



Land Governance in an Interconnected World

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HARMONIZING LAWS AND REGULATIONS WITH NEW TECHNOLOGIES AND INNOVATIONS IN LAND ADMINISTRATION

TAREK ZEIN

Hansa Luftbild AG, Germany
zein@hansaluftbild.de

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Abstract

Over the last decade innovative technologies and methods have been developed to demarcate land parcels and register land rights in an inexpensive and swift way. These new technologies and innovations, such as rectified imagery acquired by aircraft, satellites or drones / UAVs or UAS, are now used by the fit-for-purpose land administration approach in order to register land rights systematically. Though these innovative technologies have been applied in some developing countries for land registration there is a time lag between such developments and existing land legislation. The land legislation in developing countries often appears to be out of date which is impeding the legal application of innovative technologies. In addition, the lack of or the existence of difficult to implement UAV regulations is hindering the drone operators to fly UAVs. This is making the usage of drones in the land registration problematic. This paper presents a case study of some of the countries and describe their current drone regulations and land laws and recommends a harmonization of laws and regulations with new land registration methods and technologies.

Key Words:

Drone regulations, fit-for-purpose land administration, land parcel registration, land laws, systematic registration

Introduction

Over the last decade innovative technologies have been developed to demarcate land parcels and register land rights in an inexpensive and swift way. These new technologies and innovations, such as rectified imagery acquired by aircraft, satellites or drones / UAVs or UAS, are now used by the fit-for-purpose land administration approach in order to register land rights systematically. Such swift and inexpensive technology, which acquires accurate and high resolution aerial imagery using drones, is attractive to land experts. For sporadic registration mobile data collection technologies have also emerged which can facilitate the registration process. Though these innovative technologies have been applied in some developing countries for land registration there is a time lag between such developments and existing land legislation in many of these countries. The land legislation in these countries often appears to be out of date and hence full legal endorsement of application of such technologies can be impeded. In addition, the lack of or the existence of difficult to implement UAV regulations is hindering the drone operators to fly unmanned aerial vehicles freely. This is making the usage of drones in the land registration problematic. This paper presents a case study of some of the countries and describe their current drone regulations and land laws and recommends a suitable approach to harmonize laws and regulations with new land registration methods and technologies.

UAV in Land Registration

One example of new technologies in use is drones / UAVs or UAS, which have become popular in land administration. Over the last five years drones have found their place in the land governance. They are used to acquire aerial imagery for the spatial capture of visible parcel boundaries and constructed structures. Drones have been used and tested in pilot land management projects in Namibia, Mauritania, Rwanda, Tanzania, Albania, Indonesia, Peru and other countries.

In Tanzania, drones have been exploited in Dar-es-Salaam to acquire aerial imagery used in mapping and modelling flood risks as part of the Ramani Huria project, a community-based mapping project. This project trained teams of local university students and community members from throughout Dar-es-Salaam to use OpenStreetMap to create sophisticated and highly-accurate maps of Dar-es-Salaam with aerial imagery. This imagery was acquired at an average resolution of 5cm and used to produce a drainage map and model the city surface. The mapping data was made openly available in order to promote the use of this information in government decisions when planning for flood mitigation. Figure 1 shows the drainage map which was produced on the basis of UAV imagery.

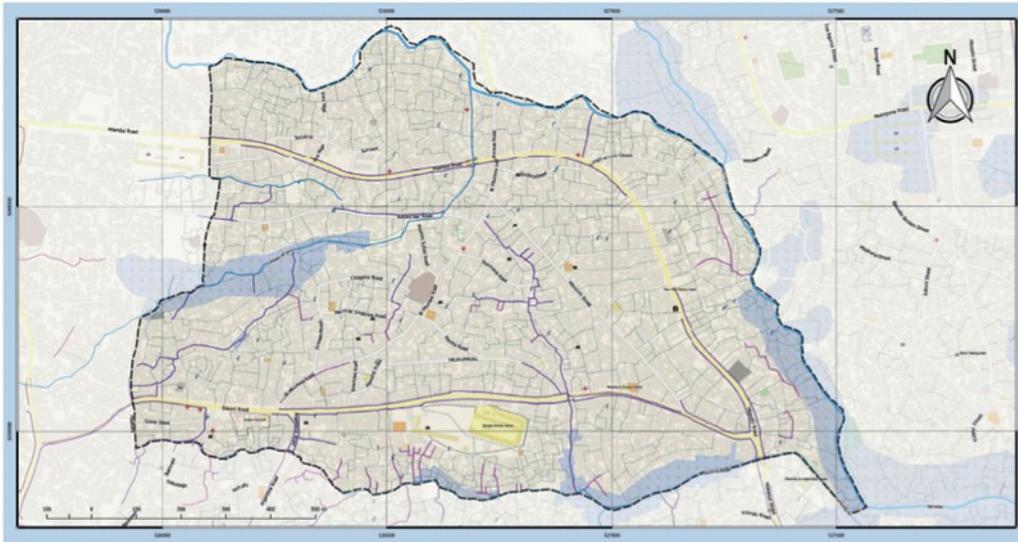


Figure 1: Detailed drainage map that was drawn up with help of the orthomosaics produced from UAV imagery (source: <http://floodlist.com/africa/using-drones-map-model-flood-risks-dar-es-salaam-tanzania>, 2016)

Drones have also been used in the Zanzibar Mapping Initiative to acquire aerial imagery at 7cm and 2.5cm of the Zanzibar isles, Unguja and Pemba, covering an area of 2,300.00 km². This high resolution imagery will be used to produce maps which the Zanzibar Commission of Lands will apply for planning, development, land tenure and environmental monitoring. Using drones is attractive due to the low cost of acquiring and producing high resolution maps. The cost is a fraction of the price of capturing the imagery using satellite or manned aircraft.

In Namibia an informal settlement located at the outskirts of Gobabis, the capital of the Omaheke region, have been covered with high resolution aerial imagery using a drone in 2014. The imagery was acquired at an average resolution of better than 5cm and was used to map customary land parcels on the basis of produced orthophotos. The positional accuracy achieved was better than 10cm, which is more than sufficient for cadastral mapping in rural areas. Figure 2 shows visual land parcel which were mapped using UAV imagery.

In Indonesia a pilot project was carried out to map land parcels using UAV captured aerial imagery in order to compare the boundary mapping with the existing approach which uses terrestrial surveying. The results of the UAV-based parcel mapping method have shown that the accuracy was fully acceptable and the UAV-based method was cost and time effective. Figure 3 shows UAV imagery with mapped visible land parcels.



Figure 2: Orthomosaic showing mapped parcels in Namibia (source: University of Twente, Netherlands – Micro Aerial Projects LLC, USA, 2015)



Figure 3: Orthophoto showing mapped land parcels using UAV imagery captured in Indonesia (source: GIM International, 2016)

Using drones as a reliable and innovative tool in the land registration process, is also being researched and funded by many different organizations, such as the European Commission through the Horizon 2020 its4land project. This project is built around an ICT innovation process that incorporates a broad range of stakeholders with emergent geospatial technologies, including smart sketchmaps, UAVs, automated feature extraction, and geocloud services. It consists of nine work packages. The application of UAVs in land tenure data acquisition is one of work packages.

In addition the World Bank Group has published guidelines about the management of the risks associated with unmanned aircraft system operation in its development projects. The guidelines cover the regulatory frameworks for operating UAVs in different countries, potential operation risks, risk management and recommendations for World Bank Group operations. It also includes an annex which consists of UAV operational checklists.

Fit-for-Purpose Land Administration

The fit-for-purpose land administration approach (FFP) is a method that has proven itself as a fast and accurate procedure to mass register land inexpensively and swiftly. The principles of this approach are flexibility, inclusiveness, community participation, affordability, reliability, attainability, and upgradeability. This approach has been applied in many countries in Asia, Eastern Europe and Africa. It was used in Rwanda where more than ten million parcels were demarcated and registered over a period of 4 years (2009 – 2013). It is currently being used in Ethiopia, Mozambique, Indonesia and other countries. This approach is well described in the Fit-For-Purpose Land Administration FIG Guide.

In Mozambique this approach was first piloted in a project in 2016 to establish the methodology that best fits that country to achieve the goals of the tenure security program which was set by its government. These goals are the regularization of five million parcels and demarcating four thousand communities in a period of 5 years. The pilot project results have shown a reduction in the time needed to demarcate the communities, a reduction of 30% in budget required for tenure security, reducing the malpractice of land registration through transparency of processes, community satisfaction due to their participation in the processes, and enhancement of the land cadastre by producing accurate and complete data.

The FFP approach is also currently being used by the Land Investment for Transformation (LIFT) project in Ethiopia. The project, funded by the Department of Foreign International Development of the United Kingdom, plans to mass register and issue second level land certificates for fourteen million parcels in less than six years, from 2014 to 2020.

UAV Regulations

UAVs as a swift and inexpensive technology which accurately acquires aerial imagery for usage in demarcating visible land parcels is attractive to land experts. However, the lack of regulations or laws to fly drones is not allowing the drone operators to fly unmanned vehicles freely. Even if a developing country has regulations which allow the flying of drones, the relevant civil aviation authority of such a country has often drafted these regulations which are difficult to interpret or to implement for drone operators. This makes it hard or impossible for the operators to fly their UAVs. A lack of clear or implementable regulations is hindering the use of drones at a larger scale, and these are urgently needed in the land administration sector.

The International Civil Aviation Organization ((ICAO), which is a United National specialized agency responsible for regulating international aviation, has 191 member states. On its website <https://www4.icao.int/uastoolkit/Home/BestPractices> it lists 32 countries with state regulations regarding the operation of UAVs. Only South Africa is listed on the website as having UAV regulations in Africa. However, other websites such as <https://www.droneregulations.info/index.html> or <https://www.airport-uav.com/> show that more countries in Africa have UAV regulations. Figure 4 shows the African countries which supposedly have UAV regulations according to the www.airport-uav.com website. However, when checking for the Ethiopian regulations one will notice that these are not yet available. This could be confirmed within the its4land project. This project includes the execution of UAV flights in Ethiopia, Rwanda and Kenya. Figure 5 shows a map of the three East African countries which are involved in that project.

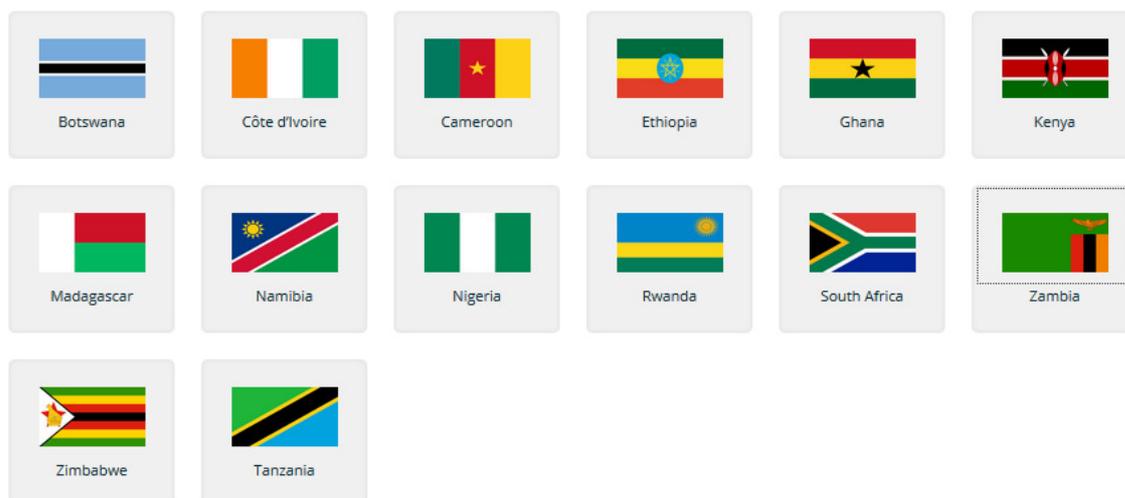


Figure 4: African countries with supposed UAV regulations (source: www.airport-uav.com, 2018)



Figure 5: Map of the three East African countries involved in the its4land project (source: www.droneregulation.info and Hansa Luftbild AG, 2018)

The drones to be used in the its4land project are fixed wing aerial vehicles which are equipped with high precision GPS and Inertial Measurement Units (IMU).

In Ethiopia no UAV flight in the its4land project could be carried out over the last one year period due to the lack of a flight permit and non-existent regulations.

In Kenya UAV regulations were introduced in October 2017. The UAV regulations in Kenya require the operator to register the UAV with the Kenyan Civil Aviation Authority (KCAA). However, before registering the UAV the KCAA will have to obtain the necessary security clearance from the relevant security agencies and the approval of the Ministry of Defense. In addition, the Kenyan regulations require the pilot of the UAV to be certified though the regulations don't specify by whom certification should be. To date no UAV flights could be carried out within the its4land project in Kenya. However, the KCAA has issued on January 29th an authorization to operate a UAV in order to acquire aerial imagery which will be used in mapping Mailua in the Kajiado county, which is a study case location in the its4land project.

Rwanda enacted its UAV regulations / laws in March 2016. The Rwandan regulations apply to individuals conducting UAV operations within the Rwandan airspace with a maximum take-off weight of 25kg. The UAVs are to be flown only within the visual line of sight of the pilot and are allowed for the following activities:

- aerial photography/filming;
- agriculture for crop monitoring/inspection;
- search and rescue or delivery of emergency supplies;
- research and development;
- educational / academic use; and
- recreation / leisure.

The following are the rules of these regulations / laws in brief as displayed on the website www.droneregulations.info:

- All UAS / UAVs must be registered
- A remotely piloted aircraft is eligible for registration if it is owned by: the Government of Rwanda or one of its institutions; a Rwandan or any other person legally residing in Rwanda; bodies incorporated under the Rwandan laws
- The permit may be obtained by submitting the application form, evidence of ownership (sale receipt or similar) and a registration fee.
- The registration number must be displayed prominently on the UAV.
- Local authorities must be notified before launch and flight of the UAS and consent from property owners must be sought if launch and landing is to take place on that property.
- Night operations are not permitted under these regulations.
- The operator must maintain visual line of sight to be able to a) maintain operational control of the remotely piloted aircraft; b) know the remotely piloted aircraft 's location; c) determine the remotely piloted aircraft 's attitude, altitude, and direction; d) observe the airspace for other air traffic or hazards; and e) determine that the remotely piloted aircraft does not endanger the life or property of others.
- A person may only pilot one UAS at a time.
- The pilot must avoid other aircraft and yield right of way to all aircraft and vehicles
- UAS may not be operated over people or crowds and may not be operated in controlled airspace unless prior authorization by air traffic control has been granted.

- Operators must have a remotely piloted aircraft system operator certificate (ROC) in accordance with the specifications laid out in the regulations
- Operators must have a remote pilot license (eligibility requirements are laid out under (31).
- Use of UAS is strictly limited to public (governmental) functions such as deliver of disaster or emergency supplies, search and rescue, and other government operational missions.
- Failure to comply with these regulations is liable to a fine not exceeding twenty million (20,000,000) Rwandan francs and licenses may be revoked.

Source: www.droneregulations.info

The regulations state every drone coming into Rwanda must be registered by the Rwandan Civil Aviation Authority (RCAA). In addition to the registration the operator requires an operator permit issued by the RCAA. The rules to obtain such a permit are very strict and currently there is only one company with such a permit in Rwanda. In addition, drone pilots have to be certified to fly their UAVs. Though the Rwandan UAV regulations state that the applicant for the UAV pilot certificate should include a knowledge test report showing that the applicant passed an initial aeronautical knowledge test it does not state where this test should be conducted. However, experience has shown that the RCAA accepts test results issued by UAV training schools which have the National Qualified Entity (NQE) status in the UK or by an FAA-approved knowledge testing center in the USA. In addition, experience has shown that only a drone operator, whose pilots are holding certificates for the UAV types which are accepted by the RCAA, may request a flight permit. Such a permit is then issued in accordance with the tight Rwandan flight regulations. In case a different drone model is operated by the pilot then the RCAA will request the pilot to undergo training for that particular model to prove that he/she can operate the drone. Hence it is very difficult for a drone operator to obtain the operator permit and certify his pilots in Rwanda.

As a consequence of these regulations the its4land project had to enter into a partnership with the only company which has the UAV operator permit in Rwanda. The company became the operator of the project's fixed wing drone but not its owner. The certified pilot of this company had to be trained on this UAV at the site of the drone manufacturer in France in order to allow the company to fly the drone. In addition its4land project staff in Rwanda had to travel to Wales in order to be assessed for their aeronautical knowledge at a UK Civil Aviation Authority (CAA) compliant UAV training school. This will allow the Rwandan staff to apply at RCAA to become Rwandan certified drone pilots. The RCAA pilot certificates are a requirement for the drone operators in order to apply to RCAA for an operator permit. The certification procedure briefly described in this paragraphs shows the difficulties which are facing drone operators in Rwanda.

The Rwandan regulations which require an applicant for the pilot certificate to have aeronautical knowledge test results from a UK recognized school or from a FAA-approved knowledge testing center makes it prohibitively expensive for local drone operators to operate in Rwanda and thus making initially affordable technology prohibitively expensive.

In comparison with the Rwandan regulations the Indonesian UAV regulations are less restrictive and simpler to implement. These state

- UAV flights are prohibited in controlled airspace, prohibited areas and restricted areas;
- UAV flights are allowed to be operated within uncontrolled airspace but only up to 150m.
- Small UAVs <55lbs can be used for hobby/recreational purposes and must comply with CASR Part 107.
- UAVs >55lbs should obtain experimental certificates / special flight permits as stated in 21.193 CASR Part 21
- Drone pilots that intend to fly for photography / videography should have a letter from their institution stating the reasons for and the use of the imagery.

Source: www.droneregulations.info

Land Laws and Legislation

In many developing countries land legislation decrees high precision field surveys with conventional cadastral systems in order to determine the boundary of a land parcel. Conventional cadastral systems are slow and not suitable for mass land registration due to the amount of work, expertise and costs involved. This is seen as a hindrance by the majority of the small land holders to formalizing their informal land right. These land holders want to secure the land tenure by having their land demarcated and their rights registered swiftly and inexpensively. Thus, small land holders would like to see their government legislating for and embracing the new technologies and approaches in order to regularize their land rights.

In Ethiopia the Federal Government distinguishes between rural land and urban land. Accordingly it has enacted two proclamations, one being the Rural Land Administration and Use Proclamation 456/2005 and the other being the Urban Lands Lease Holding Proclamation 721/2011. The rural land proclamation stipulates under Article 6 that the sizes of the land holdings be measured by the competent authorities using traditional and modern measurement equipment. The urban land proclamation stipulates under Article 8 that urban land should be parceled and delineated prior to offering it for tender. Both proclamations don't stipulate the use of the FFP approach even though this approach is being used in Ethiopia, most recently in

the LIFT project as previously mentioned in this paper. Though both proclamations are enacted by the Federal Government, regions are permitted to develop their own legal system in alignment with these.

Kenya's land laws which can be viewed and downloaded from <http://www.kenyalaw.org> don't endorse the fit-for-purpose land administration approach even though the main land concerned laws were revised recently. For example the Land Act, the Land Adjudication Act, the Land Registration Act and the Survey Act which were revised in 2012 and 2016 do not legally endorse the FFP land administration approach.

In Rwanda the Organic Law 08/2005 which determines the use and the management of land stipulates that the registration of land is obligatory. However, it does not stipulate a methodology for demarcating and registering the land. Nevertheless, Rwanda has registered more than 10 million land parcels using a FFP land administration approach through the Land Tenure Regularisation Programme. This approach was embraced by the Rwandan Government because of international support and encouragement, which it received, in order to carry out the mass land registration exercise in a swift and inexpensive way. One would claim that without the international support, Rwanda would not have applied the FFP approach for mass land registration. After the mass land registration the Rwanda Natural Resources Authority, which is responsible for land registration, and issuance and holding of original land deeds, published the Land Registration Procedure Manual. This manual is a detailed guide to the Rwandan land administration system and describes the procedures to be followed for land transactions. Though the manual is comprehensive it lacks the guidelines which would allow the adaption of methods and technologies which fall within the FFP approach.

In Indonesia the Government Regulation No. 24 of 1997 under Article 2 states that "Land registration shall be implemented on the basis of the following principles: simplicity, safety, affordability, currency, and transparency". These principles partially coincide with the FFP land administration approach. In addition the use of photomaps in cadastral data acquisition is regulated by the Government of Indonesia through Presidential Decree No 34 of 2003 which concerns the national land policy. The decree directs the Indonesian National Land Agency (BPN) to accelerate the development of land information systems with a database of land assets, textual and spatial data to be used for land registration, cadastral mapping and an inventory of land tenure and ownership. However, cadastral data acquisition is still undertaken using a terrestrial method - measuring tape, electronic total stations or GPS receivers, in accordance with the guidelines of BPN. Hence, the guidelines for the data acquisition of the cadastral boundaries is considered outdated because the photomap is just used as a sketch map while the measurement of the boundaries is made terrestrially.

Recommendation to Harmonize Laws and Regulations

As described in the laws of the four case countries the FFP land administration approach is not legally supported through necessary legislation and applicable laws even though these countries have technically and practically applied this approach. The guide of the fit-for-purpose land administration approach, published in 2016, sets out three key principles: the spatial framework, the legal framework and the institutional framework to be considered by countries wanting to apply this approach. These principles clearly define an implementation strategy for developing countries. If the strategy is applied properly then the fit-for-purpose land administration approach will prove workable without causing a large scale land conflict between the land administration authorities and the people. Though all three key principles are important the legal framework is the one that should be set-up first prior to applying the fit-for-purpose approach.

A flexible legal and regulatory framework can ensure effective land administration. Such a framework provides for an adaptive tenure system consisting of a compliant registration system and can cover the land administration functions of land tenure, land value, land use and land development. By enshrining the FFP land administration approach in the respective land laws and regulations the legislative bodies pave the way to formalizing and regularizing the informal situations of land holders. Tenure security for land holders ensures economic progress which in turn can alleviate poverty and provide political stability.

Therefore, the endorsement and the application of new technologies and innovations in the land administration sector will require as a first step the updating, the adaptation and the harmonization of existing land laws and legislation with the application of the new technologies and innovations. If no land law or regulations exist then new ones should be drafted which will allow the usage of the new technologies and innovations in the land administration sector. Land legislation and law should be easy to interpret, easy to adhere to and easy to implement. The law should clearly legislate for the application of the fit-for-purpose land administration approach in order to give the land registration performed with this approach a legal status.

In addition, laws and regulations should also be drafted and passed to allow the usage of new technologies, such as UAVs / drones. The laws for the use of drones should provide clear rules to the relevant civil aviation authority to regulate its airspace. The civil aviation authorities themselves should support the legislators when drafting the laws. They should also set clear regulations about the usage of drones in their airspace. It is essential to issue clear and less restrictive UAV regulations which promote the use of these

new and promising technologies and at the same time ensure that the airspace remains safe and the people, and the private and public properties are protected and not endangered. It is recommended that if knowledge testing centers are to assess the pilot certificate applicants then these should be based in the region of the respective country rather than on a different continent.

Therefore it is crucial that the responsible aviation authority regulate the usage of drones in a manner that is transparent, neutral and clear. This would help the land experts wanting to use drones to set their procedures clearly and bring their drone into the airspace in order to acquire the aerial imagery needed to demarcate the visible land boundaries.

Conclusion

The application of new innovative technologies and methods can speed up the land registration process in the developing countries. The land legislation in some countries appears to be outdated and thus full legal endorsement for using such technologies and methods can be hampered. There is a need in developing countries to harmonize their aviation regulations and their land laws with the new innovative technologies and methods which have been developed.

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