

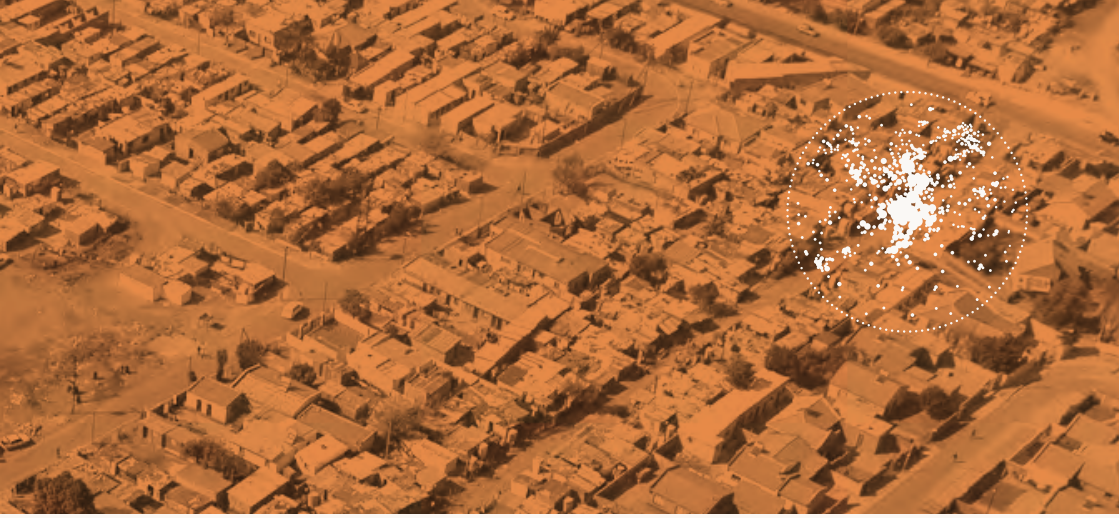
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Strengthening governance in the Gauteng City-Region through a spatial data infrastructure: The case of address data

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GOVERNING THE GCR PROVOCATION SERIES

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THE CASE OF ADDRESS DATA

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#05

[to provoke: to stimulate, incite, stir up, challenge, irk, exasperate, vex]

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Governing the Gauteng City-Region

A Provocation series

The idea of the city-region is growing in international prominence. This is because the form has been hailed as a means to promote a range of agendas, including boosting economic competitiveness; fostering integrated development; building partnerships between state and non-state actors; and solving urban growth challenges by offering ways to think differently about mass infrastructure provision, environmental sustainability, and the like.

A growing amount of academic and policy work is being done on the issue of city-region governance, with many arguing that the burgeoning of thinking and practice represents a dedicated 'process of scale building' (Brenner, 1999; Harrison & Hoyler, 2014; Jonas, 2006; Scott & Storper, 2003). Brenner in fact argues that the rise of regional governance can be understood as a process of 'state reterritorialization' or 'state rescaling', and that the specific form of the city-region reflects 'state spatial selectivity'. In other words, this scale has been specifically chosen or assembled by the state to facilitate various processes such as economic agglomeration or competitiveness (Brenner cited in Wu, 2017, p. 1135). In other contexts, the scale has been asserted as a way to mitigate the negative effects of inter-locality competition (ibid).

Regardless of the deliberative processes behind this 're-scaling', the city-region is not a straightforward site in which to organise governance. As Storper (2014) points out, governance at this scale necessarily involves many large, contested and intertwined issues that arise as a result of strong interdependencies and cleavages, combined with fragmented geographies and overlapping implementing agencies. This means that the issues that become the object of regional governance are not amenable to a 'solution' so much as a haphazard muddling through. Similarly, Wu (2017) interprets the state spatial selectivity of the city-region form less as a proactive model to manage social provision or promote democratisation, but rather as an attempt to manage intractable crises.

The Gauteng City-Region (GCR) is increasingly recognised in official and other discourse. That said, the acknowledgement of something that can be described as a city-region has not resulted in consensus on what this means, or should mean, for planning, public investment or governance. This series of GCRO Provocations examines different aspects of governance of and in the GCR. Taken together, they hope to trigger debate and dialogue on various complexities of the issue, and signal a series of priorities for consideration in thinking about the future and the fortunes of the city-region.

Abstract

Geospatial data, such as administrative boundaries, property information, addresses, streets and utility networks, provide the backbone for city governance. Availability, accessibility and usability of such data and related services are typically facilitated through a spatial data infrastructure (SDI), which requires careful stakeholder coordination and an information-driven approach that can unlock the value of geospatial data. This Provocation reviews the current state of affairs regarding address data in the Gauteng City-Region (GCR) and explores prospects for coordinating a GCR address dataset in an SDI context. The focus is on addresses because of their important role in service delivery, the socio-economic well-being of residents and the recognition of civic and human rights. For example, good quality addresses are vital in the current COVID-19 crisis, as government strives to map COVID-19 cases in order to identify emerging local clusters of infections and spatially target responses. Currently, address data in the GCR are maintained in silos at different provincial departments and municipalities, without any coordination and without adherence to international standards and good practices for addressing and information management. This results in duplication, inconsistencies and even fraud, which not only costs the municipalities, national and provincial governments billions but also damages their reputations. To rectify this, this Provocation identifies various entities for taking the responsibility to methodically coordinate GCR address data into a single reference dataset. Since many entities have a legal accountability related to address data, a decision and strong political leadership are required to lead multiple interventions and initiatives in parallel with the aim of reaping benefits for governance and society in the long run. As Gauteng is one of few provinces with municipal address datasets, the GCR could serve as an example for coordinating the maintenance of geospatial datasets among its municipalities, as few (if any) such datasets exist in South African municipalities, provinces and national departments. However, private companies have successfully created such datasets.



Introduction

This Provocation is part of a series on the topic of governing the Gauteng City-Region (GCR) which explores prospects for a more integrated and coordinated GCR. The focus here is on the integration and coordination of geospatial data through a spatial data infrastructure (SDI) in support of governance in the GCR. The topic is explored with specific reference to a typical SDI data theme, namely address data.

Drawing on standard dictionary definitions of 'infrastructure', an SDI can be defined as the 'facilities, services, systems and installations to provide a country, city or area with geospatial data and services that are required for the functioning of society' (Coetzee et al., 2019). It has also been defined as 'an evolving concept about facilitating and coordinating the exchange and sharing of spatial data and services between stakeholders from different levels in the spatial data community' (Hjelmager et al., 2008).

An SDI should not be regarded solely as a technology issue: it requires careful coordination of technologies, networks, legislation, policies, standards and institutional arrangements through which geospatial data are maintained and shared among diverse stakeholders. As with any other type of infrastructure, the value of an SDI is in it being used, and not in it being built to be admired as a perfect technical solution. Geospatial data are key to management and decision-making in a city or country, be it for tax collection, service delivery planning or emergency response, to name a few examples. Such geospatial data include property and administrative boundaries, topographic information, buildings and addresses. Since multiple stakeholders operate in the same geographical space, it makes sense to coordinate, share and integrate geospatial data from different sources. The data ought to be collected with taxpayers' money and belong to the state, thus avoiding duplication, reducing costs and exploiting synergies in order to render a better return on investment – something that private companies have done very effectively in the South African context in the absence of such public sector datasets.



Photograph by Serena Coetzee

Addresses are essential for governance because they can be used as a link between all kinds of information (Coetzee & Bishop, 2009). If property, billing, valuation and service delivery information is linked to the same address, it is possible to coordinate between different municipal entities who are accountable and to analyse the information on a single map in support of planning, management and decision-making. To do this, the different municipal entities have to work with the same address data source (Coetzee et al., 2020). Address data have therefore been included as fundamental data themes in SDIs (European Parliament, 2007; Hadley, 2018; Schwabe & Govender, 2012) and are an important component of government operations and e-government services (National States Geographic Information Council [NSGIC], 2014; Buyle et al., 2018).

This Provocation starts with a review of the importance of address data for city-region governance and urban management. Next, address data are placed into the context of SDIs generally and the South African SDI (SASDI) specifically. The current state of affairs regarding address data in the GCR is presented with reference to SASDI and SDI initiatives in Gauteng. Last, based on identified challenges, the prospects and considerations for coordinating and maintaining address data in the GCR are explored.



Photograph by Serena Coetzee

The importance of address data for governance and socio-economic well-being in the GCR

Due to rapid urbanisation, municipalities increasingly face complex challenges in effectively serving their residents. In the past, addresses were mostly used for postal delivery. In today's digital world, there are many new possibilities, such as routing and navigation, geo-marketing, spatially optimised service delivery and generally improving the management of cities and making them smarter. Correct addresses are essential for good governance of municipal assets, financial management, service delivery and emergency response. The need for good quality address data has become especially evident in the current COVID-19 crisis, as government strives to geo-locate and map COVID-19 cases based on addresses provided by patients. This is vital to identify emerging local clusters of infections and spatially target responses. However, addresses are important beyond governance and urban management: they provide individuals with an identifiable location in the city as both a physical and a symbolic connecting point to society (Farvacque-Vitkovic et al., 2005). Addresses are thus indispensable for the recognition of residents' civic rights (Farvacque-Vitkovic et al., 2005; Universal Postal Union [UPU], 2012). Yet, addresses lack this quality in many South African townships, where many streets have no names and suburbs often have descriptors such as 'Block A', 'Block B', 'Block C', etc.

In South Africa, an address is defined as 'an unambiguous specification of a point of service delivery', which is an 'actual location where a service is provided' (South African Bureau of Standards [SABS], 2009a). An address makes service delivery possible, be it for postal services, utility services, billing, disaster relief, emergency response, goods delivery, opening bank accounts, voting (as discussed below) or just visiting friends. Further, having an address provides one with a social status: a sense of identity and being recognised as a proper citizen (Cooper, 2007). Addresses are not only for people, organisations or buildings; in the City of Johannesburg addresses have also been assigned to graves and parking bays. Addresses can be both permanent (e.g. for a building) and transient (e.g. for recording the location of a traffic collision between two intersections) (Coetzee & Cooper, 2007).

In South Africa, municipalities have the responsibility for assigning street addresses, delegated to them by the South African Geographical Names Council. The South African Post Office (SAPO) is responsible for postal addresses, but it struggles to fulfil even its most basic functions and many South Africans have stopped using its services (BusinessTech, 2018; MyBroadband, 2018; Pillay, 2018). South Africa has published a set of standards for addresses which provide the format of addresses (SANS 1883-1:2009), data exchange specifications (SANS 1883-2:2018) and guidelines for assigning addresses (SANS 1883-3:2009) (SABS, 2009a, 2018, 2009b, respectively). SANS 1883-1:2009 caters for the wide variety of addresses used in South Africa, including informal addresses.

These standards led to the development of the International Organization for Standardization (ISO) suite of international standards on addressing, such as ISO 19160-1, which specifies a conceptual model for addressing (ISO, 2015).

The importance of providing all voters with addresses has been upheld several times by the Constitutional Court of South Africa. For example, when registering a voter, the Independent Electoral Commission (IEC) 'is obliged to obtain sufficient particularity of the voter's address to enable it to ensure that the voter is at the time of registration ordinarily resident in that voting district' (Constitutional Court, 2015); and that the 'Electoral Commission must by 30 June 2018 have obtained and recorded on the national common voters' roll all addresses that were reasonably available as at 17 December 2003' and report six-monthly on progress with addresses outstanding post-December 2003 and on 'steps taken and to be taken to obtain outstanding post-December 2003 addresses' (Constitutional Court, 2016). This was not possible for the IEC, so the Constitutional Court (2018) declared that 'the Electoral Commission must by 30 November 2019 have obtained and recorded on the national common voters' roll all addresses that were reasonably available as at 17 December 2003' and

> the Electoral Commission must set out a means by which it proposes to –
> i. indicate clearly on the voters' roll which voters have incomplete, inadequate or no addresses;
> ii. require voters with incomplete, inadequate or no addresses who wish to vote to supply their addresses before voting on voting day; and
> iii. enable political parties to access and scrutinise the addresses and any other details supplied in this way.

SANS 1883-1:2009 (SABS, 2009a) caters for informal addresses and all other types needed by the IEC to fulfil these requirements of the Constitutional Court – but the real problem is getting the people so affected to provide their addresses to the IEC, and having the front-line staff and systems that can validate addresses against a reference dataset immediately on submission. This Provocation investigates challenges and solutions for coordinating and maintaining address reference datasets for South Africa.

Addresses are essential for asset registers maintained by financial departments in municipalities. However, there is typically a disconnect between the (text-only) addresses used in financial departments and the validated municipal geospatial address datasets. E-government policies and initiatives for municipalities in Gauteng seem to overlook geospatial data and, based on interviews conducted as part of this research, geospatial data managers are often ignorant of information management theory and practice. As a result, interviewees reported limited application of sound information management principles in the maintenance and management of geospatial data. Additionally, there are few municipalities in South Africa (if any) with a comprehensive address dataset that can be used as a reference for their areas of jurisdiction.

There are many challenges, including:

- Settlements emerging in municipalities and changing faster than any process of public consultation can assign addresses to them;
- Addresses are only assigned once a new settlement or settlement expansion has been proclaimed, i.e. rural and peri-urban areas are not addressed;
- The fact that it is difficult to automatically detect and 'decipher' addresses from imagery if they are displayed on buildings or street fronts, which often they are not;
- Multiple street name changes in recent years;
- Former townships where some streets have no names and houses are not necessarily numbered in sequence along a street; and
- The fact that address data need to be constantly maintained and verified against different sources.



Photograph by Serena Coetzee

Address data in the context of SDIs generally and SASDI specifically

Data in an SDI are usually organised into a set of themes or datasets (e.g. administrative boundaries, transport, hydrology, etc.), and these are prioritised (European Parliament, 2007; Federal Geographic Data Committee, 2018; Okafoor, 2011; Schwabe & Govender, 2012) depending on their importance and relevance to priorities set for the specific SDI. Addresses are prioritised in the list of data themes in the Directive that established INSPIRE (the Infrastructure for Spatial Information in the European Community) (European Parliament, 2007) and have been identified as a fundamental geospatial dataset by the Committee of Experts of the United Nations Global Geospatial Information Management (UN GGIM). They are included as priority datasets in various national SDIs, for example, in Australia (Christensen et al., 2014), Belgium (Buyle et al., 2018), Ghana (Owusu-Banahene et al., 2013), the Netherlands (Coetzee et al., 2020) and the United States of America (NSGIC, 2014).

Through the Spatial Data Infrastructure Act (No. 54 of 2003), the South African SDI (SASDI) was established in 2003 as the technical, institutional and policy framework for facilitating the discovery, use and sharing of geospatial data and services in the country. The Committee for



Photograph by Serena Coetzee

Spatial Information (CSI) is responsible for SASDI. Selected SASDI components are now in place. For example, base datasets (themes of spatial information) have been identified and prioritised; custodians for each are currently being appointed; and two policies have been published: the Base Data Set Custodianship Policy and the Policy on Pricing of Spatial Information Products and Services (South Africa, 2015). While metadata are now available in the electronic metadata catalogue,[1] its full use has been extremely slow to get off the ground due to various technical and procurement challenges, such as the lapsing of a contract with the South African Environmental Observation Network (SAEON), which hosted the catalogue and provided technical support. Addresses were identified as a SASDI base dataset. Initially, they were not prioritised. However, following the UN GGIM prioritisation of addresses, the CSI may now prioritise addresses as part of its review of the base datasets.

Some provincial and municipal initiatives in South Africa are aimed at the discovery, use and sharing of geospatial data, but they are not necessarily termed SDI. For example, through collaboration with the City of Cape Town Municipality, the Provincial Government of the Western Cape could provide new web services for its departments (Heald, 2011). The collaboration now includes an open data portal with over 135 datasets[2] and has led to the establishment of the Western Cape Spatial Information Forum (Du Preez & Heald, 2019). Another example is SPIsys,[3] a spatial planning and information system run in partnership by the national Department of Rural Development and Land Reform and the Free State and Northern Cape provincial governments. SPIsys supports the implementation of the Spatial Planning and Land Use Management Act (SPLUMA, No. 16 of 2013) and provides services for the public and the three spheres of government, such as e-lodgement of development applications. Finally, the National Spatial Planning Data Repository (NSPDR) is a digital ecosystem for national spatial planning aimed at sharing spatial planning information and data (such as land use and zoning information) across all spheres of government to support key objectives of SPLUMA and the National Development Plan.[4] These initiatives could eventually form part of the national SASDI or at least be aligned and harmonised with SASDI (Coetzee & Smit, 2015) in order to avoid duplication and to promote the use of geospatial data 'in support of spatial planning, socio-economic development and related activities', as stipulated in the Spatial Data Infrastructure Act (No. 54 of 2003).

Despite the importance of geospatial data for local government and the contribution of local SDIs to the use and availability of geospatial data in a country, researchers have noted that there is limited research on local SDIs in many countries and therefore limited knowledge and understanding of local SDIs. The point has been noted by Van Loenen (2006) in relation to the Netherlands, Vancauwenberghe et al. (2010) in Flanders, Hećimović et al. (2014) in Croatia, and by Coetzee and Wolff-Piggott (2015) in their review of SDI scientific literature.

1. www.sasdi.net
2. https://web1.capetown.gov.za/web1/OpenDataPortal/
3. http://www.spisys.co.za/
4. http://nspdr.info/

The current state of SDI initiatives and address data in the GCR

In Gauteng, the GIS (geographic information systems) Directorate in the Planning Division at the Office of the Premier has the mandate to coordinate GIS activities for the GCR. To date, three main initiatives have contributed towards the establishment of an SDI for Gauteng.

First, the GCR GIS Forum was established in 2015 by the GIS Directorate in the Planning Division at the Office of the Premier. It provides a platform whereby GIS professionals from various municipalities, government departments, academia and the private sector meet on a regular basis to discuss activities related to GIS and geospatial data-sharing in Gauteng. Official representatives of the various provincial organisations (municipalities, government departments, etc.) participating in the GCR GIS Forum are referred to as 'GIS Champions'.

Second, the 'GCR Coordinating Office', the GIS Directorate in the Planning Division at the Office of the Premier, established a centralised GCR GIS in 2015. Subsequently, since 2017, a GCR Integrated Geospatial Data Platform[5] is publicly accessible as a central data and information repository to which GCR stakeholders (sector departments, municipalities, state-owned agencies) contribute geospatial and other data. The platform provides authoritative data related to performance monitoring, infrastructure locations, transport, imagery and base-maps, to name a few. The initiative continues to enjoy the support of stakeholders despite challenges encountered, including inconsistencies between stakeholders in handling geospatial data and related standards. The platform will continuously be enhanced with more functionalities, data and other relevant features, including mechanisms for tracking the profile of its various users and frequency of use.

One challenge is that data (e.g. about a project for upgrading a specific building) are often collected either without any geospatial component or with an incorrect one (e.g. an erf number associated with a building that lies outside the actual erf to which the number refers). In the absence of a geospatial component (latitude and longitude geographic coordinates), an address can be used to locate the asset. However, this is often not possible due to the inconsistent and error-prone manner in which addresses are collected, captured or recorded by the concerned government entities. Such challenges can be attributed to the lack or the failure to implement validation and quality control mechanisms in the computer systems or electronic devices used for capturing address data. Furthermore, some municipalities and departments lack well-capacitated and competent professionals who are able to manage and maintain address data and other geospatial

5. https://gisportal.gauteng.gov.za/portal/home/

data appropriately. Some of the smaller municipalities do not have the capacity to record all their addresses and assets, which then makes it difficult for them to deliver services or to make investments to generate income that will enable them to capture address data. In some cases, the nature of assets and their respective addresses get 'fudged' due to the lack of a reference address dataset for verification. This may result in excessive funding from government grants to such assets (e.g. claiming subsidies for a farm on an urban erf). Such problems can significantly affect the provincial government's budget and expenditure. Additionally, the coordination and sharing of geospatial data among government departments and municipalities remains an issue.

Third, to address some of these challenges, the GIS Directorate through the GCR GIS Forum has drafted a GCR GIS Policy, recently published in the *Gauteng Provincial Gazette*. The policy, together with the Gauteng GIS Framework of 2015, aims to guide and improve the production, integration, accessibility and use of geospatial data in and around Gauteng. The policy was informed by relevant South African Acts (e.g. the Spatial Data Infrastructure Act [No. 54 of 2003] and the Geomatics Profession Act [No. 19 of 2013]), as well as national and international standards (e.g. SANS 1878-1:2005, South African spatial metadata standard – Part 1: Core metadata profile [SABS, 2005], and the ISO 19100 series of standards for geographic information[6]). The policy recommends that any data collected through surveys or field work be captured and stored electronically, associated either with coordinates or with an address conforming to the South African address standards (SABS, 2009a, 2018, 2009b). Furthermore, the implementation of standards towards facilitating interoperability is mandatory. To varying extents, individual municipalities in Gauteng have their own policies for GIS and/or SDIs that have been approved, are drafts awaiting approval, or are under development. Some municipalities specify general policies or standards for data to be delivered to them. The GCR GIS Policy supports the development and maintenance of GCR-wide integrated and harmonised policies and geospatial datasets.

According to their websites, the City of Johannesburg and the City of Tshwane provide address data on request. In order to raise awareness of the importance and challenges related to street address data, in 2016, the City of Johannesburg in partnership with Wits University, Johannesburg Centre for Software Engineering and Esri South Africa, launched the '2016 GeoJozi Developer Challenge'.[7] The aim was to invite young software engineers to develop web-based applications that could provide solutions for the City's address data challenges, such as the lack of visible and accurate addresses in some areas of the City which impede the City's service delivery to its residents. The challenge was successful in raising awareness about the use of geospatial data and address data among the participants. In future, such an initiative could be repeated more often to assist the City of Johannesburg in finding solutions to its pressing challenges and for the participants, who are young people, to develop entrepreneurial skills by commercialising their solutions.

6. https://www.iso.org/committee/54904/x/catalogue/p/1/u/0/w/0/d/0

7. https://www.geojozi.joburg/



Photograph by Serena Coetzee

Considerations for maintaining address data across municipalities

In this section, examples of coordinating and maintaining address data in other countries are presented as possible solutions for the GCR. The section is concluded with a discussion on who should take responsibility for integrating address data in South Africa.

Registers maintained by a legislated governance framework

In some developed countries, sophisticated governance frameworks are in place for coordinating the maintenance of address data and collating these into regional or national datasets. For example, in the Netherlands, the *Basisregistratie Adressen en Gebouwen* (BAG) is a single national address dataset representing a well-established physical addressing system (Netherlands, 2008). Information about addresses and buildings is captured and maintained by municipalities. *Kadaster*, the Dutch land registry and mapping agency, facilitates the integration of municipal datasets into a single national base register. The BAG is one of several key registers. Collectively, the registers contain all the information required to govern and provide services in the country, such as information about citizens, companies and organisations, and the physical environment (Coetzee et al., 2020). The quality of the information in the registers is promoted by the fact that government users are legally obliged to use the information in the registers. The information in the different registers is interlinked. For example, the addresses in the BAG are linked to business information in the Business Register, to land parcels in the cadastre and to information about citizens in the Register of Persons (*Digitale overheid*, 2015).

Similarly, the *Centraal Referentieadressen Bestand* (CRAB) is an authoritative address dataset (register) for Flanders, one of three regions in Belgium. Here also, municipalities capture and maintain the data. The Flemish regional government owns the dataset. Public sector organisations are obliged to use CRAB addresses and to report errors (Peeters, 2011). In 2016, the Flemish Agency for Geographic Information (*Agentschap Geografische Informatie Vlaanderen*, AGIV) and the Coordination Department Flemish E-government (*Coördinatiecel Vlaams e-government*, CORVE) were merged into a single agency, *Informatie Vlaanderen*. Before the merger, AGIV was responsible for all geospatial data, including the CRAB, and CORVE dealt with all non-geographical information and transactions. The merger established a single coherent information network spanning all of government (Coetzee et al., 2019). Today, *Informatie Vlaanderen* maintains registers for large-scale topography, roads, addresses, buildings, organisations and public services. These registers are part of a semantically coherent system of civic objects and relations and are aligned with two European standards, ISA for interoperability among public administrations and INSPIRE for interoperability of geospatial information (Buyle et al., 2016, 2018).

The registers of Flanders and the Netherlands are strategic building blocks for realising e-government and information-driven government. According to the European Commission's European Interoperability Framework, base registers are 'authentic and authoritative sources of information that form, separately or in combination, the cornerstone of public services'. The European Commission recommends that such registers 'be maintained and legally controlled by public administrations, but that the information should be made available for wider reuse with the appropriate security and privacy measures' (European Parliament, 2013; European Commission, 2010, 2017).

Involving the private sector

In the governance frameworks of the above Dutch and Flemish address registers, most influence is exerted by municipalities and organisations responsible for hosting and maintaining the register (Coetzee et al., 2020; Coetzee et al., 2019). As a result, there is a delicate balance between local funding for municipal priorities and the requirements that address wider national or regional interests. Because of limited public budgets, SDI funding is often a challenge. This can be overcome by converting SDIs from relying on government budgets to funding mechanisms that are self-sustainable (Jabbour et al., 2019). Given the current financial situation of South African municipalities, it is advisable to explore and consider self-sustained funding mechanisms, for example by involving the private sector in the GCR.

A public–private partnership provided the initial investment for the National Land and Property Gazetteer (NLPG), a single source of address data for England and Wales (Nicholson, 2007). A contractual relationship was established between the NLPG hub service provider (a private company) and local government: in return for training, services and support with address data capture, maintenance and improvement, the service provider obtained the rights to include the local government data in a national dataset. It was agreed that local governments would supply address data according to the British Standard on addressing.[8]

The process of establishing the NLPG was guided by a central local government body (IDeA) and regional mutually supporting local government working groups. Initial barriers included (Nicholson, 2007):

8. https://www.agi.org.uk/agi-groups/standards-committee/bs7666-guidelines

- Lack of statutory drivers and government funding;
- A knowledgeable but fragmented local government;
- Little enthusiasm from central government;
- A silo mentality of suspicion and concern for ownership and control;
- A disconnect between data managers and data beneficiaries (users);
- A government focused on technological solutions and not on data; and
- Commercial conflicts of interests preventing wider availability of the data.

The partnership eventually encompassed all counties in England and Wales and was later transferred to the public sector. Today, the NLPG is managed by GeoPlace,[9] a limited liability partnership jointly owned by the Local Government Association and Ordnance Survey, the mapping agency of the United Kingdom (UK).

In South Africa in the 1990s, the four major banks jointly established and maintained for several years, a national address dataset together with related national datasets, such as street centre lines, suburb boundaries and land parcels. Around 2002, the datasets were sold to a private company that maintains the datasets to date by integrating data from individual municipalities into national datasets, and supplies services (such as geocoding, navigation and mobile mapping) that make use of the data. In the past decade, several other private companies have come up with a similar approach of maintaining datasets that are integrated from individual municipalities and then selling products and services that make use of the data. Their expertise and capacity could be leveraged for authoritative provincial or national datasets, for example through a business model similar to that applied in England and Wales.

Addressing by cities or municipalities

Between 1989 and 2004, the World Bank and France (Ministry of Foreign Affairs) were involved in the financing of street addressing projects in 51 cities in 15 sub-Saharan African countries, installing 84 000 street signs and assigning addresses to 1 200 000 buildings. They developed an addressing approach aimed at achieving greater impact on urban information systems in developing countries that have resource and capacity constraints at municipal level.

A unit at each municipality takes on the responsibility for street addressing. In spite of limited resources and a short implementation time frame, baseline information about the city was collected. Through their projects, they showed that the involvement of municipalities is key for sustaining an urban information system (Farvacque-Vitkovic et al., 2005). Farvacque-Vitkovic et al. (2005) advise

9. https://www.geoplace.co.uk/

municipalities 'to gradually broaden the scope beyond street addressing to evolve into a municipal unit that will collect and analyse data and provide city authorities with all the information they need to make decisions'. This emphasises that addresses are critical references for gathering and using urban data. They also emphasise the importance of continually updating and maintaining address data. After successfully implementing the approach in 15 capital cities, it was expanded to 37 secondary cities (Farvacque-Vitkovic et al., 2005).

Collaborative approach between local government, civil society and the private sector

More recently, the World Bank launched the Open Cities South Asia initiative, followed by the Open Cities Africa initiative carried out in 11 cities in sub-Saharan Africa. Through its Global Facility for Disaster Reduction and Recovery, an open data ecosystem is built around OpenStreetMap to facilitate data-driven urban planning and disaster risk management. Instead of placing the entire burden of creating and maintaining geospatial data on local government, an information infrastructure is jointly developed by local government, civil society and the private sector. In this approach, small teams are trained, supported, mentored and funded to:

- Create open spatial datasets of key features and hazards in the city;
- Develop the tools and systems needed by key stakeholders for exploiting the data collected on risks; and
- Facilitate evidence-driven interventions to build urban resilience, such as through building capacity.[10]

Similarly, Dar Ramani Huria is a community-based mapping project in Dar es Salaam, Tanzania, built on the OpenStreetMap ecosystem and funded by the UK's Department for International Development through the Tanzania Urban Resilience Programme. It commenced with training university students and local community members in creating maps of those areas in the city that are most prone to floods. Map use rapidly expanded well beyond flood resilience to provide primary tools for planning and managing development in various other socio-economic aspects, such as waste management. [11]

Nationalised address data

All of the approaches described above have relied on cooperation between the various stakeholders, be they providers or users of address data, and by significant investment – particularly in cleaning

10. https://opencitiesproject.org/about/
11. http://ramanihuria.org/

and maintaining the address data and in matching addresses from different sources. However, there are those who perceive the value to be in holding a monopoly over addresses rather than in making the data readily available to all. For example, this would appear to be the reason that the following was proposed by the Postal Services Amendment Bill in Clause 46(6): 'All addresses database [*sic*] that prior to the commencement of this Act were developed and maintained by any person other than the postal company must be handed over by such person to the postal company to be incorporated in the National Address Database referred to in (4)' (South Africa, 2017), where SAPO is the postal company. Besides being invalid and unenforceable because it constitutes expropriation without any compensation, SAPO does not have the resources to consolidate, correlate and validate all of the address databases in South Africa. Even then, SAPO did not envisage such a monopoly as being profitable, as Clause 46(7) stated: 'The national address system must be funded through annual [*sic*] subsidy allocation by government or from any other source as determined by the Minister' (South Africa, 2017).

This draft Bill shows a poor understanding of addresses, as it defined an address as 'an unambiguous specification of a point of postal service delivery where people reside or businesses are located' (South Africa, 2017), which explicitly excludes post office boxes, but covers every address database of all forms that every South African has, which includes all their address books on all their computers, cell phones and other devices. Hence, probably unintentionally, the Bill aimed to collect enormous amounts of private data and, as such, contravenes the Protection of Personal Information Act (No. 4 of 2013).

Free and open address data

The Danish Enterprise and Construction Authority (DECA, 2010) conducted a study that quantified the various socio-economic benefits resulting from the official Danish address reference data for the whole of Denmark being made freely available in 2002. The study estimated that the benefits were about 14 million euros, while the cost of providing free data was only about 0.2 million euros. Further, 70% of these benefits were realised in the private sector, 30% in the public sector. The study estimated only the direct financial benefits to the over 1 200 parties that received the free address data, and not the supplementary economic benefits to others further down the distribution chain, for example using quality addresses in location-based services and global positioning systems. Such downstream benefits are likely to be as much, if not more (DECA, 2010).

Taking responsibility for a provincial or national address dataset

A particular conundrum in South Africa lies in deciding who should take responsibility for integrating address data into provincial and national address datasets. The issue is not new (Coetzee

& Cooper, 2007), but still we are no closer to a solution. Table 1 provides an overview of possible candidate organisations, revealing the plethora of accountabilities related to address data. They are mostly national, although Gauteng provincial departments with relevant functions could also be candidates. Municipalities certainly are most suitable for maintaining address data for their areas of jurisdiction, but apart from their capacity challenges, they are also not concerned with data beyond their boundaries. A recent SASDI newsletter (National Spatial Information Framework [NSIF], 2019) alludes to the appointment of SAPO as the SASDI base dataset coordinator of address data. Municipalities would remain custodians of address data for their areas of jurisdiction, with SAPO coordinating the integration into a national address dataset. As coordinating custodian, SAPO would have to deal with more address types than the four in SANS 1883-1:2009 (SABS, 2009a) that are within its mandate. The newsletter does not state whether coordinating custodians at the provincial level would be appointed or not.

Table 1: Candidate organisations for coordinating provincial or national address datasets

Offices of the Premiers of the provinces	They are a natural choice because they have developed geospatial capabilities in several provinces. They could coordinate SDI activities in a province and provide support to capacity-constrained municipalities in rural and peri-urban areas.
Gauteng Provincial Department of e-Government	This department could support a provincial address dataset through its network infrastructure that connects government buildings, digitisation of back-office support, and a digital document management system.
Department of Home Affairs (DHA)	In various European countries, similar national departments or agencies take responsibility for coordinating national address datasets. DHA systems and processes have improved considerably in the past few years, but to date, the address where a citizen lives is not well maintained.
Department of Monitoring and Evaluation (DPME) in the Presidency	The DPME in the Presidency has an overarching mandate for national planning, governance and intergovernmental relations. It has been suggested as a possible coordinating organisation, not only for address data, but for geospatial data generally. However, based on this reason, many (maybe most) other government functions should then be moved to the DPME, which would make it clumsy and difficult to manage.

Financial Intelligence Centre (FIC)	The FIC administers the Financial Intelligence Act (No. 38 of 2001) for which an individual has to provide proof of residence at an address in South Africa. A national authoritative reference address dataset for address verification would substantially contribute to the delivery of its mandate.
Independent Electoral Commission (IEC)	The IEC relies heavily on addresses to fulfill its mandate (the residential address of each voter needs to be recorded and verified), but address data collection and maintenance is not their responsibility (Electoral Act, No. 73 of 1998).
South African Local Government Association (SALGA)	SALGA represents the interests of local government in South Africa. Their focus on ICT, planning, finance and housing in municipalities presents a strong link to the need for well-maintained municipal address datasets. However, to date, SALGA has shown limited interest in SASDI and the CSI.
South African Post Office (SAPO)	SAPO is mandated to conduct postal services (Postal Service Act, No. 124 of 1998) and for this mandate only 4 of the 12 address types defined in SANS 1883-1:2009 (SABS, 2009a) are required.
South African Revenue Service (SARS)	SARS has a strong requirement for address data that is linked to revenue collection from individuals and businesses (South African Revenue Services Act, No. 32 of 1997), but they have no responsibility for assigning addresses, and also not for maintaining address data.
State IT Agency (SITA)	SITA could play a role in providing underlying services and infrastructure for the coordination of a national address dataset because of their aim to provide an efficient and value-added ICT service to the public sector.
Statistics South Africa (StatsSA)	StatsSA needs addresses to fulfil their mandate of 'collection, production and dissemination of official and other statistics' (Statistics Act, No. 6 of 1999). As such, they are users of address data but have no responsibility for assigning addresses, and also not for maintaining address data.

Conclusion

Geospatial data maintained and provided through an SDI provide the backbone for city governance. The UN GGIM has raised the importance of such geospatial data and SDIs. Establishing and maintaining such national or provincial datasets that are integrated from many different local sources requires judicious coordination of the many stakeholders involved. It also requires public organisations and their service providers to treat geospatial data as information (not as maps or pictures) and to apply information management principles and good practices where geospatial data are concerned. The GCR could lead the way in South Africa by demonstrating how the collection and maintenance of geospatial data can be coordinated.

The importance of georeferenced address data is manifested in the SDIs of many countries, and also recognised by international organisations such as the UN GGIM, the UPU and the World Bank. In South Africa, the recent Constitutional Court cases involving the IEC underline the importance of properly managed and reliable reference address datasets for a healthy democracy. The current state of affairs regarding address data in the GCR lacks coordination and adherence to standards as well as lacking best practices for addressing and information management. As a result, municipalities and provincial departments are adversely affected in terms of money and reputation: good governance is impeded, service delivery is frustrated, and civic rights are poorly recognised.

The road to a national or provincial address dataset calls for an approach of multiple interventions and initiatives in parallel, including raising awareness of addresses and standards, defining and following standard operating procedures, encouraging and nurturing good practices, policy development and implementation, and all of this grounded in legislation. Various government



entities could take the responsibility for coordinating a national or provincial address dataset. However, a decision and strong political leadership with sustainable funding is required to address wicked issues spanning several accountabilities. Once this decision has been taken, it will eventually become necessary to enforce the use of the authoritative reference datasets – to ensure that addresses are properly verified, and any errors are reported for continuous maintenance and improvement. The next steps for advancing in the direction of an integrated GCR-wide address reference dataset, would be:

1. A stakeholder survey to better understand current barriers and challenges;
2. A cost–benefit analysis that can be used to justify the funding that would be required; and
3. A pilot project, starting out with coordinating address data for a small area in a single municipality and gradually expanding to a larger area and eventually involving other municipalities and provincial departments as well.

South Africa experiences severe financial, human resource and other constraints at all levels of government. These are especially severe in rural and peri-urban areas of the country. As the economic powerhouse of the country, and with relatively strong provincial and local government institutions, the GCR could show the way through improved cooperation between different parts of government, as well as collaboration with local communities, civil society and the private sector, towards achieving a province-wide address dataset. In time, this GCR approach may also be achievable in the less urbanised parts of the country.



Photograph by Clive Hassall

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[to provoke: to stimulate, incite, stir up, challenge, irk, exasperate, vex]

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