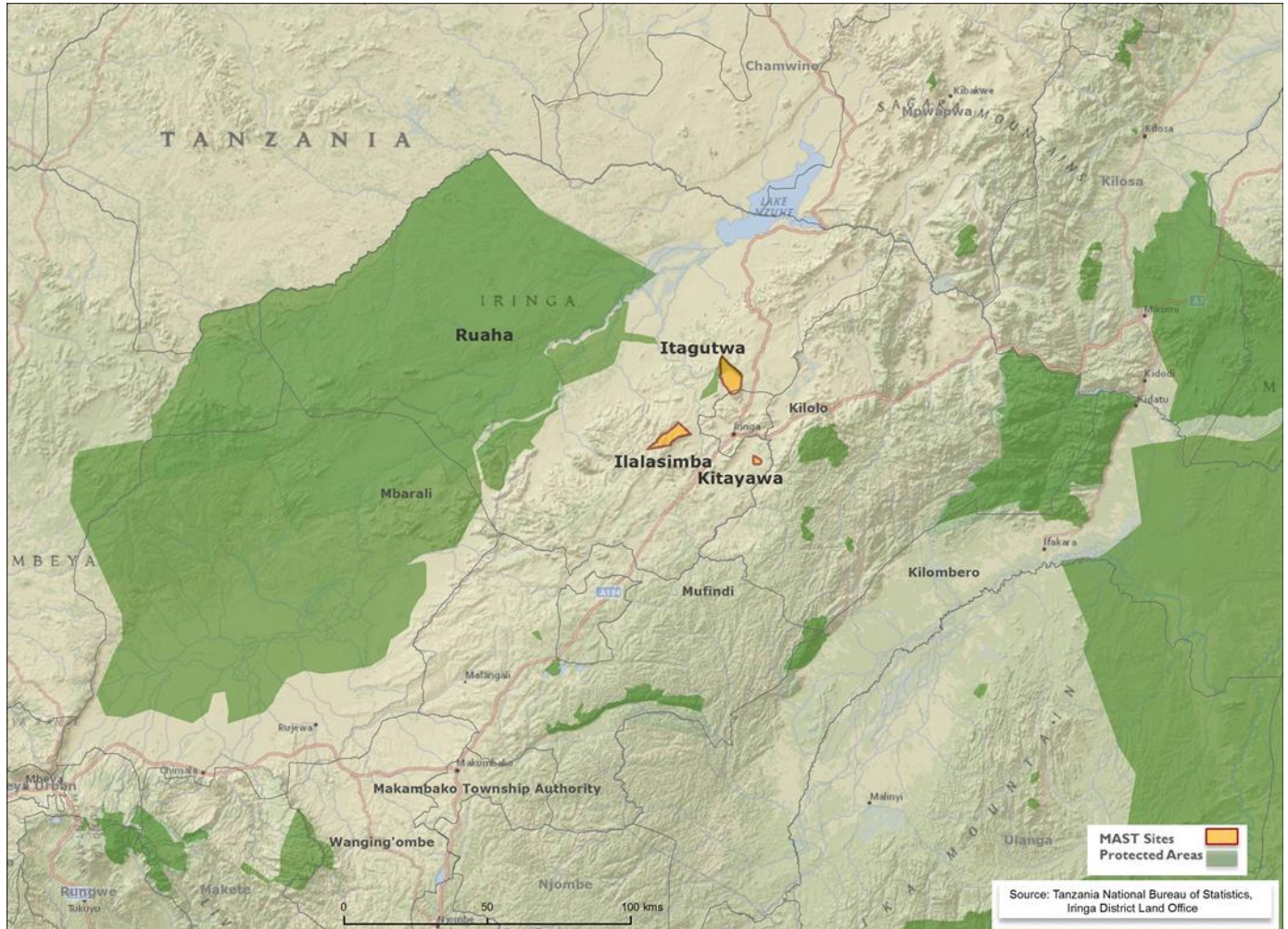


Figure I.1: Map of Iringa Rural District with Ilalasimba, Itagutwa and Kitayawa highlighted

2.0 METHODOLOGY

The MAST pilot project was implemented in two phases. The first (mobilization) phase was focused on developing and testing a simple-to-use land information system. The land information system consists of a mobile application that can be used to record and capture property rights information, and a back-end data management infrastructure that imports and stores the information that was recorded in the field. The GOT imported this information in order to issue Adjudication Forms and CCROs, which provide legal recognition of rights to property. The second (implementation) phase of the project was replicated in each pilot village and was led by national implementation partners, CARE International Tanzania and its partner TAGRODE. Work was conducted in close collaboration with the Iringa DLO. Implementation involved mobilizing and organizing each village in preparation for adjudication, building awareness of land laws and land rights, and providing technical training on the mobile application in order to build capacity. Once training was complete, the land adjudication process started. The process involved mapping lands and collecting of property and personal information from villagers and then processing and validating this information in order to issue legal documentation of land rights.

2.1 MOBILIZATION PHASE

2.1.1 MOBILE APPLICATION TO SECURE TENURE

The MAST application is an integrated suite of applications that was designed to support the collection and management of land rights information. It consists of a mobile application to capture land rights information in the field, and a back-end land rights data management web infrastructure application that includes tools to manage an inventory of land information. The data management web infrastructure application is housed on a cloud-based server. **Figure 2.1** below provides a conceptual overview of the MAST architecture.

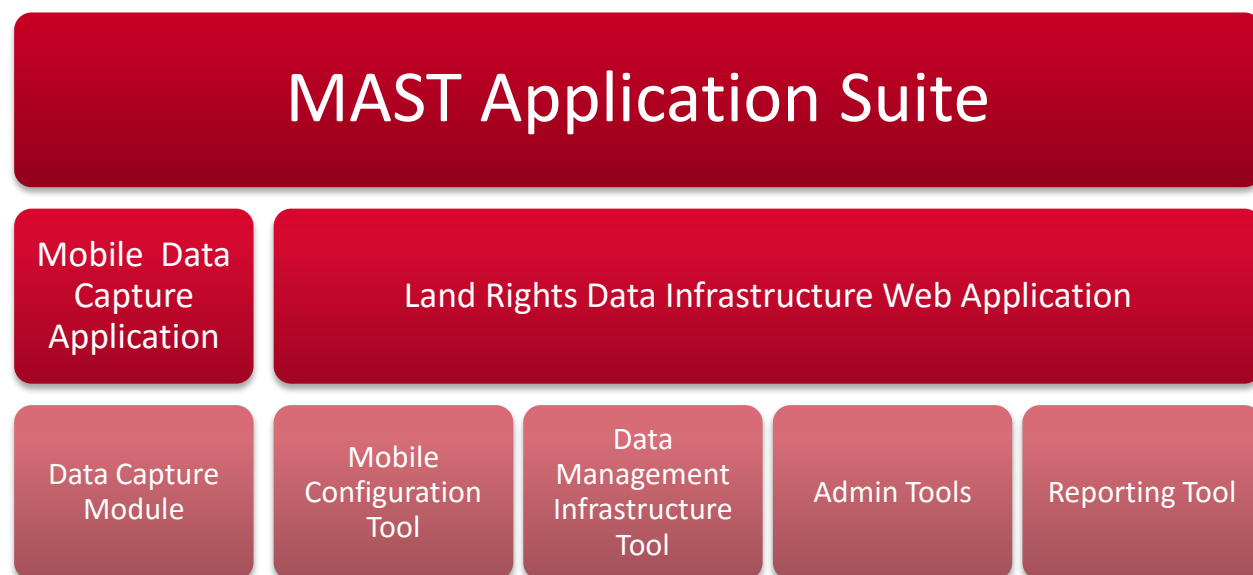


Figure 2.1: MAST Conceptual Architecture

The key component of MAST Framework is an Android-based **Mobile Data Capture Application** that can be used to capture of land rights information (spatial, alphanumeric and multimedia). Data can be collected off-line; users do not need to be connected to the cloud-based server on which data is stored. Rather, data is collected and stored on the users' handheld device, and once the user has internet access, data can be synced and sent back to the server.

The **Land Rights Data Management Web Application** provides the MAST Mobile Data Capture Application with a back-end web application facility to configure the mobile application, manage data collection, and manage land rights information data that has been collected in the field. It has three principle components:

- The **MAST Administration Tool** provides functionality to manage users and roles; configure survey projects; configure master attributes for use in projects, and manage base mapping data (i.e. import and configure data layers/layer groups).
- The **MAST Configuration Tool** provides functionality to configure the attribute fields that are required for a specific project on a data form template. The configured data template is then downloaded to the MAST mobile application through a web service, which allows for a pre-defined form to be used for data collection.
- The **Data Management Tool** enables the import and validation of data that is transferred from a mobile device to the data management web application. It processes and validates data according to predefined rules, facilitates the visualization and editing of data, and allows for the configuration and generation of formal land rights documentation (i.e. Adjudication Form and CCROs).

2.1.2 DATA MODEL AND ATTRIBUTES

MAST provides a flexible data model that was adapted to meet the needs of rural land adjudication and in accordance with the requirements of the Village Land Act of 1999 (VLA). The project adapted the Social Tenure Domain Model (STDM)² as the appropriate data framework for configuring MAST for Tanzania.

The basic structure of the STDM model is shown in Figure 2.2.

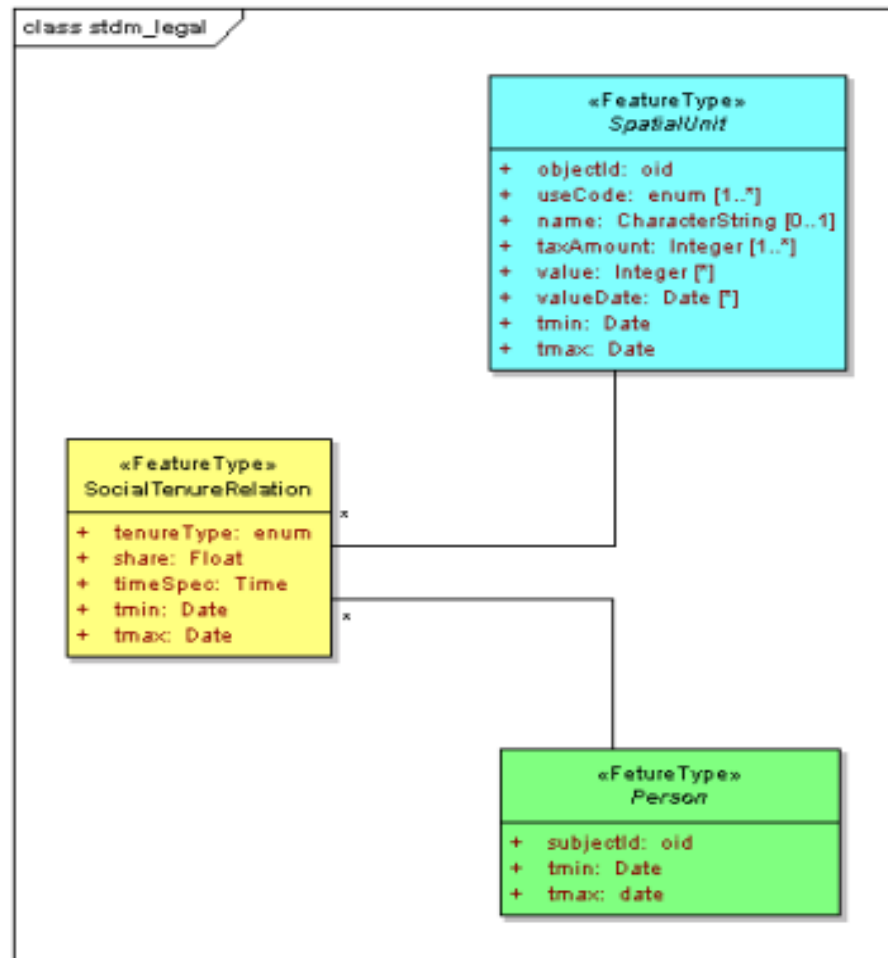


Figure 2.2: Core of the Social Tenure Domain Model: Spatial Unit, Social Tenure Relation, Person, Source: Lemmen, 2010

² The STDM extends the Land Administration Domain Model (LADM) and provides a flexible approach to land information infrastructures. STDM also supports the UN-Habitat “continuum of land rights” approach, which advocates documenting a range of informal rights rather than the formal rights alone (UN-HABITAT, 2008). The STDM has at its core a central relationship between parties (persons), social tenure relationship (right) and spatial unit.

In Tanzania, MAST initially used the STDM as the basis to configure attributes required for rural land adjudication. However, this model was adapted, with the help of the MOL and the District Land Office, to mirror the contents of legal documents that are normally needed to apply for CCROs (i.e. specific tenure type). The primary documents utilized to identify and define the MAST attributes were the Adjudication Form and the CCRO. For each spatial unit (parcel in the case of Tanzania), the following attributes were captured: (listed below in four categories):

General	Property	Person	Type of Tenure
Person Type	Existing Use	First Name	Type of Tenure (single occupancy, multiple occupancy (joint), multiple occupancy (in common), tenancy in probate, and tenancy with (guardian or administrator))
Number of signatory(s)	Proposed Use	Last Name	
Witness 1	Right of Way/Other Use	Middle Name	Occupancy Type/Right (Certificate of Customary Rights of Occupancy, Derivative Right)
Witness 2	Land Type	Gender	
	Neighbor North	Mobile No.	Resident
	Neighbor South	Occupation	
	Neighbor East	Education Level	
	Neighbor West	Age	
		Marital Status	
		Owner	
		Administrator	
		Citizenship	
		Resident	
		Institution name	
		Address	
		Phone Number	

2.2 IMPLEMENTATION PHASE

The implementation phase focused on raising awareness of the provisions of Tanzania's land laws, land rights generally, and women's land rights specifically, and on training local youth to systematically capture land rights information with mobile phones. It involved the following nine steps that are outlined in Figure 2.3.

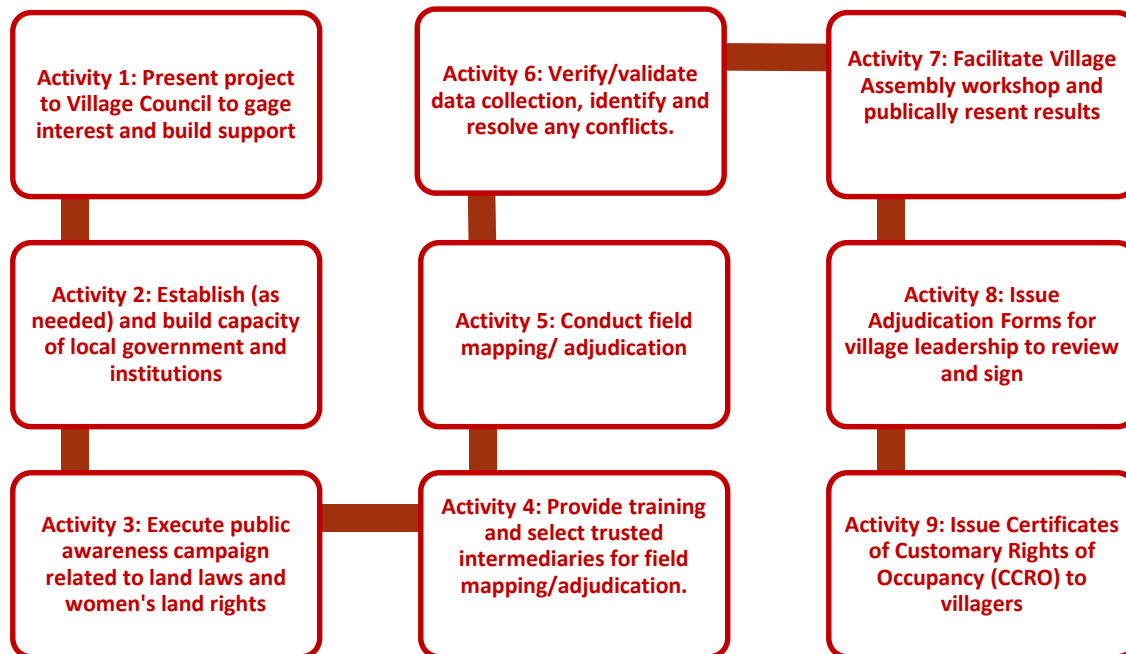


Figure 2.3: Implementation Steps

Implementation activities were broken into four main phases: Outreach and Training; Field Adjudication and Data Processing; Data Verification and Validation; and Printing and Presentation of Land Rights Documents.

2.2.1 OUTREACH AND TRAINING

The project was initiated and coordinated at the District Level, through discussions with the District Land Office and the District Executive Director. Through a series of discussions with district leaders the pilot identified required steps for implementation, potential sites for implementation, and how to engage with DLO staff.

Once target villages were identified (in coordination with USAID and the DLO) the next step was outreach to the Village Council (VC) to gauge local interest in and support for the project. If the Village Council provided permission to launch the project, discussions then focused on the importance of a high level of community participation. The project explained that the desired end result of the pilot would be a systematic adjudication of all parcels within the village, which would result in all villagers being granted CCROs. The pilot team explained that the costs for adjudication would be paid by the project. This coordination with village leaders paved the way for outreach and training.

The pilot provided training to members of the Village Council. The focus of this training was on land laws, land rights, and the land adjudication process. Training sessions were conducted by CARE and

TAGRODE, in collaboration with DLO officials. Training materials were collected from the MOL, Haki Ardhi, and the Participatory Ecological Land Use Management Tanzania (PELUM) project. All training materials were provided in Swahili.³ The logic behind providing training to the Village Council was to have leaders serve as key stakeholders in the project and enable them to speak authoritatively about the land laws, and associated rights and processes.

Following the training of the VC, a village-level workshop was held to provide information and improve awareness of land laws and the adjudication process to the wider community. This workshop provided a forum to explain and promote a participatory adjudication process within the village. During the workshop, the village leaders identified members for the Land Adjudication Committees. A separate Village Assembly workshop was held to confirm the members of the LAC and to identify persons who would serve as Trusted Intermediaries: youth who could be trained to use the MAST mobile application to support land adjudication.

Once village-level workshops were completed, the project conducted hamlet-level outreach sessions in each village. Hamlet-level outreach sessions were initiated by TAGRODE and facilitated by the DLO. DLO staff facilitated training of land laws at the hamlet level, while TAGRODE prepared villagers for the process by presenting maps to hamlet leaders, obtaining descriptions of lands occupied by villagers and discussing logistics/requirements for mapping. The execution of hamlet level training was an important component in the project, as it was found to be most appropriate method of disseminating information in the village, and allowed for greater participation from female members.

2.2.2 FIELD ADJUDICATION AND DATA PROCESSING

The adjudication process started with training on the use of the MAST technology. In 2015, the MAST project team started by training DLO staff and District government staff on MAST. Training was provided in a workshop format, which included lectures, presentations and step-by-step demonstration of the MAST tools. Hands-on training of the MAST Mobile Data Capture Application was also provided at a park in Iringa Town. Data that was captured on the mobile application was then uploaded to the MAST Data Management Infrastructure, and was subsequently reviewed with participants.

At the end of the training course, the DLO designated two persons to work with the MAST implementation team at the village level to train local youth, called trusted intermediaries (TIs), to use MAST. TIs received training on the land laws, the adjudication process, and the MAST technologies, specifically the MAST Data Capture Application. A Field Training Manual was used to guide participants in the key steps required for collecting the data for adjudication. The training culminated in the selection of women and men who worked as TIs during the course of field adjudication. The selection of TIs was based on their execution of field tests and an assessment of their performance. TIs received a small per diem for their work.

The formal adjudication process consists of mapping parcel boundaries and collecting needed information from villagers. To ensure good participation in the process, TAGRODE engaged with hamlet leaders and villagers, reviewing hard copy maps that display hamlet boundaries placed on top of satellite images. These maps were used to gather information about the general types of land holdings in each hamlet. This engagement helped bring the adjudication process to life for villagers, and at the same

³ Training guide book for Village Land Act of 1999; Land Act of 1999 (Swahili version); Village Land Act No. 5 of 1999 (Swahili Version); Village Land Policy of 2002; and Land Regulation, Land rights for women, conflict resolution, and marriage law.

time, provided an important reference for field mapping. TAGRODE worked with hamlet leaders to identify dates for mapping by TIs. The project requested that villagers be available on those dates to facilitate the adjudication process.



Figure 2.4: Trusted Intermediaries capturing land rights information in Ilalasimba

After TIs were trained, they were deployed to capture the parcel boundaries in their village using MAST. TIs capture data by interviewing villagers and walking the boundaries of their parcels along with members of the Land Adjudication Committee and neighbors. The MAST mobile application provides integrated geospatial and visualization tools which facilitate the recording of boundary points by GPS, with a satellite image backdrop. A Land Adjudication Committee member supervises this process.

For each parcel, information about the person/land relationship is captured. TIs capture general property information, personal information and the current tenure relationship, as well as information required for printing Adjudication Forms and CCROs (including photos of parcel owners). Data that is captured by TIs is verified (see more details in section below) by Land Adjudication Committee members, who are present throughout the interview process. Data is also verified in the field by TAGRODE and/or DLO staff, before being marked as complete. Figure 2.5 below outlines the general steps of the adjudication process. Once spatial data is captured, and before personal information is captured, parcel owners are asked if the maps captured on the device reflect what is was on the ground.

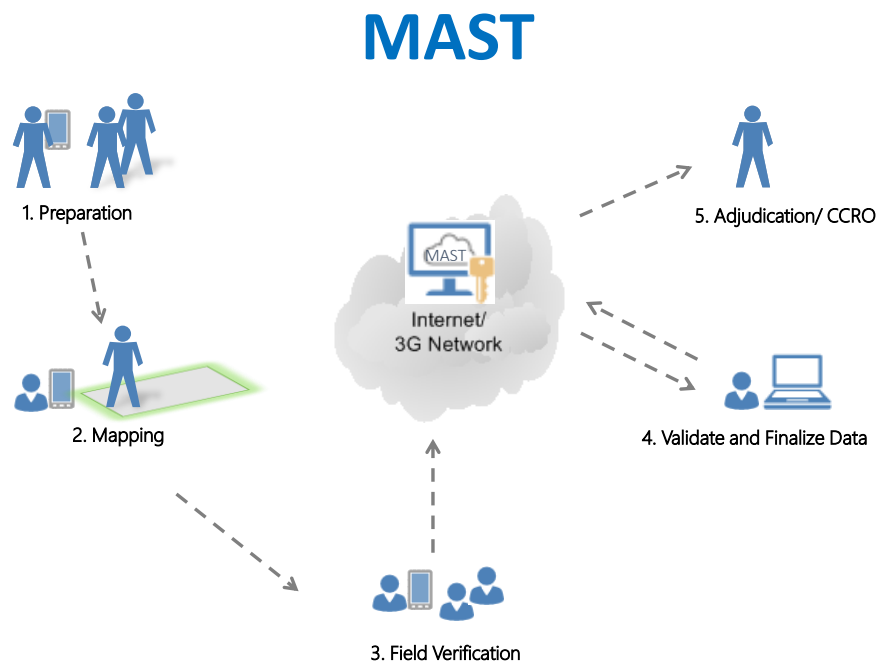


Figure 2.5: Village-Level Adjudication Process using MAST

2.2.3 DATA VERIFICATION AND VALIDATION

The MAST project created data verification and validation protocols that were followed in each village. Data verification occurred in the field, and focused on reviewing spatial data collected by TIs to determine whether units coincided with the physical landscape features, and that attributes concerning persons and tenure were complete. If data records were confirmed to be complete, data records were marked as “complete” in the mobile device, and then uploaded to the MAST Data Management Infrastructure at the end of the day, when the project team returned to Iringa Town and was able to connect to the internet.

Once data was synced to the Data Management Infrastructure, DLO staff would validate it. The most critical step in the process was editing and correcting data, which usually required manipulations such as the movement of vertexes. Approved data would be used to finalize land records; rejected data would need to be revised and re-reviewed. Once data was validated, the MAST Data Management Infrastructure was used to generate and print Adjudication Forms and CCROs.

Key Lesson: Data validation and editing was the most labor intensive and time consuming part of the MAST adjudication exercise. Workflow processes should be carefully evaluated when implementing future projects that use the MAST technology.

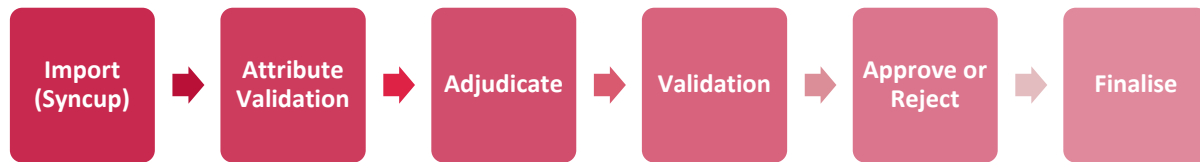


Figure 2.6: Stages of land record validation

2.2.4 PRINTING AND PRESENTATION OF LAND RIGHTS DOCUMENTS

Once mapping was completed and data was verified by the DLO, results were presented to village leaders, and to villagers. This allowed villagers and the MAST project team to discuss the process and any concerns related to the adjudication process.



Figure 2.7: TAGRODE field coordinator providing brief on MAST project in general

These workshops also served another function: they helped the project team understand how villagers perceived the project – the benefits and the costs – and it ensured greater transparency around the important public service of delivering CCROs. Based on a limited number of informal interviews conducted during these events, citizens reported the following benefits from the project: a better understanding of the legal framework related to land (rights and obligations); improved sense of security of tenure, particularly for women and children; a reduction in land conflicts; a sense that land was less likely to be provided to non-residents; and, the introduction of a more formalized structure for the selling of lands by villagers. In each village the project prepared a poster was prepared. The poster contains a map that identifies the lands that were mapped.

DLO staff then used MAST to generate and print Adjudication Forms. The Adjudication Forms were delivered to members of each Village Council for review and signature. DLO staff were present during this process to note any corrections to data on each of the Adjudication Forms. This review of the Adjudication Forms serves as the final verification of land rights data at the village, and where errors were encountered, DLO staff made manual corrections to the forms and then made corrections in the MAST Data Management Infrastructure application. The corrected final forms were taken back to each of the villages for final signature. Once Adjudication Forms were verified, they are signed by the Village Chairman/woman and parcel owners (and/or property administrators).

Once the Adjudication Forms are signed and finalized at the village, the formal status of the spatial unit in the MAST Data Infrastructure was changed to “adjudicated.” District Land Officials used MAST to print draft CCROs, and verify these draft documents against information in the signed Adjudication Form. This final verification step was introduced to reduce the potential for error during printing. The GOT requires that CCROs to be printed on official, government-issued “crested” paper, which is quite costly.

After draft CCROs are verified, the final, official CCROs are printed in triplicate on crested paper, registered at the DLO, and then dispatched and delivered to the village for signature. After the appropriate signatures are collected at the village, the CCROs are returned to the DLO where they are signed by the Land Officer. Once CCROs are signed they are again returned to the village and distributed to parcel owners (and/or property administrators). One copy of the CCROs remains at the DLO, one copy is filed in the Village Land Registry and one laminated copy is given to the parcel owner.

3.0 RESULTS

The MAST pilot project was designed, in part, to determine whether a process could be developed that would use a crowd sourced approach to capturing land rights information using mobile technology. The pilot then evolved to also test if this information, once gathered, could be used by the GOT to issue formal documentation of land rights, particularly CCROs.

One of the main results from the pilot is the mapping of parcels and collection of geospatial and personal/tenure information on a mass scale and in a systematic manner. A second critical result from the pilot is the issuance and delivery of legal land rights documentation (CCROs), again in a systematic manner. We discuss each set of results (to date) below.

3.1 MAPPING RESULTS

The mapping effort and spatial data generated from the MAST project in Ilalasimba and in Itagutwa are presented by in the tables below.

3.1.1 SPATIAL AND PERSONAL DATA CAPTURE

In the first pilot village, Ilalasimba, data capture and field adjudication took place over a three-week period and resulted in the capture of nine hundred and ten (910) parcels. This represents an average of 6 parcels per day by each TI, or 55 parcels per day in total.

Table 3.1 Ilalasimba: Number of Parcels, by Hamlet

Hamlet	# of parcels	% of total	Average size of Parcel (ha)	Total Area Mapped (ha)
SONGAMBELE	162	18%	1.7	275.7
IPANGANI	112	12%	1.6	178.1
ILALASIMBA	245	27%	0.7	173.8
KALANGALI	146	16%	1.1	164.2
IGUNGANDEMBWE	245	27%	1.7	413.6
Total	910	100%	1.3	1205.3

In the second pilot village, Itagutwa, data capture and field adjudication took place over a five-week period and resulted in the capture of 1139 parcels as of May 2016. This represents an average of 3.9 parcels per day by each of the 11 TIs, or an average of 39 parcels per day in total.

Table 3.2 Itagutwa: Number of Parcel, by Hamlet

Hamlet Name	# of parcels	% of total	Average size of Parcel (ha)	Total Area Mapped (ha)
MAPULULU	328	28.80%	1.7	565.642
ITAGUTWA	428	37.58%	1.3	550.7359
MLENGE	120	10.54%	3.5	423.5139
KIPENGELE	263	23.09%	0.9	246.5371
Total	1139	100.00%	1.6	1786.4

To date, in the third pilot village, Kitayawa the average mapping has resulted in capture of 1878 parcels in a four-week period. This represents an average of 6 parcels per day by each of 12 TIs, or an average of 72 parcels per day in total.

Table 3.3 Kitayawa: Number of Parcel, by Hamlet

Hamlet Name	# of parcels	% of total	Average size of Parcel (ha)	Total Area Mapped (ha)
IDOTWE	179	9.53%	1.4	241.9
IGULA_A	70	3.73%	0.6	41.7
IGULA_B	168	8.95%	1.3	213.1
LUSAULA	213	11.34%	2.7	579.5
MADUKANI	304	16.19%	0.7	207.2
MBOTE	309	16.45%	1.4	435.6
MSEKE_A	174	9.27%	0.9	162.0
MSEKE_B	68	3.62%	1.8	120.6
SEKUSE	230	12.25%	1.5	352.4
UNYANYE	163	8.68%	2.7	439.0
Total	1878	100.00%	1.48	2793.0

TIs from Ilalasimba helped to train TIs in Itagutwa and TIs from Itagutwa helped to train TIs in Kitayawa. This type of training model helped save costs while also building inter-community trust and reinforcing to new TIs that they did not have to be surveying professionals to learn how to map.

3.1.2 LAND RIGHTS DOCUMENTS

In the first pilot village, Ilalasimba, 910 parcels were mapped and 910 Certificates of Customary Rights of Occupancy (CCRO) were issued to villagers. In Itagutwa, over 1139 parcels were mapped. Of these, 1,126 land holders were issued CCROs⁴. Data of CCRO issuance for Kitayawa was not available at the time of this report, however, a general land holding classification is provided in Table 3.6 for the 1,878 parcels that have been mapped in that village. It should be highlighted that MAST had a significant impact on women's land rights in the villages in which it worked. In all three pilot villages, men were originally opposed to the idea of women owning land and receiving CCROs. However, as the numbers below

⁴ It is important to note that the difference between the number of parcels mapped for Itagutwa and the number of CCROs issued was due to cancelation of 13 parcels by Village Council during the data verification and validation process in the village.

show, through education, training, and outreach, the project achieved parity between land registrations for women and men. This is a critical outcome.

Table 3.4: Number of Land Rights Documents Issued, by Tenure, Ilalasimba

Type of Tenure	# of Land Holdings, by Tenure Type	% of land Holdings, by Tenure Type
Single occupancy/ male	447	49%
Single Occupancy/ female	278	31%
Joint Tenancy/ Male & Female	28	3%
Tenancy in Common	136	15%
Institution	10	1%
Tenancy in Common (probate)	11	1%
Total	910	100%

Table 3.5: Number of Land Rights Documents Issued, by Tenure, Itagutwa

Tenure Type	Holding by Tenure, by Tenure Type	% of land Holdings, by Tenure Type
Single occupancy/ male	231	20.52%
Single Occupancy/ female	373	33.13%
Joint Tenancy/ Male & Female	359	31.88%
Joint Tenancy/ Male & Male	3	0.27%
Joint Tenancy/ Female & Female	7	0.62%
Tenancy in Common	48	4.26%
Institution	16	1.42%
Tenancy in Common (probate)	91	8.08%
Guardian(Minor)	10	0.89%
Total	1126	100%

Table 3.5: Number of Land Holdings, by Tenure, Kitayawa

Tenure Type	Holding by Tenure, by Tenure Type	% of land Holdings, by Tenure Type
Single occupancy/ male	422	22.47%
Single Occupancy/ female	501	26.68%
Joint Tenancy/ Male & Female	387	20.61%
Joint Tenancy/ Male & Male	9	0.48%
Joint Tenancy/ Female & Female	7	0.37%
Tenancy in Common	76	4.05%
Institution	15	0.80%
Tenancy in Common (probate)	458	24.39%
Guardian(Minor)	3	0.16%
Total	1,878	100%

3.2 Project Timeline

[illegible]

3.3 Early Observed Benefits

During the course of the pilot project the MAST project team conducted a number of field visits to observe progress and to engage with GOT officials and with villagers. These trips provided an opportunity for the team to discuss initial benefits with villagers, typically during a group gathering. The following early benefits from the project were identified by villagers during these informal discussions:

- Women felt more empowered as a result of trainings on women's land rights and as a result of acquiring formal rights to land;
- Women felt that the land rights of their children would be more secure as a result of having the children's names listed on CCROs;
- Some villagers noted that they would now invest in cash crops, such as tomatoes, for sale in markets;
- Youth felt as though they made a positive contribution to their community by serving as Trusted Intermediaries;
- Youth felt encouraged and empowered by the capacity building experience using the mobile technology;
- Villagers felt that some conflicts would be avoided in the future given that land rights were clarified and secured;
- Villagers felt that they were less likely to be expropriated or wrongfully lose land rights;
- Villagers felt that by having CCROs the value of their land would rise;
- Villagers felt that they would be able to use their CCROs as collateral for loans; and
- Villagers felt that they would be able to use their CCROs as bonds to release family members who were in jail.

We note that while villagers expressed an interest in using CCROs as collateral for loans it is not clear how accessible finance will be using rural parcels as collateral. We also note that villagers expressed an interest in learning more about the soil conditions of their parcels, and how to access credit and markets to improve income. This may reflect their sense that with more secure land rights they will be more likely to invest in cash crops, improved inputs or in expanding production. This presents an opportunity to provide follow-on technical assistance or other support to help villagers leverage their increased tenure security to improve livelihoods.

4.0 DISCUSSION

The MAST pilot project faced a number of challenges from inception to final implementation. In this final section, general observations and key lessons learned are presented. These observations are grouped into the following six thematic categories:

1. National Level
2. District Level
3. Village Level
4. Mapping/Technology
5. Land Use
6. General Issues and Sustainability Concerns

These observations can inform the development of future implementations of MAST in rural Tanzania and in other locations.

NATIONAL LEVEL

Early stakeholder outreach helped to inform the design of the MAST pilot program. The project used an extensive stakeholder outreach strategy to collect information from a variety of NGOs, donors and government agencies regarding the land administration framework in Tanzania. Stakeholder engagement helped to inform project design by highlighting pitfalls associated with previous land administration programs. This early engagement facilitated a detailed understanding of the rural development context as well as local land laws and associated rights.

Government engagement was important for integrating MAST into rural adjudication processes. The primary focus of early meetings with the GOT was to determine whether the generalized boundary mapping approach proposed by utilization and testing of mobile technologies was consistent with the requirements of the land laws. The formalization of land rights in Tanzania requires government to exercise its authority for issuing rural land rights documentation. The MOL provided an authoritative interpretation of land laws, helped with key legal definitions and was particularly important for integrating legal requirements into the MAST software.

Partnering with government at the operational level facilitated implementation at the district and local levels. While senior MOL officials were generally supportive of the MAST pilot, a particularly helpful working relationship with the Ministry was forged at the operational level. MOL Land Officers worked collaboratively with MAST project staff in the field to provide introductions to district officials, assisted in the selection of pilot villages based on defined criteria, and helped bridge an important gap with beneficiaries, both at the district and village levels.

Lack of funding inhibits a stronger partnership with Ministry. The lack of funding or financial support for rural adjudication programs, however, inhibits the development of a more robust partnership with the Ministry. Despite a well-defined legal framework that seeks to facilitate more transparent and efficient land administration, a lack of funding means that the mandate of the Land Office at the MOL remains weak. In the absence of adequate funding, the Ministry's capacity to deliver land administration services at large scale may be challenged.

DISTRICT LEVEL

District staff brought a sufficient level of expertise in surveying and mapping. Systematic land regularization or adjudication programs, like the one implemented under the MAST pilot, requires a high level of technical expertise in demarcating lands, digitizing and creating maps, and managing land data. The MAST pilot benefited from the DLO's experience and expertise in this regard. The DLO staff had no difficulties in understanding MAST, utilizing the MAST technologies and/or adapting them to rural adjudication processes.

Implementation activities benefited from active supervision by our implementing partners. CARE International, and its implementing partner, TAGRODE, provided technical support and forged a working relationship with the DLO for the implementation of MAST. Active engagement by CARE and TAGRODE was necessary to ensure that project activities were being implemented according to established schedules. However, the need for active oversight and support to the DLO during this pilot placed additional pressures on project resources. It also raises some concerns related to scaling-up systematic adjudication programs and ensuring the sustainability of this effort.

Cumbersome procedures defined in the VLA place pressure on limited resources at the DLO. Despite having experience in implementing rural adjudication processes, the DLO processes for implementation are quite rigid. This means that the DLO follows very prescriptive procedures, such as being present to witness the signing, registration and dispatching of CCROs to villages. As a result, these seemingly simple procedures required the full attention of the District's Senior Land Officer, creating additional stresses on the DLO, on the project timeline and on project resources. These procedures are very time consuming, especially when performed by a single person. As a result, while parcels were mapped quite quickly, actual data verification, adjudication and processing of final land rights documents took substantially more time than anticipated. It would be helpful to identify opportunities to streamline these procedures.

Expectations and roles need to be clarified and aligned. Although the project team developed a strong and collaborative relationship with the DLO it was necessary to take time to clarify project roles and responsibilities and the responsibilities of the DLO. For example, the project was not aware, that after the delivery ceremony of CCROs in Ilalasimba, the DLO had not established an expedited timeline to sign and deliver CCROs back to the village. As a result, the delivery of documents was delayed by several months. The DLO expected that costs associated with this work would be assumed by the project, while the project assumed that these tasks would be undertaken by the DLO as a part of their normal business operations. To overcome this problem, the project entered into a Memorandum of Understanding with the DLO to clearly define roles and responsibilities, to expedite the timeline for processing Adjudication Forms and CCROs for Itagutwa and Kitayawa, and to clarify payment of extra duty per diems for some project work.

Lack of funding and technical resources limits the DLO's land administration capacity. Especially in pilot villages 2 and 3, the MAST project found that DLO had limited capacity to address project demands while also addressing other regular office demands. The capacity of the DLO is directly tied to the limited financial resources that are allocated by PMO-RALG to the district for implementation or support of adjudication programs. Seemingly routine land administration work executed under MAST, such as printing and processing of CCROs, required additional financial (extra-duty per diems) and logistical (transportation) support.

VILLAGE LEVEL

Regular and active engagement with community leaders helped to improve project planning and create realistic timelines. The MAST project engaged village leaders to establish buy-in to the project, and collect information regarding the village, local population and economic activities. This was done through culturally appropriate engagement methods (for example, having local staff sit with and listen to village leaders) prior to initiating project activities. The information that was gathered helped MAST improve project planning and address, at an early stage, logistical challenges that could impede implementation – i.e. land disputes, understanding the number of persons not currently residing in village, villagers' availability in relation to planting or rainy season.

Prioritizing hyper-local advocacy and training was key to securing and protecting land rights. While initial outreach and training efforts in Ilalasimba were provided at the village level, hamlet-level training proved particularly effective. Early on, the MAST team noticed that few women attended and were vocal during village-level meetings. Therefore, the project decided to emphasize hamlet-level outreach efforts in order to extend land rights trainings to more villagers, particularly women, and to build household-level buy-in for the mapping process. This hyper-local approach resulted in increased knowledge and a deeper understanding of land laws and land rights in each of the pilot villages. Hamlet-level outreach and training took place before the start of land mapping. Much of the success of the MAST program may be due to villager-level buy-in that resulted from this implementation activity.

The Trusted Intermediary model proved effective. The process of engaging villagers in land rights documentation has proven effective, and TIs proved themselves to be capable, efficient, and reliable para-surveyors. The rural land adjudication process requires knowledge of the local environment and land holdings, and benefited from the TI's institutional and physical knowledge of their village. As a result, entire villages were mapped in a matter of 3-4 weeks; a stark improvement over prior tilting efforts. Having fellow villagers conduct the mapping also helped to build trust and willingness among other villagers to participate in the project. TIs essentially became the internal champions of the project, and facilitated the execution of an effective and efficient field adjudication program in pilot villages.

Putting youth engagement at the center of technology training yielded benefits. Technology training programs focused on youth and incorporated observation and active learning (i.e. hands-on training that was easily adopted by youths at the village level). Active learning led to better learning outcomes and good use of MAST technologies at the village level. TIs were so interested in this experience that some expressed a desire to do more – to learn how to verify data collected, or to volunteer to train youth in follow-on villages. TIs also expressed an interest in learning and using other mobile technology, such as LandPKS. This suggests that the MAST project was able to build practical skills and capacity among youth: capacity that other donors and other projects might leverage to extend benefits and improve livelihoods.

Trusted Intermediaries from one village were effective trainers of other TIs. Trusted Intermediaries in Ilalasimba expressed a strong interest in helping to train TIs in the next pilot village. The MAST project experimented by inviting four of these TIs to work alongside project staff to train TIs in the second village, Itagutwa. This proved to be a successful innovation as youth in Itagutwa pointed out that having the TIs from Ilalasimba involved in training built their confidence. One youth from Itagutwa noted that he felt that if the youth from Ilalasimba could do this work then he (and his peers) were more confident that they could also do the work effectively. He said that they might not have felt

this way if only DLO or project staff provided training. TIs shared their experiences and knowledge with their peers and this proved beneficial during field implementation.

Targeting of women and other vulnerable groups was key to increasing security and promoting gender equality. ERC focused on raising women's awareness of land rights by incorporating gender specific materials in program activities and emphasizing the importance of having women attend village-level trainings, workshops and community activities. MAST also worked with village leaders to ensure a gender balance on governance institutions and focused on recruiting young women to work with the project as trusted intermediaries. This strategy helped build a foundation for women's participation in the project, helped build a community-wide understanding of the rights of women to land in the pilot villages, and helped ensure that CCROs would be issued to women directly. As a result, women in the pilot villages have gone from having no formal land rights and strong customary norms that discouraged claiming these rights to holding CCROs in their own names and jointly with men.

Relying on citizens in the implementation process facilitated the resolution of some land disputes. While the MAST pilot did not formally incorporate a dispute resolution mechanism in its implementation strategy, it provided training on the adjudication process to clarify how disputes would be handled during mapping and following data collection (the issuance of Adjudication Forms and CCROs). The mapping process was implemented by having TIs and LAC members walk with land holders and neighbors to identify boundaries. This participatory process helped to identify existing conflicts in pilot villages, and provided an immediate and local method to resolve them.

Careful messaging was needed to emphasize the benefits of secure tenure rights. The MAST pilot project provided careful messaging around the likely benefits of securing land tenure by procuring CCROs. This messaging was incorporated into community outreach activities in order to help align expectation of villagers. More specifically, the project emphasized that by having a CCROs a woman or man would have stronger rights to use and benefit from land, that inheritance rights would be more secure, and that future conflicts should be reduced because it would be clearer who had legal rights to which parcels. The project purposefully did not highlight the possible connection between CCROs and access to credit.

MAPPING/TECHNOLOGY

Affordability of internet services is a major barrier for the implementation of land information system projects. The pilot has illustrated that internet costs can be a barrier for implementing, utilizing and adopting ICT projects. During the course of the MAST pilot, the project explored options to reduce internet costs. However, because the DLO does not have an allocated budget for ICT, and because of the high costs of associated with obtaining and maintaining an office internet connection, the project covered these costs. The lack of dedicated funding for ICT raises challenges related to the ability of the DLO and other DLOs to support a MAST-like approach to land rights adjudication.

Geospatial resources and tools are expensive, but easily adopted by beneficiaries. Significant investment and time is required to obtain and process geospatial resources such as imagery, and create base mapping data (i.e. village roads, boundaries) in MAST, but the incorporation of these resources and the use of GIS/GPS tools in the MAST Mobile Data Capture Application proved useful for orienting villagers for field work, demarcating boundaries and resolving conflicts. This represents a tradeoff: if

MAST is to be effectively scaled, the acquisition and use of imagery will represent a substantial expense unless an alternate strategy to acquire imagery can be identified.

Mapping accuracy has been improved by tasking and orientating beneficiaries during field adjudication. Although satellite imagery proved important for mapping and understanding the landscape, simple errors in parcel boundary demarcation were encountered. This is not unexpected given that TIs are not professionals and received limited technology training. The observations from the first two pilots and results from the final pilot village indicate that, by improving the way TIs were tasked each day (i.e., systematically mapping portions of a hamlet each day) and by providing additional landscape orientation, TIs can improve their efficiency, which can help avoid duplication of efforts (i.e. duplicate parcels, gaps, other errors).

Lack of mapping data reduces efficiencies and increases ambiguities during formal adjudication and data validation. The absence of adequate and coordinated land information, especially land use planning data, which delineates existing and future land uses in the village to guide TIs during field adjudication, has created uncertainties during the demarcation of land boundaries. This has reduced efficiencies in processing and finalizing data. It has also led to time consuming on-site audits by land officers. New workflow processes, involve rotating staff to and from the field to improve understanding of local situations, are currently being implemented in Kitayawa, and are helping to address these problems and reduce the time needed to process and validate data.

Lack of reliable existing data (including VLUPs) increases potential for land disputes. While the DLO has proven to be technically astute in absorbing technologies and processes, the use of inadequate base mapping data during the land use planning process has created an environment where designated uses conflict with existing uses. Using an outdated or non-representative land use plan can lead to conflicts, and also introduces potential errors in the rural adjudication process.

LAND USE

Poor land use planning framework has potential for excluding pastoralists and farmers in marginalized zones, and is increasing disputes. While the village land use planning (VLUP) process, as outlined in the laws and procedure manuals, is supposed to be participatory, the pilot found that village-level participation in the VLUP process is often not representative. For example, in Ilalasimba, pastoralists felt that their concerns were not addressed by the VLUP process. The pilot also found that VLUPs often did not reflect the village's customary understanding of different land uses, land allocation, and boundaries. During village scoping, the pilot found that village leadership often either did not have a copy of the VLUP, or did not know where it was housed. This suggests that the VLUP is not seen as a useful tool for village planning, likely because it is seen as inaccurate or not representative.

Villagers and village leaders may benefit from coupling MAST technology with other land use management technology. In informal interviews, MAST beneficiaries expressed the following sentiment: “my land is mapped, documented, and secured: now what?”. Villagers noted that now that their land rights were more secure, they would benefit from having access to land use management information so that they could better capitalize on their CCROs. Such information might be provided by coupling the deployment of MAST technology with other USAID-supported mobile technology,

specifically the LandPKS applications. This would enable land rights holders to identify soil conditions, land cover and share information with others who face similar concerns and constraints.

GENERAL ISSUES AND SUSTAINABILITY CONCERNS

Financial Sustainability. The systematic registration of land rights is a large undertaking that requires both a political commitment and a financial commitment. The MAST pilot tested an approach that reduces the time and may reduce the costs associated with this process. Such an approach may prove helpful to the GOT in achieving its goals regarding the registration of land rights for a large number of citizens. However, to implement this approach at scale, district land offices will need dedicated and sufficient funding from PMO-RALG, including funding for ICT needs and for staff to travel to and from villages. In addition, the GOT will need to identify an appropriate revenue-generating strategy to sustain these efforts. The MAST pilot assumed the costs of issuing CCROs – villagers received documents for free. Assuming the GOT will continue to charge a fee to deliver CCROs, the price to do so needs to reflect demand for these services and needs to be transparent. Currently, it is not clear what villagers in different locations are willing to pay for these services (given the fact that many villagers do not understand or do not see many benefits associated with having a CCRO). This is an issue that will, presumably, be addressed by the GOT and/or through USAID's Land Tenure Assistance (LTA) Activity and DfID's Land Tenure Support Program (LTSP) activities.

Subsequent registration. The MAST pilot project was designed to test a citizen-centric approach to capturing land rights; it was extended to support the issuance of formal land rights documents. It was not designed as a land information system nor to provide functionality for the subsequent registration or transfer of land rights stemming from inheritance, sale, subdivision, etc. However, it is clearly the case that in order for a technology-based approach to land registration to succeed and meet the needs of the GOT and land users in the country, a solution to the problem of efficiently and effectively transferring rights to parcels will need to be developed. While this is possible, it is an issue that, like financial sustainability, will presumably be addressed by the GOT and/or through the LTA and LTSP activities.

Staffing issues. The DLO is currently not staffed at a sufficient level to support the systematic adjudication of land rights while also conducting normal office business. The project experienced delays processing and validating data as a result of limited number of DLO staff with GIS expertise. In addition, because DLO staff participate in training exercises, mapping exercises, the delivery of Adjudication Forms, signing Adjudication Forms, and the delivery of CCROs – all of which take place in villages – staff needed to juggle responsibilities and, at times, this negatively impacted the project's delivery timeline. If the GOT wishes to implement a broader systematic adjudication process it will need to build capacity among a cadres of professionals and devote resources to staffing District Land Offices. This capacity building might be done in conjunction with universities and training colleges.

The requirement to use official “crested papers” and ancillary forms and/or supplies creates a high “sunk cost” for the adjudication of land. The costs associated with adjudicating lands in Tanzania are quite high due in part to the requirement to use official papers and ancillary forms. These costs are significant: on average they are approximately \$6.50 USD per parcel. The MAST pilot project absorbed these and other costs of delivering CCROs, rather than passing these costs on to villagers. In order to encourage more villagers to participate in adjudication efforts, the GOT should consider relaxing some of these requirements. Reducing costs associated with procuring official papers could help efforts associated with scaling adjudication process in Tanzania.

Using and transitioning to a cloud-based land information system presents opportunities and challenges. The MAST pilot has proven that cloud-based systems and mobile technologies can be deployed and used in rural areas with limited internet access. This approach may present opportunities for building a reliable inventory of lands quickly. The MAST suite uses cloud-based technologies and does not require the same level of investment as traditional ICT systems. However, the cloud storage chosen for MAST is not without a cost. The hosting service chosen for MAST costs approximately \$500 a month. While it is not an insignificant sum, it is lower than large-scale investments in software and hardware that are typically involved in creating formal land information systems. Nevertheless, the GOT wishes to use a cloud-based data storage system to provide land titles, it will need to allocate an adequate budget for the costs of storage. At the same time, the transition to cloud storage has also had an impact on existing business processes at the DLO and highlighted that the systematic adjudication of lands places strains on resources. It has also raised concerns related to the hosting, management, storage and privacy of resultant land rights information.

Clarifying benefits of technology. Government ownership and political will are essential to successfully implement any important policy. The Government, particularly the MOL, may face challenges in meeting commitments to implement national-level adjudication programs, given the limited staff and budgets available for these activities. The GOT has approached the option to use mobile technology cautiously and so it will be important to understand the potential this (or other) technology has to deliver land administration services in a more timely, and perhaps more cost-effective manner. MAST seems to fit well with government development priorities for inventorying lands and attracting agricultural investment, but it remains to be seen whether it will be widely adopted by the GOT.

Per-diems and Participation: As highlighted in the sections above, community engagement was effective to implement a MAST-driven adjudication process. However, this participation came at a cost. Almost all activities, including the participation of the DLO and of villagers in the project, was tied to the provision of per-diems. In Tanzania, per-diems are used as the main incentive for ensuring engagement in development programs. While the pilot incorporated per diems in order to guarantee the participation of GOT officials (including the DLO), budget allocations for per diems for villagers were low. The apparent need to use per diems to ensure participation in project implementation activities has implications for efforts to scale MAST and land adjudication.

5.0 Conclusion

As noted above, as the MAST Pilot Project nears the end of its life, the project is able to provide field-based insights into the following issues that motivated the activity:

1. Citizens' and communities' reaction to and engagement with the approach and its impact on perception of tenure security:

Citizens and communities were supportive of this approach to mapping and capturing land rights information. The project did not, in its limited experience, encounter any resistance from community members or village leaders to the methodology or to the activities. Rather, in each community villagers expressed an interest in participating in the project. The project, like many land certification or titling projects, did raise some conflicts – often intra-familial conflicts that needed to be resolved by the Village Council. Only in rare cases were conflicts taken beyond the Council to the ward level or higher. Villagers also self-reported that they expect the delivery of CCROs to reduce future conflicts – particularly for women and their children. The project also helped to expand understanding around women's land rights, which had, anecdotally, a strong impact on women's perception that their tenure security had increased as a result of the project.

2. The ability of the surveying profession / land professionals to support efforts to crowdsource land rights information in a collaborative manner with citizens:

Surveying and land professionals working in the DLO, the NLUPC and the MOL were very capable of supporting the MAST pilot activities related to crowdsourcing land rights and working collaboratively with citizens. In particular, GOT staff led trainings on the land laws, provided careful oversight of data validation, and engaged with citizens on the review of Adjudication Forms. Staff from the NLUPC assisted in updating land use plans and in identifying conflicts among land users during land use planning process. MOL staff were very helpful in identifying ways to improve the MAST technology so that it tracked legal requirements more closely. Taken together, these professionals made important contributions that improved MAST application functionality. Their strong involvement in the pilot may also have provided villagers with a greater confidence and trust in the MAST methodologies.

3. The characteristics of a good 'Trusted Intermediary' (TI) to support the capture and maintenance of land rights information:

The pilot worked with over two dozen young women and men who served as Trusted Intermediaries. We identified several characteristics of a "good" TI. These included the following: a strong interest in learning new skills, adaptability, a willingness to engage with others, and facility with technology. Both women and men made good TIs and in both Ilalasimba and Itagutwa women held the record for mapping the most parcels in a day. Having both women and men as TIs may have helped to encourage conversations around women's land rights and may have helped women feel more comfortable seeking rights in their own names, though this is speculative.

4. Identify what land rights information must be captured to meet the legal requirements of the Government of Tanzania:

By working closely with the DLO and the MOL, the project was able to identify what land rights information is required in order to issue formal documentation of rights. As noted above, there is not a consistent interpretation at the district level of what land rights data is required, and so being able to rely on the MOL to provide expert guidance on these points was very helpful.

5. Test a range of technology tools available and identifying the most affordable and appropriate to support the approach:

In the initial stages of the pilot, ERC worked with USAID to explore and test a variety of data platforms, technologies and mobile applications that could be applied to the MAST pilot. The initial focus of discussions was on identifying existing web mapping platforms, web mapping servers, and development frameworks, tool kits, libraries and databases that could be used for hosting data or as tools to develop a data management back-end. The project also explored an assortment of mobile applications or tools kits that could either be used for a mobile application. Most prominent among these was ESRI's ArcGIS mobile application. Options were also explored to build the platform using Open Data Kit (ODK). The project decided, however, to issue a Request for Proposals for the development of an integrated solution: a mobile data capture tool and data management facility, given that these were identified as key elements to test the technology in Tanzania and given opportunities for securing tenure by issuing land rights documents.

6. Establish approaches for sustaining the maintenance and security of land right information after the pilot and expanding its use:

Throughout this project, the MAST team has sought to engage national and district level stakeholders to build support for the pilot's new and innovative approaches to collecting and storing land rights information. These approaches, particularly, general boundary mapping, the use of relatively simple tools (mobile phones), the use of local people to support the adjudication process, and the use of cloud-based tools and storage facilities, were presented to GOT and other stakeholders as tools that could be used to address many of the shortcomings of conventional land administration systems. The MAST team has worked closely with the DLO to build capacity to carry on land adjudication efforts using MAST by providing a variety of trainings and by procuring a server and printer for the office. The MAST team has also shared information with, and made presentations to, other donor agencies operating in the land sector in Tanzania. Most recently, USAID has integrated MAST into its Land Tenure Assistance (LTA) program and will utilize the technology at larger scale to support efforts to deliver secure land rights in 41 villages in Tanzania. However, for the GOT to deploy MAST at a large scale, the government would need to dedicate financial resources to the acquisition of geospatial imagery, the training of staff, hiring personnel, providing for logistical support and the appropriate ICT infrastructure.

7. Explore how the results from the pilot can be shared and the lessons and practical applications expanded, replicated and scaled for USAID and others:

USAID has been able to share the results and lessons learned from the MAST Pilot Project in several ways. First, the Agency supported the developed of a Performance Evaluation of the pilot, which is publically available. Second, the Agency has discussed MAST at several forums, sharing

lessons and discussing opportunities to replication. For example, this past March USAID supported a panel discussion of the MAST project at the 2015 LANDac Conference in Utrecht, at a FIG Conference in Malta in 2015, and at the 2016 Annual World Bank Conference on Land and Poverty. The Agency has developed other materials, including stories and commentaries that discuss the impact of the MAST project. And finally, this lessons learned document attempts to share lessons learned related to the project. USAID plans to scale MAST in Tanzania through the Land Tenure Assistance (LTA) Activity, a Feed the Future program being managed by USAID/Tanzania.

By sharing these lessons learned, the MAST project hopes to inform discussions related to the use of technology to close the worldwide tenure gap, the important issue of securing women's rights to land and the role that local citizens – or para-professionals – can play in mapping and recording land rights. The MAST pilot provides some evidence that coupling awareness raising around land laws and land rights with training on the use of technology, local citizens can have a more central voice in the process of securing land rights. The pilot also provides some evidence that this participatory approach may be especially important for women, whose land rights remain insecure due to persistent customary practices.

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