

Is local level implementation of the Integrated Geospatial Information Framework (IGIF) in South Africa feasible?

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Abstract:

The United Nations Committee of Experts on Global Geospatial Information Management has introduced the concept of the Integrated Geospatial Information Framework (IGIF) to help overcome problems with accessing and reusing data and integrating various data sets together to improve decision-making, particularly to achieve the Sustainable Development Goals and to address other global challenges. The IGIF aims to address societal and environmental problems from local to global levels, but it appears to be aimed primarily at national governments and regional and international organisations. We explore here how the IGIF could be implemented at the local (municipal) level in a developing country such as South Africa.

Keywords: municipality, developing country, SASDI, CSI, governance structure.

1. Introduction

A spatial data infrastructure (SDI) aims at facilitating and coordinating the managing and sharing of geospatial data and metadata – but also includes services and products and is dependent on inter-organisation arrangements and structures, and on standards [Cooper 2016]. While not explicit in the label, the SDI concept has always been people centric.

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) began developing the concept of the Integrated Geospatial Information Framework (IGIF) in 2017. The IGIF is aimed at overcoming problems with accessing and reusing data and integrating various data sets together to improve decision-making, particularly to achieve the Sustainable Development Goals (SDGs) [UNGA 2015] and to address other global challenges [UN-GGIM 2022].

The concept of an SDI has always been evolving. The foundation of the IGIF is SDIs, as they establish the necessary environment: policies, laws, data governance frameworks, standards and the technology platforms. The IGIF aims to go further than the SDI, delivering knowledge and not just data [UN-GGIM 2022].

While the IGIF is to address societal and environmental problems from local to global levels [UN-GGIM 2022], it appears to be aimed primarily at national governments and regional and international organisations. The UN-GGIM discussion paper states that the governance model of an SDI is “typically nationally focused, hierarchical and government led. Future governance models will need to be more inclusive of the broader stakeholder group (private sector, academia, open-source community, policy makers, community groups and beneficiaries)” [UN-GGIM 2022] – but this statement does not mention local government.

The IGIF was designed to be enduring and consistent, but also flexible, as countries have different circumstances. It has three drivers for change, with technology being the enabler:

- Unified solutions to global challenges.
- Affordable and equitable access to knowledge on demand.
- Bridge the geospatial digital divide [UN-GGIM 2022].

The IGIF has nine strategic pathways organised in three bands of influence, as shown in the IGIF puzzle diagram in Figure 1. Each of these nine strategic pathways conveniently has four key elements. For example, for *Governance and Institutions*, these are Governance Model,

Leadership, Value Proposition and Institutional Arrangements [UN-GGIM 2022]. It is beyond the scope of this paper to examine all 36 key elements in detail, but some of them will be included in the discussions below. The IGIF aims to establish effective implementation of an SDI and go further than the initial SDI deliverables, but importantly promote knowledge, innovation, partnership and integrated planning.

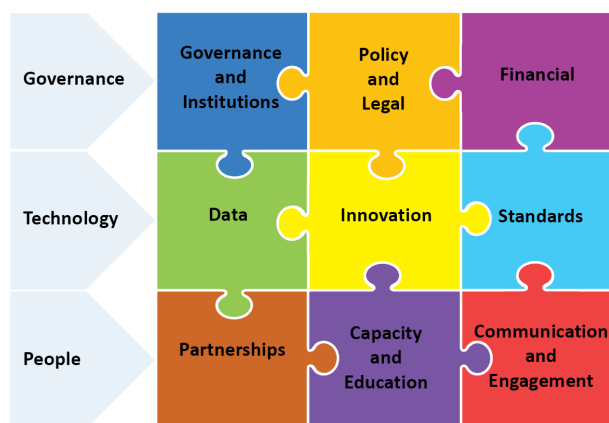


Figure 1: IGIF puzzle diagram © UN-GGIM 2022

The Partnerships strategic pathway aims at establishing “cross-sector and interdisciplinary cooperation, coordination and collaboration with all levels of government, the geospatial industry, private sector, academia, and the international community, with the objective to deliver on the drivers for change” [UN-GGIM 2022]. This then includes local government or municipalities explicitly. The obvious problems with establishing useful and successful partnerships are the sheer number of municipalities, private companies, public enterprises, universities and other organisations, and their diversity in terms of size, resources, expertise and politics.

For example, the United Kingdom has a complex system of regional and local government that differs between its four constituent countries. England has over 10 000 civil parishes (though parts of England lie outside the parishes), with populations ranging from under 100 to over 100 000. While their powers are limited and vary around the country, civil parishes do affect geospatial data by establishing allotments and setting neighbourhood development plans. There are also other authorities with separate geographical responsibilities, such as for fire and policing. Obviously, Greater London is the largest regional government, with 32 boroughs and a population over 8 800 000. There are fewer than 2300 people in the area for which the Council of the Isles of Scilly is responsible. The Highland Council in Scotland has the largest area (25 653 km²) of any local government in the

UK, but with a population under 240 000 [ONS 2024a, 2024b].

One of the key elements of the *Partnerships* strategic pathway is *Community Participation*. The IGIF aim is to move from community members just collecting local information (volunteered geographical information (VGI)) for an SDI to community members helping with problem solving and creating new innovations, such as through citizen sensing technologies [UN-GGIM 2022].

2. South African local government

2.1 Overview

South Africa has three spheres of government: national, provincial (nine of them) and local (257 municipalities), with their powers determined by the South African Constitution [South Africa 2013b]. There are three types of local government or municipalities:

- **8 Category A or metropolitan municipalities** (metros). Effectively, each metro combines a district and a local municipality. The two largest in area (Mangaung and Tshwane) include extensive rural areas, but the others are largely urban. Their 2022 populations¹ ranged from over 4 800 000 (Johannesburg) to under 820 000 (Mangaung) [StatsSA 2023].
- **44 Category C or district municipalities**. The metros and district municipalities form a contiguous coverage of South Africa. Each district municipality consists of several local municipalities. A district municipality is primarily responsible for planning across the whole district and building capacity, particularly within its local municipalities. Sometimes a district provides specialised services to local municipalities that lack the relevant experts (which is unfortunately common). Districts range in size from 126 836 km² (Namakwa) to 3269 km² (iLembe), and the population in 2022 from over 1 750 000 (Ehlanzeni Municipality) to under 75 000 (Central Karoo) [StatsSA 2023].
- **205 Category B or local municipalities**, forming a contiguous coverage with the metros of the whole country. They range in size from 44 231 km² (Dawid Kruiper, including the Kgalagadi Transfrontier Park) to 545 km² (Mandeni), and in population in 2022 from over 945 000 (Emfuleni) to under 8 600 (Khâi-Ma) [StatsSA 2023].

The South African Local Government Association (SALGA) is an autonomous and voluntary association of the local governments. It represents, promotes and protects the interests of local governments.

¹ Note that there are concerns over the quality of Census 2022, due to COVID-19, budget constraints, etc. For example, see Moultrie & Dorrington 2024].

As can be seen in the South African context, there is a wide range in area and population sizes for local government. In comparison to the UK, for example, five local municipalities and a further 13 district municipalities are larger than the Highland Council.

These variations mean that some municipalities have robust local economies with substantial resources (though not necessarily well managed) while others are precarious and have far-flung settlements. Note also that some deep rural municipalities have high population densities, such as the iLembe District municipality with a density over 200 people/km² and the Dr JS Moroka Municipality with a density over 170 people/km².

2.2 Performance

Local government performance relies heavily on the science of *where* – needing and sharing quality geospatial data to inform proper planning and making decisions. Local governments need qualified and capable staff to generate, implement and maintain geospatial integration, especially in the predominantly rural municipalities. These are all huge challenges for many municipalities.

As the Auditor-General South Africa (AGSA) reveals every year, many South African municipalities face severe challenges, preventing them from delivering services, being solvent and meeting reporting requirements. For the municipal financial year ended June 2023, the AGSA stated:

“After years of service delivery failures, council and administrative instability, financial mismanagement, and disregard for the law, this sphere of government faces greater demands than ever before to regain the trust of South Africans. Despite the commitments made ... action has been too slow and has had little impact on the lived realities of ordinary South Africans. As a result, I can report only on pockets of improvement” [AGSA 2024].

Some key results of these audits for 2022-23 are:

- Only 34 of the metros and district and local municipalities obtaining clean audits.
- The main hindrance to meaningful improvement is not complying with legislation, with 86% receiving findings of material non-compliance and 45% of non-compliance on strategic planning and performance management.
- 48% of municipal performance reports included useless and/or unreliable information and even worse, this was after the AGSA allowed municipalities to correct misstatements the AGSA identified. 19%

(including 5 metros) did not have indicators to measure performance on core mandated functions.

- 94% submitted their financial statements by the legislated date. However, financial reporting is still of a poor quality, as municipalities tend to rely on AGSA to identify misstatements.
- Poor financial management remains common, with much lost revenue due to inadequate billing and collecting, and to infrastructure neglect [AGSA 2024].

Examples of meaningless targets are a target of zero for an indicator; a target for submitting water samples to a laboratory rather than a target for actual water quality; an indicator not related to the municipality’s mandate; and a target for the number of monitoring reports submitted, not for what should be achieved. Indicators and/or targets in performance reports are often different from those committed to in the performance plan and there are often no verifiable processes for measuring against targets [AGSA 2024]. Many municipalities are unable “*to plan for, and report on, their performance*” [AGSA 2022].

Many municipalities are in poor financial health due to carelessness with spending, uncompetitive and uneconomical procurement, limited value for money, poor project management, unfunded budgets and much unauthorised expenditure. Finances are so dire in 74 municipalities (including two metros) that they themselves disclosed doubt about being able to continue operating fully – and many of them have been stating this for years [AGSA 2024]. Consequently, this limits their ability to deliver services and pay creditors, hampering local businesses and hence the local economy.

Further, municipalities combined owe Eskom² over R 107 bn, of which over R 77 bn has been outstanding for over 90 days. For example, the Enoch Mgijima Local Municipality in the Eastern Cape has owed Eskom over R 1.2 bn for over 90 days, yet its total revenue for 2022/23 was under R 932m [Hlabisa 2024; AGSA 2024]. Thus, it is unlikely the municipality can ever pay its debt.

The municipalities also owe the Water Boards over R 23 bn, of which over R 17 bn has been outstanding for over 120 days [Hlabisa 2024]. The debts to Eskom and the Water Boards continue to increase, to the extent that electricity and water supply to communities can get cut until debts are paid or arrangements are made [AGSA 2024]. Further, Eskom and the Water Boards themselves carry large debts, so the lack of payments by local governments hamper their abilities to improve and maintain infrastructure.

² The main supplier of electricity across South Africa.

“Local government is characterised by accountability and service delivery failures, poor governance, weak institutional capacity, and instability” [AGSA 2022]. The AGSA identified three critical weaknesses in municipalities that the AGSA has highlighted repeatedly before:

- Inadequate skills and capacity.
- Governance failures.
- A culture of no accountability and consequences [AGSA 2024].

To address these problems with local government and a lack of coordination between the various government entities on all three levels, the national government launched the *District Development Model* (DDM) in 2019 to have coherent and integrated planning and implementation of service delivery. The DDM focuses on the 44 Districts and 8 Metros to make them the centres for delivering services and improving local economies, particularly to provide jobs [DPME 2019].

The DDM framework is to foster “*intergovernmental joint planning, budgeting and programme and project implementation*” and to monitor this through developing and implementing a *One Plan* for each district and metro [DCoG 2024]. A One Plan does not replace other plans but must align with them.

A One Plan is to coordinate “*intergovernmental catalytic programmes and projects*”, which are multi-year plans with high budgets and impacts [DCoG 2024]. By July 2024, most districts had developed their One Plans [Mohai 2024]. Clearly, each One Plan (and hence the DDM as a whole) depends on ready access to quality geospatial data.

2.3 Context

The authors have had some experience in a metro, the City of Johannesburg, and a district, Ngaka Modiri Molema District Municipality (NMMDM) in the North West, which includes five local municipalities: Ditsobotla, Mafeking, Ratlou, Ramotshere Moiloa and Tswaing. NMMDM is predominantly rural.

Johannesburg has the highest municipal revenue, for 2022-23 being R 63.2 bn, R 53.5 bn own revenue and R 9.7 bn from grants. However, Johannesburg is in poor financial health, taking an average of 262 days to pay creditors, 43 days to collect debt and with 88% of its debt that cannot be recovered [AGSA 2024]. Johannesburg has been politically unstable since the 2016 elections, with coalition governments and eight mayors³ from three parties. Currently, there are 18 parties represented in the Council with eight having only one councillor each [IEC 2025].

³ One was arrested for fraud in October 2024 on unrelated matters [Luvhengo 2024].

3. South African Spatial Data Infrastructure

3.1 Overview

The Spatial Data Infrastructure Act [South Africa 2003] established the South African Spatial Data Infrastructure (SASDI) and to implement it, the Committee for Spatial Information (CSI). The CSI first met in 2010 and consists of representatives of key national departments and government entities, each province, the geoinformatics profession, academia and the identified data custodians. Local government is represented by two delegates, “*one of whom shall be from a municipality that is rural in character, and the other from a municipality which is mainly urban in character*” [South Africa 2003]. The members of the CSI are appointed to three-year terms. Support for the CSI is provided by the Directorate: National Spatial Information Framework (NSIF) in the Department of Rural Development and Land Reform (DALRRD).

While the CSI has existed since 2010, it has had a limited budget and there have been gaps between some iterations of the CSI. These have limited what the CSI has been able to achieve. Some of these are mentioned below. For more details, see Chauke *et al* [2021].

The CSI and its sub-committees have been investigating the IGIF and how to implement it in South Africa. The IGIF documentation has three main parts: Overarching Strategy, Implementation Guide and Country-level Action Plan. Part of the Country-level Action Plan is establishing a baseline for the country which can be used to assess maturity and develop a roadmap to implement IGIF. This should be able to guide municipalities, distinguishing between basic (enabling) capability and implementation (execution) ability. Several South Africans have also been taking leading roles in UN-GGIM and IGIF.

South Africa has adopted IGIF through the CSI for implementation across the country. So far, the implementation has revealed that seven provinces have geospatial structures at the provincial level, mostly championed by the Offices of the Premiers. Only a few metros, district and local municipalities have formalised geospatial information management (GIM) or geographical information system (GIS) forums. The work further shows that these existing structures exclude the private sector and more alarming, the provincial structures have few or no representatives from district or local municipalities.

Note that over the years, the three authors have all been members of the CSI and been active in its sub-committees.

3.2 SASDI and local government

A key problem with the CSI is that it is difficult to represent 257 different local governments on it, particularly given the differences in sizes, populations, economic and other infrastructure, and political leadership. Hence, the sentiment is that local government is marginalised, even if unintentionally. Further, only some of the provincial governments have participated in the CSI.

Hence and unsurprisingly, the CSI is dominated by national departments with national perspectives, mandates, governance and funding. This makes it top down, local last, something the IGIF aims to address [UN-GGIM 2022].

The CSI has identified 13 themes of base (or fundamental) geospatial data, which comprise 38 data sets. These are primarily national data sets, though provincial and local governments will contribute feature types and attributes for some to them. Each theme has been allocated to a Base Dataset Coordinator and most of the base data sets have a Custodian [CSI 2020].

For example, the Custodian for land parcels is the Chief Surveyor General and for ownership records it is the Chief Registrar of Deeds (through their provincial offices) and both are part of the national Department of Rural Development and Land Reform (DALRRD). However, the metros and many municipalities capture and maintain the cadastre at a frequency and accuracy required at municipal level and provide the updates and metadata to DALRRD. Officially, the CSI must use the *de jure* custodians, not the *de facto* custodians (the municipalities). To compensate, the CSI has also implemented the designation of Contributing Custodian for such municipalities.

At local level, many more data sets exist which can be, in the context of local government operations, defined as fundamental data sets. Physical (street) addresses are assigned by municipalities and are one key data set that has not yet been adopted by the CSI as a base data set. Nevertheless, the CSI has adopted two South African national address standards [DALRRD 2024], the address formats [SANS 1883-1 2008] and address guidelines [SANS 1883-3 2009]. It is 14 years since the CSI started functioning and much has changed – the reason for the IGIF.

Base data sets and services from national departments do not always provide for the detailed scale and update frequency required at a local level, primarily because of their limited resources. For example, metros and other municipalities need to budget to capture aerial imagery themselves for their own products to support decision-making at local level. However, this means there is a data

gap between what national departments provide and what poorly resourced municipalities need but cannot provide themselves (assuming they have the capabilities to use the data).

Statistics South Africa (StatsSA) is responsible for South Africa's country reports on the SDGs and manages the South African SDG portal [StatsSA 2025]. The portal and reports use data sourced from national systems, such as StatsSA itself. In many (even most?) cases these data bases should be fed from the local level, contributing towards the overall picture of the country. It is not clear what is being done to ensure the necessary support and empowerment at the local level, or how this affects the accuracy of monitoring and reporting.

This is a global problem with reporting on the SDGs and achieving them. Thus, in many cases, the reporting on the SDG indicators is done using sample surveys (such as many of StatsSA's products), administrative data at the national level (such as tax) and modelling, rather than by aggregating reporting from provincial and local governments.

Similarly, the SDG indicators tend not to measure operational, "on the ground", local conditions, but rather aggregated results, without the detail as input. Again, for the SDGs the priority probably was to select a set of indicators that most countries could measure, or that could be estimated reliably by the UN. There are 169 targets and 225 indicators, so some targets have few indicators. It also took much effort to develop internationally established methodologies or standards for the indicators [UN 2023].

Proper geospatial data management and data governance at the local level will contribute to better monitoring of the SDGs at national level. However, there needs to be a national plan to devolve the SDGs to the provinces and then to the municipalities.

4. IGIF and municipalities

In our opinion, it is feasible to implement the IGIF at a local level, in the same way that various South African municipalities have implemented SDIs (though not necessarily so termed) for discovering, using and sharing their data [Coetzee *et al* 2020]. An example is the City of Cape Town's Open Data Portal [CoCT 2025].

However, there are stumbling blocks related to achieving a municipal IGIF. The nine IGIF strategic pathways provide a framework for unpacking these stumbling blocks, or for classifying the stumbling blocks. Any SDI or IGIF for a municipality must be driven by the municipality's priorities, and not the national or provincial priorities. If the SDI or IGIF is helping the municipality function better, then it will help the municipality support the national and provincial priorities.

One cross-cutting impediment to any SDI or IGIF at a local level is perceptions by national government that such an SDI or IGIF must comply with national policies and priorities to satisfy the needs of national government. However, these national concerns might not meet the needs of the municipality and hence waste limited municipal resources. The national policies and priorities should be based on having municipalities that function well, rather than running the risk of preventing competent municipalities from getting even better because of different political ideologies. Further, municipalities are not homogenous.

This is obviously more complicated when a better resourced city has political leadership significantly different from that for the national government. The networks of cities across continents, such as the C40 Cities, can also make national governments less important and could develop their own multi-city IGIFs.

While IGIF is a fairly new concept in South Africa, the CSI intends incorporating the framework in the CSI's work and in achieving the SASDI and the CSI's Sub-committees on Data and on Policy & Legislation are exploring the issues. From this work, for example, key lessons (or points of interest) have been applied in developing the Provincial GIS Strategy for the North West, approved for implementation in January 2022. Of course, this does not mean that this strategy complies with the IGIF vision already.

The SDI Act [South Africa 2004] does not provide for provincial and local government structures. This caused few departments and municipalities to implement this fundamental function, though section 6(2)(g) of the Act provides for implementing IGIF successfully as the CSI "*may do anything necessary for the proper performance of its functions or to achieve the objectives of the SASDI*" [South Africa 2004]. Universities also need to align their programmes to meet the country's needs for geospatial integration. Through collaborative efforts and collaborative engagements, all three spheres of government for South Africa can advance the implementation of IGIF in South Africa.

Many institutions, especially municipalities, lack the needed capacity and expertise on geospatial integration and geospatial information management (GIM). For example, a district may have a Geomatics Practitioner or Technologist or Technician⁴ to give support to all the departments in the district municipality and to the local municipalities, which defeats the purpose, especially for a Technologist or Technician. A Practitioner should have an approach at the strategic level which requires patience,

resilience, time, resources and buy-in – but not so many are prepared to stand the pressure. There are few who have succeeded and their work is still celebrated.

In some situations where the municipality has GIM work well or successfully established through SASDI, there has been no continuity plan when officials move on to experience growth or retire and this may lead to the work collapsing. This is where implementing the elements of the IGIF strategic pathways becomes critical for all the IGIF strategic pathways. Priorities must be set. Not everything will or can be implemented simultaneously, but work must unfold to ensure progress on implementing a useful and sustainable IGIF.

Currently, municipalities rarely cater for GIM in their organisational structures (organograms) and where they do, the positions are either partially filled or not filled at all. Often, the required GIM work is somehow or partially done by other professionals without the needed expertise, such as town planners or engineers, because they need the geospatial data for their daily tasks. Hence many geospatial data sets lack metadata and have not been tested against quality standards for geospatial data, such as SANS 19157, for which the CSI and DALRRD have provided training [Cooper *et al* 2025].

Even in the municipalities that have the minimum GIM staff compliment required, there are still few of such practicing municipal officials that have registered with statutory professional bodies such as the South African Geomatics Council (SAGC). This can cause problems with protecting the interests of the public and might show the level of commitment to GIM work.

Geomatics officials in the municipal space need to be fully involved in and aware of the work with geospatial information across the organisation because the work environment is technological, and research driven. Thus, such officials need to invest not only on continuous professional development, but also on attending regional, national and international workshops and conferences and being aware of the needs of the stakeholders, institution and country.

Each province in South Africa has some form of a GIM structure, such as a forum that meets regularly and a provincial SDI. These can help support the municipalities and have been making progress on issues of geospatial information. It will be useful to document what is being done so that the provinces can share good practices. Based on our personal experiences and the engagements through a baseline survey conducted through the CSI, these provincial structures are probably not yet fit for the IGIF. For example, in the North West, most of the key drivers of

⁴ The professional designations in terms of the Geomatics Profession Act [South Africa 2013a].

the structure are officials from the Provincial Department of Local Government and Traditional Affairs, who are driven by the needs at their work environment.

Further work needs to be done to meet the recommendations of the working groups that inform the IGIF implementation, to eliminate the stumbling blocks mentioned above, and others that are likely to arise.

5. Conclusions

We have provided here an overview of the Integrated Geospatial Information Framework (IGIF) and how it could be implemented in a developing country such as South Africa. While the IGIF aims to address societal and environmental problems from local to global levels, it appears to be aimed primarily at national governments and regional and international organisations. Hence, we focus here on how the IGIF could be implemented at the local (municipal) level.

Implementing the IGIF at a national or local level requires a conducive, enabling environment. However, from the reports of the Auditor-General South Africa [AGSA 2022, 2023, 2024], it is clear that such an environment is not common in municipalities. Hence, far more support to municipalities and better coordination are required to enable IGIF implementation at the municipal level. Implementing the IGIF goals should be included in the municipalities' strategic and other plans to facilitate inclusion and integration of the three spheres of government.

We recommend that South Africa prioritises completing the National Geospatial Information Management Framework and Strategy (which has been in abeyance for some years) to enable delivery of basic services, to promote proactiveness as opposed to reactivity, and to enhance responsiveness. We also recommend that this runs concurrently with reviewing the SDI Act and its regulations, to promote geospatial integration and minimize non-compliance on delivering basic services, fruitless expenditure and exorbitant costs for operations and maintenance. Finally, the national government needs to provide municipalities with the support they need to implement IGIF implementation.

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