



# Land Governance in an Interconnected World

ANNUAL WORLD BANK CONFERENCE ON LAND AND POVERTY  
WASHINGTON DC, MARCH 19-23, 2018



## MAPPING COMMUNITY LAND IN MOZAMBIQUE: OPPORTUNITY AND CHALLENGES FOR COMBINING TECHNOLOGY WITH GOOD LAND GOVERNANCE

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## **Abstract**

This paper discusses opportunities and challenges for the integration and combination of a participatory mapping and high-resolution satellite within the community land delimitation process. Based on the principle that information is crucial for decision making at the local and provincial level, the paper discusses the benefits of associating the CADASTA platform approach with community delimitation processes, where information gathered through a participatory process at the community level, can improve land use planning and inform decisions for land-based investments. The discussion will be based in a context of existing land information management systems (SiGIT), and the opportunities and challenges for accessing, archiving, and print information. Making these maps available for the public (including the community) is considered to be a key point for participatory planning and inclusive land-based investments.

**Key Words: (i) Community land mapping; (ii) CADASTA; (iii) Community land delimitation; (iv) Rural Mozambique**



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## 1. THE CURRENT LAND ADMINISTRATION CONTEXT: TERRA SEGURA

Land administration in Mozambique has been a matter of a heated discussion among the policy-makers, civil society, and local communities. Twenty years into implementing the Land Law (1997-2017), Mozambique has experienced enormous progress and challenges, particularly on the matter of protecting the land rights of local communities and its members. In general, land in Mozambique is considered a state property (GoM, 1990). The 1997 Land Law enables the leasehold of land for productive purposes to individuals and private entities and, recognizes the customary rights by rural communities (communities, associations, and individuals) through occupation of ten years or more (QUAN, MONTEIRO, & MOLE, 2013).

Yet, customary rights by rural communities can be formalized through a systematic process of community land delimitation (CLD), where the physical limits of the communities are recorded in the national cadaster system and issued a certificate of delimitation (WIT & NORFOLK, 2010). Community land delimitation is considered a step towards establishing and promoting community-private-partnerships. According to Aquino, Fonseca, and Mwehe (2016), after almost twenty years of the implementation of Land Law, it has been difficult to provide a consensus argument about the status of implementation of the CDL as well as the impact on the local people. While there have been some advances on promoting community land delimitation and DUATs for small farmer associations, the same progress was not achieved in the same pace for the individual land titling, under customary tenure rights. Rural communities make about 70% of the country's population where, the majority depend on agriculture to sustain their livelihoods (Bank, 2017b). According to Deloitte (2016), agriculture- which is mostly driven by small-scale farmers- accounts for twenty five percent of the country's GDP (in 2015).

Seeking an ideal path for sustainable development, the five-year Government Plan (Plano Quinquenal 2015-2019) recognizes the importance of small-scale rain fed agriculture to the country's economy, particularly for the livelihood of local people (GoM, 2015). Despite such recognition, small-scale farmers continue to face enormous land tenure security challenges, which affects the overall agriculture productivity. Given that a large majority of Mozambique's workforce is reliant on small-scale rain-fed



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agriculture for their livelihoods, the government of Mozambique, in partnership with Dutch Government, DFID, and Swedish SIDA launched GESTERRA (Capacity Building Program on Land Management and Administration), to provide continued support for some of the activities initiated by the MCA “Access to Land” (Azul, 2018). Among other objectives, the program intended to improve land management, linking land delimitation, land tenure regularization and land-use planning with local level planning and development processes and with investment promotion services. The program also intends to consolidate land administration and build the national land cadaster system. The government’s efforts to improve the cadastral system are based on the principle that improved interactions between people and land will result in better economic, political, social, and environmental outcomes. To achieve these goals, an effective and fully operational LIS is required (Enemark *et al.*, 2015).

Under the land tenure regularization, the Ministry of Land, Environment and Rural Development (MITADER) launched a “Terra Segura” initiative, aiming to provide and register a total of five million individual DUAT titles to land right holders between 2015 and 2019 (Christoplos, Doré, Calengo, & Sørensen, 2016). Terra Segura is also expected to deliver 4000 community land delimitation within five-year period. Although, the program seems to be a step towards expanding the individual titling in rural areas, there are still some challenges regarding with the effectiveness of the program. Yet, the targets set by Terra Segura, have been widely discussed among civil society and other groups involved in the promotion of land tenure security in Mozambique.

## **Main wins and challenges of Terra Segura program**

Individual titling has been considered priority to achieve a sustainable use and management of land in Mozambique. The 1995 Land National Policy and 1997 Land Law have clearly defined a strategic approach towards land tenure security for rural people, which includes: the recognition of the role of the customary norms and practices in land administration and management, together with statutory norms, particularly with regard to access and use of land and land conflict resolution (Christoplos *et al.*, 2016). According to Bank (2017a), the Mozambique land sector capacity to issue and monitor the use of DUATs as well as to register land occupations is still low. The problem is often attributed to insufficient human and financial resources. The Terra Segura initiative, in part was supposed to address some of the shortcomings of the land sector in Mozambique. The mid-term review report of GESTERRA found that



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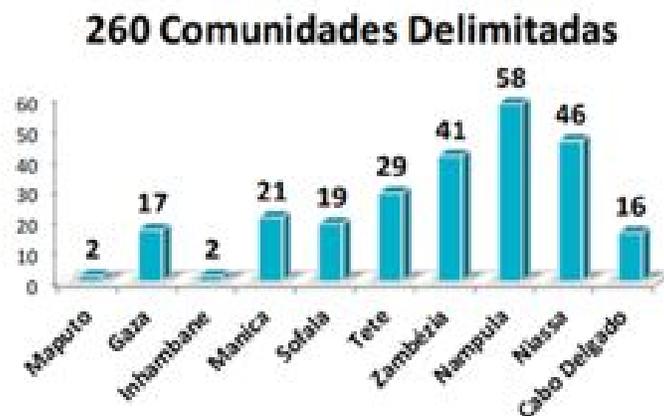
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“Terra Segura” overwhelmingly created pressure to focus on individual land titling, undermining the other components such as investments on capacity building and technical assistance (SIDA, 2016).

In 2012, the Mozambican Land Information Management System (SiGIT) was built to deliver all land administration processes (Balas, *et al.*, 2017) and today, it is the system being used to record data coming from Terra Segura program. Despite progress, inadequate access to land-use information and weak community consultation processes persist. There is a need to capture not only the boundaries of a community, but also understand the resource governance system within the community, through mapping their land use rights as a path to secure sustainable rural development.

Preliminary results from the evaluation conducted by EXI (a private company in the field of Information and Technology) in 2016, shows that there has been a significant advance toward the targets established for the program. The program has supported the Provincial Services of Geography and Cadaster on: i) equipment (laboratories for processing information); and ii) technical capacity building (25 system administrators, 10 data managers and 215 system operators)<sup>1</sup>. The evaluation also indicates that the program has covered 10 provinces, making in total 10 million hectares and 260 communities, as shown below in Figure 1.



**Fig. 1:** Delimited communities under the Terra Segura program

<sup>1</sup> SiGIT alavancado pela Lei de Terras para suportar a Administração da Terra em Moçambique, presented by EXI. <http://omrmz.org/omrweb/wp-content/uploads/4.-SIGIT-alavancado-pela-Lei-de-Terras-para-Suportar-a-Administra%C3%A7%C3%A3o-da-Terra-em-Mo%C3%A7ambique.pdf>



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Overall, the program has assessed and registered five hundred thousand parcels, where 401,541 were processed and introduced in the SiGIT, and 30,000 already delivered to the beneficiaries (see Figure 2).



**Fig. 2:** Parcels registered and DUATs delivered to the beneficiaries of Terra Segura

## 2. COMMUNITY LAND DELIMITATION: OPPORTUNITIES

Although rural land in Mozambique is regarded as state property, the law enables both allocation of private leasehold rights to individuals and corporate bodies for productive purposes, and registration of customary rights established by rural communities through beneficial occupation for 10 years or more. This customary tenure rights can be formalized through a relatively simple process of land delimitation, which consists of geo-referencing the boundaries of the area under occupation by the communities. In conceiving the legislation, community land delimitation was considered useful to promote economic development and assist in land use planning to enable private investment in community land, and ultimately promote rural development.

From the different forms of securing community land rights, community land delimitation is the one that have been commonly applied in the country. Effectively, community land delimitation started in 1999, and it was mainly implemented by NGOs with supports from different donors, but under the supervision of the Provincial Cadastral Services (SPGC). Considered as a new approach, methodologies, and approaches have been evolving throughout the years, and some integrated directly into the legislation, such as Social Preparation, which is an approach developed by Community Land initiative to empower rural communities to lead development processes in land-based context.



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Community Land initiative (iTC) plays a significant role in supporting the Government on delivering community land delimitation. Since 2006, iTC has been improving its approach and focusing its activities on areas that are prominent to receive large land-based investments. The objectives and key results achieved by iTC are presented in Box 1.

## **Box 1. Community Land initiative (iTC) – Objectives and Results**

From 2006 to 2014, Community Land initiative (iTC) was a Project funded by a group of donors (United Kingdom, the Netherlands, Switzerland, Sweden, Denmark and Ireland) and Millennium Challenge Corporation (for the period of 2009 to 2013) to implement activities related to secure community land rights in the provinces of Cabo Delgado, Gaza, Manica, Nampula, Niassa, Sofala Tete, and Zambézia. From May 2014, with the same donors, iTC is the process of institutionalization, aiming to become a Foundation. The initiative main objective is to support the Government of Mozambique to secure community land use rights, through registration in the cadastral services of their limits and rights, as a contribution to promote rural development. Community Land initiative tends to elevate and empower community based organizations so they can become active actors of their development, leading the planning and implementation of activities that promote sustainable land and natural resources use and management.

Main activities of iTC includes (i) Land delimitation and demarcation, based on the land law; (ii) Capacity building of rural communities; (iii) Sensitization and awareness rising in regards to land and natural resources management. These activities are implemented in a contract arrangement with selected service providers in each province.

Results from iTC support since 2006 to November 2017 are as follow:

**Number of Community delimitations:** 1066

**Number of hectares secured through community delimitations:** 10 million

**Number of land demarcations:** 850

**Number of hectares secured through land demarcations:** 51 hectares

**Number of community members supported:** 3 millions



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## **Percentage of women supported as community members: 55 %**

Recent achievement was the approval, during the Annual Land Consultation Forum, of the Social Preparation, as a tool to be integrated in the Community Land Delimitation process. Along with above mentioned results, a compilation of iTC lessons learned was produced, which reflects evidences of key issues that can contribute to improve community – investor partnership and other land administration issues, related to community rights.

Community land delimitation has proven to be an important contribution to the land administration system in Mozambique, as it improves the cadastral database, and empowers rural communities in engaging into sustainable land use practices. As results of iTC's more than ten years of experience on securing community land rights, key challenges still remain, when it comes to the improvement of land administration and promoting sustainable development.

## **2.1 OPPORTUNITIES FROM SECURING COMMUNITY LAND RIGHTS**

Delivering community land delimitation as legislated is challenging in the current country socio-economic context, where there is a slowdown in the economic performance (The World Bank, 2017) and high demographic indexes. Nevertheless, progress in transforming natural resources into real economic opportunities, requires a proper land administration and management. As results of iTC's community land delimitations approaches and products, some opportunities for both land administration and sustainable development are mentioned below.

### **Community development agenda: participatory planning for development**

In the process of delivering community land delimitation, iTC's approach includes a Social Preparation Phase (see Figure 3), and technical procedures for delivering a participatory community land delimitation. A full guideline for delivering community land delimitation has been produced by iTC. Social preparation is a participatory planning tool, that aims to empower rural communities to lead sustainable development

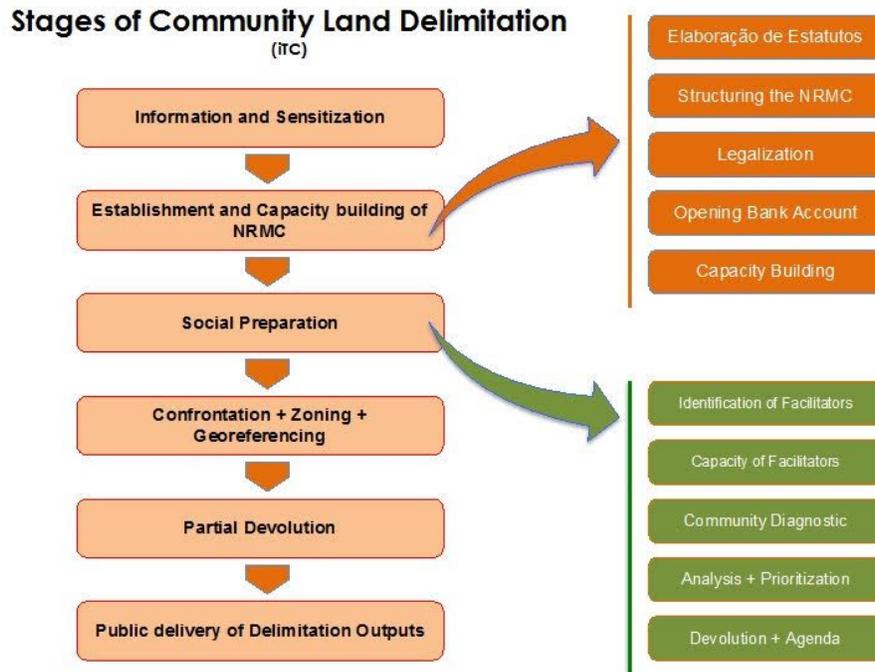


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based on the adequate use of their surrounded land and natural resources opportunities. Box 2, describes the Social Preparation process as implemented by community land initiative.



**Fig. 3:** Steps for delivering community land delimitation: iTC’s approach

## Box 2. Social preparation

As result of the iTC’s first performance evaluation on 2008, a recommendation to add value and create ownership to the iTC beneficiaries in all land delimitations activities (Boyd & Calengo, 2008) led to the creation of a participatory tool: iTC Social Preparation. Social preparation is considered a natural resources management-planning tool, on which rural communities are engaged on definition of their on development priorities based on the use and management of natural resources. As a tool, Social Preparation is implemented in every land delimitation activity supported by iTC, and the result is the creation of a Community Development Agenda, that reflects a short long-term aspiration of the communities in regards to their development priorities. Social preparation, as part of the delimitation activity, involves the following steps:



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- 1. Identification of community facilitators.** Through a participatory process, these community facilitators are selected within community members, and have the responsibility to collect information and transfer knowledge back to the communities.
- 2. Training of the community facilitators.** The selected community facilitators are trained on various techniques to collect information about economic, socio-cultural, and environmental aspects of the community, all referenced into a historical profile.
- 3. Participatory Rural Appraisal.** Based on familiar techniques of rural appraisal, all relevant information that helps to describe the life in the community is gathered and processed.
- 4. Devolution.** The process of presenting back to the communities all the information produced, for validation and ownership by all community members.
- 5. Community Development Agenda.** The agenda reflects the aspiration of the communities in long-term spectrum, and how willing they are to use the available natural resources to achieve each of the prioritized development needs.

As part of the principle stated in iTC gender strategy, all the social preparation steps are participatory, and gender sensitive. Today, iTC is dedicating efforts to widespread the approach among various actors, including the government, as a key player to ensuring the implementation of the approach under the land law.

Social preparation output is a community development agenda, which highlights the basic development aspiration of a rural community who does not have much at stake. As for development practitioners, the compilations of rural community development aspirations are the basic key to (i) design a ground level development program, and improve the current local district level socioeconomic development plan; (ii) improve Social Corporate Responsibility, linking real business and economic opportunities to livelihood improvement and empowerment; and (iii) improve benefit sharing and allocation of financial benefits coming from tax contribution of natural resources-based investments, such as mining, tourism, fisheries and forestry.

Improvement and dissemination of these community development agendas is a solid opportunity to boost economic and social investment in rural communities, supporting both government and investors to deliver a sustainable and inclusive development approach.



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## **Natural Resources Management**

The rational use and management of available natural resources (water, soil, forest, mining, etc.) for the quality of life today without affecting the quality of life tomorrow is referred to as Natural Resource Management. Mozambique natural resources abundance has attracted various national and international business interests, creating a real challenge to avoid the resource curse paradox. As most of the rural communities in Mozambique lives where most of these natural resources occur, registering community land rights creates opportunities for inclusive development. Furthermore, the opportunities for a community based natural resources management allows for community land and resources mapping. Despite rural communities direct dependence on natural resources (Lee & Neves, 2011), legal access to these resources are not clearly defined, and access to information is not easily available, setting a risky scenario for land and natural resources conflicts. Participatory mapping the community key resources and land improves the access of information for communities, government and investors, making it easy to plan access, allocation, use, and management of natural resources at community level.

## **Community-Investors Partnerships**

Community land delimitation brings an opportunity to elevate the knowledge of rural communities livelihoods, and through mapping, information about natural resources are also made available. Community-investors partnerships are presented with the opportunity to improve land use for development. Some of these opportunities include: (i) identification of new agriculture and natural resources value chains, bringing new economic opportunities for rural communities, in production, manufacturing, and services perspectives; (ii) development of community-based enterprises as result of capacity building being delivered during the community land delimitation; and (iii) combining more natural resources management and business development training, communities can build community organization.



### 3. CADASTA PLATFORM: AN OPEN, VERSATILE, AND PARTICIPATORY APPROACH

Cadasta Foundation is a Washington, D.C. based nonprofit organization that works to meet the growing demand for documenting the land and resource rights of those left out of formal land administration systems in emerging economies. Comprised of technologists and land sector experts, Cadasta works to tackle land administration constraints with easy-to-use digital tools and technology designed to help its partners efficiently document, analyze, store, and share critical land and resource rights information - particularly in places where governments are failing to deliver the public good of equitable and affordable land administration.

#### Cadasta Design Principles

Cadasta's set of tools have been designed with the following principles in mind:

- **Open data.** Cadasta recognizes the tremendous potential of open data to access and share information. Open data can reduce barriers to development, promote conservation, reduce corruption, improve land related services and disaster response (Ferris, et al., 2017). For these reasons, Cadasta promotes open data with their partners and on its platform. To meet these standards, the Cadasta platform allows for data sharing among users while also keeping users' privacy and security in mind by offering user determined permission settings.
- **Ease of use.** Classical approaches to documenting land rights have typically made use of powerful but complex - and often expensive- software and mapping tools. These tools often require skilled and trained personnel to assist in mapping lands and gathering information. Under most of the circumstances where data is being collected and properties mapped, the availability of technically trained staff is limited due to the remoteness of the areas, and the limited or inexistent budget to contract needed expertise. The use of simple, easy-to-use mapping and data collection tools opens the door for non-technically savvy people to collaborate and make the process much more efficient and inexpensive. This approach makes it possible to overcome technical entry barriers and makes it possible to quickly train local people in the use of data collection tools to document land rights. An additional benefit of training local users is that it utilizes their



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familiarity with the region and enables more trusting relations with community members. Simple design interfaces is at the core of Cadasta's tools so that local communities can collect and manage their own data. By using the ODK Collect mobile application- a freely available and easy-to-use app for Android based devices- the Cadasta team has successfully trained local community members with fairly limited technological knowledge to collect their own data in the local language in just a matter of a few hours.

- **Collaborative approach.** Many different actors are involved in land and property rights, from landowners and leaseholders, to governments and land agencies. However, the required government staff and resources to map and document large areas of land are often very constrained. By involving local communities in the data collection and mapping process, Cadasta's strategy is both time and cost efficient.
- **Offline use.** Collecting information from the field can be a challenge when telecommunication infrastructures are lacking. Thus, when working in these environments, it is necessary for any data collection tool to function offline and allow users to submit information to the cloud when connectivity is available days or even weeks after the data collection process.  
Cadasta actively collaborates with partners that are working in remote areas without any internet connectivity. To do so, Cadasta utilizes ODK Collect's mobile application to collect data offline. Once connected to the internet, the Cadasta platform is able to be synchronized with the mobile agents to ensure the data is up to date.
- **Versatility.** The needs of each project and partner vary depending on the program's key objectives- which can include advocacy, tenure regularization, or documentation of land use- and in this sense the accuracy and quantity of information being demanded varies greatly. A successful set of tools needs to adapt easily to various needs, while also being flexible enough to not need an ad-hoc solution any time a new project arises. Cadasta platform's unique capability to generating a customizable data schema for every project in the platform allows great flexibility in the variety of different partners' goals. Each project has its own set of data attributes associated with each entity type, either a geometry, a party or people entity, or a relationship. External



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objects in the form of resources are also allowed to be attached to each entity, permitting to associated documents, pictures or even audio or video files to the project records.

- **Free of use.** Last but not least, the setup and maintenance costs required for collecting, managing, and storing the land rights data and information needs to be affordable for all. Given the constrained environments that Cadasta's partners work in and the amount of information that needs to be managed, Cadasta's services are offered at a low or zero cost. Another important factor that affects Cadasta's willingness to offer their tools and services at low to no cost is the often unreliable intermittency of project budgets. It is quite common for partner organizations to see periods of time where there are no resources assigned to maintain their project data, which could put their data maintenance and security at risk.

In this sense, as Cadasta is a non-profit generously funded by its donors Omidyar Network Foundation and UK Aid, any platform user is free to register and start creating their projects by their own and without any limitation or cost. The Cadasta platform is totally distributed and cloud based, and no infrastructure beyond a simple computer connected to internet is required to start working and managing projects.

In addition to offering their tools free of charge, Cadasta offers remote and in-person trainings to key partners, and occasionally participates in pilot projects with organizations that are working in the field. In July of 2017, iTC-F and Cadasta ran a pilot project for collecting data in remote communities in Mozambique. This pilot served as a base to build a refined methodology to collaboratively document land rights in rural areas and also to execute the devolution process to the local communities.

## **Cadasta Platform and Set of Tools**

Cadasta's platform and set of digital tools are designed to help partners efficiently document, analyze, store, and share critical land and resource rights information. The platform is designed to capture information about land tenure and resources as well as their relationships with people, in order to provide a simple method to analyze and consult the information.



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The platform is organized around projects that belong to organizations. Each of the organization members are able to have different roles with different levels of permission in each of the projects. A project is composed by different types of entities:

- Location entities, formed by a spatial geometry and its data attributes;
- Parties, which represent the individuals or groups of people that are related to those locations. As in the location entities parties are entitled to have related data attributes; and
- Relationships, where different types of relationships can be defined and customized to link each party with one or more location entities.

External objects, including multiple audio and video files, pictures, documents, spreadsheets and more, can be attached to any of those entities to support the documentation. All the information, including each entity type and resource, are searchable via the integrated search tool. Also, several layers of highly accurate imagery from Digital Globe are provided for all Cadasta platform users at no cost, being the users are able to dynamically switch different basemap layers from the web interface.

The process to set up the basic structure to start working with the platform is simple and intuitive, with the user simply needing to sign in, create an organization and start adding other platform users to that organization. Multiple projects are allocated within the organizations and each of those have different data schemas defined, which have had been previously specify by users via *xlsform* templates that are provided by Cadasta. Cadasta Program staff also assist users to create and optimize those data schemas. Multi-language support is integrated at all levels in Cadasta tools.

There are multiple data entry points in the platform:

- The web user interface provides a simple yet powerful mechanism to enter data. This is a useful procedure for partners looking to transcribe paper-based information into a digital format.
- Through mobile applications such as ODK Collect and other compatible apps, land surveyors are able to submit geometries and all data attributes from their mobile devices in simple and smooth way. Those applications are very low-demanding in terms of device hardware requirements, thus it is possible to perform data collection from fairly inexpensive Android devices. This is by far the most popular and convenient way of populating projects and specifically when field data collection happens in remote areas with poor or no connection to Internet. By using these



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applications it is possible to postpone the data submission process and work totally offline when needed.

- A QGIS plugin has been developed provides a direct and simple interface with the popular, free, and open source GIS tool in the market. Authorized users from the organization are able to push their data- geometries and attributes- from their datasets in QGIS directly to new or existing projects in Cadasta platform, and at no cost. This is a powerful mechanism to migrate large datasets managed by more geo-skilled organizations.
- The web based platform also offers a simple interface to import datasets via *csv* files and Excel spreadsheets. This provides a simple and robust procedure to import data for those organizations that are not familiar with GIS tools.
- For those highly technical organizations aspiring to integrate their existing databases and front-ends against Cadasta systems, a public API is available offering reciprocal features than those exposed via the web UI.

Similarly various output routes are available for extracting the land related information from the Cadasta platform:

- First and most importantly, the web user interface is designed to quickly and intuitively access land records either by navigating through the map, using the search tool, or filtering via party entities.
- Data exports via web interface in shapefile or Excel format are also available. Users are able to use the data exports to process geometric data with a GIS software, or to migrate their information into a different platform. Cadasta does not retaining the information and partners are always the owners of their data, eliminating any exit barrier from the platform.
- Through QGIS plugin authenticated Cadasta users are able to download all the information belonging to a Cadasta platform and process it using the QGIS software. Cadasta has developed specific and detailed tutorials to create advanced map reports with Cadasta project datasets with the help of QGIS Print Composer functionality.
- Lastly, for the more technically savvy organizations integrating their databases or user interfaces with Cadasta backend the public API is a mechanism to highly personalize the interaction with the final users.



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Traditional land management system usually requires of an ad-hoc IT infrastructure that needs to be allocated in partner's premises. This is an expensive, inflexible, and potentially more insecure approach, and there is an increased risk of losing the information when systems cannot be properly maintained due to logistical or financial challenges. The Cadasta platform is following a more flexible, secure, and efficient strategy, as it is relying on a distributed platform based on AWS PaaS, which allows users to optimize costs- with Cadasta assuming all hosting and maintenance costs- and provides optimal software security as well as data integrity and availability.

## **4. PILOT PROJECTS WITH CADASTA**

In July 2017, iTC-F and Cadasta spent several weeks working in the field to pilot a project to outline the necessary data structures, forms, procedures, and analysis tools for mapping communities including individual properties, communal plots, and community resources.

A number of training sessions were scheduled covering the following topics: i) the role of Cadasta and the benefits of using digital tools in land tenure and property rights documentation; ii) impact of securing the property rights of impoverished populations; iii) data privacy and ownership considerations when managing land rights; iv) set up of cloud environment to start collecting data; v) definition of data schemas associated with the questionnaires to be produced for use in the field; vi) use of ODK collect mobile application to gather data and map plots; vii) use of web user interface to introduce data records, analyze the information, execute search queries, and export the information; viii) management of user accounts permissions to establish the appropriate information access levels; ix) use of QGIS tool; x) import data from Cadasta platform into QGIS software; and xi) generation map reports.

As a result of these training sessions, key staff from iTC-F were able to autonomously set up their own user accounts and organization, as well as project settings and permissions. Thereafter a testing environment was prepared for piloting an experience in four communities in two different provinces of Mozambique: Mobanguene and Macia in Gaza province, and Belas and Chitundo in Manica.

Prior to going to the field, a project questionnaire was prepared for gathering data associated with both parcel plots and resources from the community, which included: i) community identification; ii) contact



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details from the person being interviewed; iii) type of mapped location- community boundary, parcel, forest, mining area, building, household, right of way, school, hospital, road, water source, sewage, water channel, electricity point, public transportation, cemetery, sacred place, market, shop, and church; iv) type of tenure relationship; v) spatial geometry- which could be obtained from the mobile application by selecting a point on the map, drawing a polygon or a polyline, or walking through the limits of the location to generate the polygon or the polyline; vi) pictures of points of interest; vii) location known name; viii) registration status regarding DUAT; ix) farming information; and x) livestock information.

## Mapping a community: Mobanguene

To document the process of documenting land and resources from Mabanguene- a small agriculture community in Gaza province- the following steps were followed:

1. A week before commencing the field work in the community, a staff representative of iTC-F visited the community to inform to the council about the pilot project to be performed, addressing and clarifying all concerns and questions that the community could have. This stage is critical for the effectiveness of the exercise, as the active collaboration and the total trust from the community is key for the success of the mapping experience.
2. A project for documenting households and resources in the community was created in Cadasta platform.
3. As iTC-F usually works with service providers which are supporting the work in the field, a simple two-hour training for using ODK Collect connected to Cadasta platform was delivered to service provider's staff.
4. User accounts to authenticate service provider's staff were created, and appropriate permissions to access data and submit new records from the mobile application were granted.
5. ODK Collect application was installed in tablet devices, and the necessary authentication settings were included to download the project form to collect data offline.
6. An external GPS device was paired with the Android tablet to improve GPS accuracy.
7. Mobanguene community had already geodata collected, and approximately one thousand geometries were already documented and available via *shapefiles*. Cadasta QGIS plugin was used



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to import those existing locations into the Mobanguene project, so that additional data collection would be completing this existing dataset.

8. The team went to the community to attend to an introductory meeting with community members that wished to be present. The goal of the project was again explained and data surveyors were introduced to the community.
9. Participatory maps developed by the community in the past -with the assistance of iTC-F- were analyzed to identify the key resources that needed to be documented.
10. A few members of the community accompanied data surveyors to locate the resources to map. Those resources included water sources, a cemetery, a soccer field, a school and a local health facility.
11. After the data collection exercise, a map report including the existing household information, and the new resource information was created.
12. A devolution process for the community was done, presenting the information already existing and uploaded to Cadasta platform, and the new data with regard to the community resources newly collected.

## 5. THE SUGGESTED COMMUNITY MAPPING APPROACH

As mentioned above, mapping is the most valuable tool for accessing information, and when combined with the latest information technology, it delivers vital and valuable information in real time. As mentioned by Bringezu, *et al.*, 2016, good governance and management based on information, data, and indicators are requirements for a sustainable natural resources use.

Participatory mapping delivered during the community land delimitation process needs to be improved, to make it easier for data to be analysed and information to be available for planning at the community, district, and national level. The availability of these maps make it easy for third parties and governments to make the right decisions regarding allocation of land, while respecting sociocultural points of interest for rural communities and contributing to implementation of the national plan for sustainable agricultural development, as stated in the Guiding Principles on large scale land based investments in Africa (African Union, 2014).



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Additionally, the collection of adequate land use information at the community level, through a combination of participatory and high resolution mapping, can lead to key improvements in Mozambique's LIS. These improvements can include: (i) a more responsible and participatory community consultation process when lands are allocated to investors; (ii) improved land use planning at the local and district level, contributing to a more balanced rural-urban development; and (iii) feasible information assessment for both investments and resettlement processes. The availability of modern mapping tools will likely improve access to land information in real time, especially for marginalized communities and community members, such as women. Additionally, these modern mapping approaches and technologies will make investments more inclusive and avoid land conflicts, as sensitive land features will be more carefully mapped with community involvement.

Figure 4 illustrates a sample of a participatory map from the community land delimitation process, which is then photographed and included in the community development agenda. The elaboration of maps (social, resources, infrastructure, etc.) under the social preparation phase can be highly improved, using satellite images to cadaster various features at community level. This improvement will automatically improve the dataset at community level, creating an opportunity to build a specific geospatial cadastral dataset at community level that can be useful in the territorial planning at community level. As mentioned by Macarringue *et al.*, 2015, the use of spatial dimension can improve land use planning. Using the Cadasta platform to improve the visibility of participatory maps, might become a game changer in land use planning at community level, as well a huge contribution to the land administration system in the country.



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**Fig. 4:** Women holding a sample of a participatory map

A community pilot project is current under implementation, and includes the following steps of implementation:

- Development of data collection forms, based on current community land delimitation approach;
- Capacity building of iTC service providers on managing data in the platform and data collection through ODK collection;



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- Participatory data collection in Delimited communities, in order to identify and collect key points of interest in the community. This is a participatory process that requires engagement of rural communities and the leaders. The available paper-based participatory map is important for selecting the key points of interest;
- Data analysis and elaboration of maps. Using geographic information tools, data will be analysed and maps will be printed, as result of combination of other geographical information layers;
- Deliver the maps back to communities and districts government. Information needs to be available at local level (community and district) as basic tool for land use and natural resources planning.

Data is expected to be collected in 16 rural communities, covering provinces supported by iTC, where community land delimitation have been implemented. Expected results and impacts includes:

- An accurate information of rural community participatory map, illustrating current land use, important key point of interests, location of important natural resources and their relation with the people;
- Improvement of Community consultation, as maps shall be considered as an important tool during meeting between communities, private sector and government;
- Improvement of land use planning at community level, lead by the community-based organizations, as path for integrated sustainable management;
- Improvements of community information availability, as result of networking with active and potential stakeholders involved in sustainable development in the region.

Combining community land delimitation and the Cadasta platform in delivering an accurate participatory mapping approach will push the land administration system to respond to current land use and natural resources management challenges, while meeting the rural communities basic development needs. Improvement in land delimitation processes and, especially, making this information available to the community through the devolution process will also greatly enhance land use planning and inclusive decisions for land-based investments.



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## FIGURES

Figure 1: Delimited communities under the Terra Segura program

Figure 2: Parcels registered and DUATs delivered to the beneficiaries of Terra Segura

Figure 3: Steps for delivering community land delimitation: iTC's approach

Figure 4: Women holding a sample of a participatory map