

Smart Sustainable Futures in Land Administration: A Role for Emerging Technologies

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1 Introduction

Securing land rights for all is foundational to the global development agenda yet progress is slow. While issues of power and politics are core to the problem, the limitations and failure of conventional technical surveying approaches, and the corresponding lack of appropriate professionals to undertake these activities, have undoubtedly contributed to a reality where an estimated 70% of the world's land rights remain undocumented in formal land administration systems. Without such information, evidence-based decision-making related to land for realising sustainable development is compromised.

Rapid advances in geospatial technologies now offer opportunities for developing technological interventions to facilitate land tenure information recording. In addition, these interventions are increasingly predicated on the principle of 'responsible' land administration, which advocates methods and tools that are sensitive to, and prioritises local ethical and societal conditions. Increasingly known as a third generation of alternative land tools, these tools seek to improve collaboration between the public and the public sector to facilitate better outcomes in transparency, effectiveness and engagement.

Taken together, we argue that these 'responsible' alternative land tools should be considered instrumental to delivering 'smart'-er land administration. Here, we align with the concept of 'smart' that has become synonymous with the smart city concept in that it focuses on using ICT to more effectively engage local people in cultivating and enhancing collective intelligence about their physical environment. This paper aims to contextualize this argument by presenting ongoing research and development (funded by the European Commission) into four alternative land tools for use in East Africa: UAVs, smart sketchmaps, automated feature extraction and geocloud services. The paper outlines key land information needs that were identified across Ethiopia, Kenya and Rwanda in response to rapid urbanisation. It discusses lessons gained and the potential roles these tools may play in delivering smart sustainable futures in land administration.

2 Emerging Technologies and Their Potential Roles

The needs assessment phase identified needs for an array of both cadastral and non-cadastral data. This was the case even in Ethiopia and Rwanda, where large scale land tenure regularization projects have been, or are currently, taking place. Legacies of land-based conflict in the region also contributed to an evident lack of trust in existing systems and processes. A tendency to adopt participatory methods in these projects have also not necessarily led to ongoing inclusion, leading

to an incremental deterioration in the quality of land information. The impact of not having adequate or appropriate land information in terms of both type and quality is more severely felt in rapidly urbanising peri-urban areas and undermines local resilience to change.

2.1 Smarter content: collect, analyse and share

The most evident role for the alternative land tools is to enable smarter content for land administration. Our work with UAVs in Kenya and Rwanda have produced high geometric accuracy orthomosaics (2-3cm, even pixel-level accuracy in some instances) which facilitate improved analysis such as direct measurement of area and exact identification of visible parcel boundaries and building footprints. Such data can be consumed and processed through an interactive plugin being developed for QGIS where an automatic cadastral object extraction algorithm significantly reduces manual effort in delineating cadastral boundaries. Our smart sketchmapping tool, Smart SkeMa, enables important types of socio-spatial information to be integrated with metric maps. Finally, the development of a web-based platform to host and integrate the results, methods and tools related to the aforementioned tools, as well as enabling integration with data in existing land information systems, is achieved through common APIs and services developed based on open standards and in alignment with the Land Administration Domain Model.

2.2 Smarter processes: closing digital and gender divides

The inclusive attributes of some of the technologies can play a role in closing digital and gender divides. For example, the potential for the web-based platform to improve access to and use of land tenure and other land-related information can facilitate participation in decision-making processes. At a local level, development activities with the Smart SkeMa tool shows how men and women perceive their relationship with land differently and hence the nature of tenure security may rest on different suppositions. The tool could feasibly facilitate a process for collecting gender-specific land related information that will be important to document, particularly in social tenures, to ensure women's rights and access to land can be appropriately defended.

2.3 Smarter structure: co-production and co-creation

In engaging with myriad stakeholders across the three countries, there was clear recognition that the participatory aspects of the technologies were beneficial in terms of emphasising a role for communities as co-producers of land information, and hence co-creators of more responsible land administration. For example, work with the Maasai in southern Kenya demonstrates how communities want to include other types of land information (e.g. waterways, migratory routes, etc.) that is relevant to their construction of tenure and tenure security, but these are not typically included in land administration systems. This shows how alternative land tools could add value through co-production: a structure that actively engages communities increases the quality and responsiveness of land administration services. Indeed in both Ethiopia and Rwanda, efforts to include communities as a fundamental contributor to mapping processes suggest co-production is becoming normalised; however, limited involvement thereafter suggests that no real empowerment has occurred to cultivate a more interdependent transactional relationship between people and governments.

We have shown that there is a clear role for emerging technologies to support smart sustainable futures in land administration. Smarter content enables land administration systems to become future-ready to deal with the demands of rapid land use change driven by urbanisation. Smarter processes can mitigate and close digital and gender divides. However, stakeholders at all levels must be prepared to rethink how land administration processes are structured to capitalise on the co-productive aspects of the technologies in building trust between citizens and the state so as to meet the sustainable development goal of ensuring equal access to land.