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A framework for selecting a fit-for-purpose data collection method in land administration

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ABSTRACT

The majority of the world's population do not have access to proper land administration systems to register their land and property information. The land community has come to believe that this problem is strongly related to the data collection process, where the use of highly accurate, expensive and time-consuming spatial data collection methods such as field surveying, is overemphasised. To overcome this, innovative spatial data collection methods are employed in many jurisdictions (e.g. using GPS for low-cost boundary surveys, using the power of citizen in the process of data collection). However, little is known about the parameters that affect the choice of a spatial data collection method to be appropriate for its intended purposes. Arguably, establishing a fit-for-purpose data capture method for collecting or updating RRRs related to land and property is essential for enabling the range of land administration functions around the world. This paper reports on a systematic study to determine a set of parameters that could influence the choice of a spatial data collection method in land administration. Data was collected using a Delphi study, which establishes consensus among land administration experts. This method allowed us to unlock knowledge through an iterative process with controlled feedback. For the first time in this study, an international group of land administration experts reached consensus regarding a set of parameters that should be considered in the process of selecting a fit-for-purpose spatial data collection method. These findings are incorporated to formulate a generic and innovative framework, which could potentially serve as a basis for ensuring that the choice of a spatial data collection method in land administration is fit for purpose.

1. Introduction

Land administration is a broad domain. Its main concern is collecting, managing, organising and disseminating rights, responsibilities and restrictions (RRRs) related to land or water (ISO19152, 2012). Land administration is implemented through a range of functions to organise land tenure, land value, land use, and land development (Williamson et al., 2010). However, only a minority of land administration systems can fully support these functions, while the majority of the world's population do not have access to a proper land administration system to register their land and property RRRs (Enemark et al., 2014; McLaren, 2011). The global land administration community has come to believe that the key bottleneck for providing an effective land administration system lies with the spatial data collection process (Bennett and Alemie, 2015; Enemark et al., 2014; Hackman-Antwi et al., 2013; Rijke et al., 2012; Steudler, 2014; Zevenbergen et al., 2013). Spatial data collection is one of the most time consuming and expensive, yet important, tasks in land administration. It is a key step because the entire set of land administration functionalities hinges on knowing the spatial extent of RRRs; therefore, the scope of this paper is limited to the spatial extent of land and property information. Generally, conventional strategies for spatial data collection (e.g. field surveying) are neither economically scalable nor practical. Each jurisdiction may require a different spatial data collection method to achieve their land policy aims and objectives, that is, simply to be fit for their purposes.

The phrase "fit-for-purpose" has now entered the common lexicon of land administration practitioners with the recent joint publication from the International Federation of Surveyors and the World Bank

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valorising the concept of "fit-for-purpose land administration" (Enemark et al., 2014). In this conceptualisation, a flexible approach focused on citizens' needs is recommended entailing seven different elements: flexible, inclusive, participatory, affordable, reliable, attainable, upgradeable (Enemark et al., 2014: p.6). Fit-for-purpose land administration consists of three key components: the spatial, legal and institutional frameworks (Enemark et al., 2016). These components are working together to deliver a fit-for-purpose land administration system. Each component should be focus to accommodate and serve the actual needs of today with a relevant flexibility that can be improved over time (Enemark et al., 2016).

In this paper, our use of 'fit-for-purpose spatial data collection method' broadly aligns with this conceptualisation in order to build the spatial framework of fit-for-purpose land administration. A fit-for-purpose spatial data collection method implies that a data collection method might be suitable for a particular purpose, while it might not be fit for other purposes. For example, capturing general boundaries[5] to delineate land areas by handheld GPS might be sufficient in rural and semi-urban areas, while it may not be appropriate for dense urban areas with high-value properties. While Enemark et al. (2016) prescribe four key principles to building the spatial framework in the fit-for-purpose approach, there is still little direction on how to choose a fit-for-purpose spatial data collection method and little is known about the potential parameters that could affect the choice of data collection method. Therefore, this paper aims to respond to this gap by identifying parameters that should be considered in the process of selecting a fit-for-purpose spatial data collection method for land administration and presents a framework that structures these parameters. The presented research here employs a Delphi study for identifying the parameters and, more importantly, establishing consensus among a group of international experts with respect to the identified parameters.

The remainder of the paper starts with background on fit-for-purpose land administration and various spatial data collection methods and then explains the steps that have been taken for the Delphi study. After that, it presents and discusses the results of the Delphi study, and then it introduces a framework that serves as a basis for the choice of fit-for-purpose data collection method. Finally, it presents the overall conclusions and suggests a number of future research directions.

2. Fit-for-purpose land administration

Fit-for-purpose land administration indicates that a land administration system should be focused on the actual needs of society to manage current land issues rather than being guided by high-tech solutions. Prior studies have raised awareness about the overall concept of fit-for-purpose approach in land administration and the benefit of adopting this approach (Bennett and Alemie, 2015; Enemark, 2015; Enemark et al., 2016; McLaren et al., 2016). Fit-for-purpose land administration consists of spatial, legal and institutional frameworks (Enemark et al., 2016). The spatial framework represents the way land has been used and occupied. It provides the foundation for land administration functions to operate such as recording and managing land tenure, assessing land and property value and taxation, identifying and managing land use, planning for future land development, and administrating and protecting natural resources (Williamson et al., 2010). This implies that delivering a fit-for-purpose land administration system is subject to building a fit-for-purpose spatial framework and building a fit-for-purpose spatial framework is only achievable by selecting a fit-for-purpose data collection method.

The concept of 'continuum-of-continuums' fully supports the concept of utilising a fit-for-purpose data collection method to build the underlying spatial framework in land administration (Quan and Payne, 2008; UN-HABITAT, 2012; Zevenbergen et al., 2013). This concept provides a profound foundation on which a range of land and property RRRs, with a different level of accuracy, assurance and authority, can exist. More importantly, it can be improved and upgraded over time or whenever necessary or relevant. With respect to the 'continuum-of-continuums' point of view, the Global Land Tools Network (GLTN) developed the Social Tenure Domain Model (STDM) to accommodate data that are collected through different data collection methods as well as a range of steps to collect needed data for registering land and property RRRs (Lemmen, 2010; Lemmen et al., 2007). Generally, it is important to recognise the data collection process as a dynamic process: as purposes evolve, so too will the data collection method.

2.1. Fit-for-purpose data collection method

Spatial data collection in land administration is the process of gathering and collecting the spatial extent of land and property RRRs in order to build the spatial framework. Different approaches and technologies could be used to build the fit-for-purpose spatial framework data collection. Each data collection approach has its own characteristics and requirements, and more importantly, the outcome of each approach may be different.

The history of data collection efforts in land administration goes back to ancient times. There is evidence of land registries in Egypt in 3000BC as well as the Roman Empire in 300AD (Donnelly, 2012). From that period on, the advancement of technology has had a significant role in the way spatial data about land and property is collected. For example, Gunter's chain, a distance-measuring device, was replaced by invar tapes and steel bands, and then by electronic distance measurement. In the same way for angular measurement, compasses were replaced by transits, later on by theodolites, and then by total stations.

Over time, the commissioning of global navigation satellite systems (GNSS) has led to the increased use of these systems for determining the extent of land and property RRRs. For example, Global Positioning System (GPS) receivers are widely used to facilitate and support the geospatial reference system, as well as cadastral and positioning infrastructure (Lilje et al., 2014). There is also some evidence of the use of handheld GPS in capturing boundaries to reduce the cost of data collection projects (Abidin et al., 2011).

Photogrammetric and remote sensing techniques have also been used extensively in mapping processes. For example, in Namibia, aerial photos have been used to map parcel boundaries with an accuracy of two meters with a speed eight times faster than previous methods. The accuracy of mapping land parcels better than 10 m can be easily managed through this method (Enemark et al., 2014).Under suitable conditions, this method could collect data as accurately as via field surveying. Furthermore, as (Enemark et al., 2014) said, "the benefits of the 'what-you-see-is-what- you-get-properties' deriving from the aerial photos has vastly reduced the number of mistakes made and allows the land right holders to verify their boundaries on the land right certificate".

All these advancements in technology have facilitated the process of data collection. However, spatial data collection is still a very time-consuming and expensive process. An example of technology overcoming this problem and speeding up the data collection process is the use, in some cases, of a single point representation of a parcel, i.e. a point cadastre (Hackman-Antwi et al., 2013; Home and Jackson, 1997; Kaufmann and Kaul, 2004). In this method, a single point has been captured to represent a parcel instead of collecting the boundary. Sometimes, this data has been overlayed on satellite images or available topographic maps to improve readability of data. This type of data collection is much quicker than other data collection methods. However, this sort of data cannot fully represent the spatial extent of land and property RRR.

Digitisation is another data collection method that has been used in

[5] In fit-for-purpose land administration, general boundaries are land and property boundaries whose positions have not been precisely determined and typically rely on delineation that uses physical features in the field (Enemark et al., 2014, p. 20).