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Proposal for a South African spatial data infrastructure (SASDI) stakeholder collaboration framework, informed by the case of geospatial data for the municipal land use application process

by

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Submitted in fulfilment of the requirements for the degree
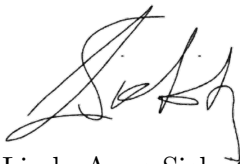
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Declaration

I, Lindy-Anne Siebritz, student number 19282088 hereby declare that this dissertation, *Proposal for a South African spatial data infrastructure (SASDI) stakeholder collaboration framework – The case of geospatial data for the municipal land use application process*, is submitted in accordance with the requirements for the degree PhD in Geoinformatics at the University of Pretoria, is my own original work and has not previously been submitted to any other institution of higher learning. All sources cited or quoted in this research paper are indicated and acknowledged with a comprehensive list of references.

Lindy-Anne Siebritz

May 2023

Ethics Statement

The author, whose name appears on the title page of this thesis, has obtained the required research ethics approval/exemption for the research described in this work.

The author declares that they have observed the ethical standards required in terms of the University's Code of ethics for scholarly activities.

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Abstract

Globally, the geospatial community is making great effort to maximise the use of geospatial information for solving complex problems, at various scales. The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) who set the international direction for the governance and management of geospatial information, has in recent years published the Integrated Geospatial Information Framework (IGIF). This framework was designed to assist countries with developing an integrated approach to geospatial information, equipping them to better respond to their national objectives. Implementation of the IGIF may be realised through various existing platforms, such as spatial data infrastructures (SDI). However, the traditional SDI with its narrow focus has to evolve one that is 'open', encourages and enables participation from a wider pool of stakeholders, and is able to contribute to various disciplines. With a wider pool stakeholders comes various governance challenges, the IGIF will assist with managing those challenges.

Efforts toward an SDI-like initiative in South Africa dates back to at least four decades. Originally, the purpose was to make standardised national geospatial datasets available to users. Over time this evolved, and with the enactment of the Spatial Data Infrastructure Act No.53 of 2003, the South African spatial data infrastructure (SASDI) was established as the technical, institutional and policy framework to govern geospatial data produced by government organisations. There have been changes and advances with the SASDI, however the governance still requires much work, which has resulted in limited access to fundamental geospatial datasets. Therefore, the aim of this research is to propose a solution for the governance challenges related to geospatial datasets in the context of SASDI.

The municipal land use use application process as prescribed in the Spatial Planning and Land use Management Act No. 16 of 2013 (SPLUMA), was selected as the case study. The results informed the proposed solution, which is a SASDI stakeholder collaboration framework. This process was ideal because it involves multiple stakeholders who all have an influence over the process, various geospatial datasets are required to make land use the land use decisions, and fundamental geospatial is derived from this process, the municipal land use rights and zoning data. Through study of the spatial planning and land use management legal framework and a process of semi-structured interviews with municipal representatives from two provinces, valuable insights were gained into the municipal business processes, their stakeholder engagement and their management of geospatial information.

The main results show that metropolitan municipalities have access to more resources compared to local municipalities, placing them at an advantage with the implementation of their land use management systems, and governance of geospatial data. On the contrary, local municipalities, especially those situated in rural areas have, and continue to rely on the support of provincial government for implementing SPLUMA-compliant systems. The type of provincial support was different between the two provinces, either way, provincial government proved to be a vital intergovernmental link between municipalities and national government.

With SPLUMA, municipalities gained influencing power of land use decisions, which has translated into urgency. The urgency was observed through their strict compliance with the SPLUMA time-frames, and the actions they take to ensure compliance, such as spending their budget on acquiring the geospatial data they need. In addition, the urgency was also determined by the individuals' attitudes; they believed that their actions contribute to societal benefits.

Municipalities experience great difficulty in accessing the geospatial information they require. National departments such as the National Mapping Agency and Office of the Surveyor General continue to disseminate data that does meet the requirements of municipalities. Despite their challenges, municipalities have been resilient; they have developed innovative ways to acquire the data in order to address their mandate for service delivery, for example, there is extensive collaboration between the departments to create the data they need and avoid duplicate data capture. There was no evidence of data-related collaborations between the municipalities and external stakeholders. There was also no evidence of any significant external support with the management of geospatial data; specifically, the SASDI has not aided in this adequately. In fact, SASDI awareness was very low amongst municipalities, and those who had knowledge expressed their need for guidance, support and mechanisms to access good quality geospatial data.

The proposed SASDI stakeholder framework is aimed at improved access to useful, usable geospatial information. The conceptual model for the framework utilises a mechanisms approach, as taken from the data governance literature and was enriched with the case study results. Four interrelated mechanisms were proposed, the structural, procedural, relational and evaluative mechanisms. For each of the four mechanisms, the structures, instruments and influences are proposed. Though the framework is designed for the South African context, it may easily be translated for other countries.

Contents

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List of Acronyms

AGIS	Agricultural Geo-referenced Information System
AGSA	Auditor-General of South Africa
ASDI	Australian Spatial Data Infrastructure
CAS	Complex Adaptive System
CCNLIS	Coordinating Committee for the National Land Information System
CD: NGI	Chief Directorate: National Geospatial Information
CD: SM	Chief Directorate: Surveys and Mapping
CGIS	Canadian Geographical Information System
CoCT	City of Cape Town Metropolitan Municipality
CoGTA	Ministry: Cooperative Governance and Traditional Affairs
CoJ	City of Johannesburg Metropolitan Municipality
CSI	Committee for Spatial Information
CSIR	Council for Scientific and Industrial Research
DARD & LR	Department of Agriculture Rural Development and Land Reform
DCPR	Data Capture Project Register
DEA & DP	Department of Environmental Affairs and Development Planning
DPME	Department of Planning, Monitoring and Evaluation
DRD & LR	Department of Rural Development and Land Reform
EIS	Environmental Information System
EMC	Electronic Metadata Catalogue
FRD	Foundation for Research Development
GCR	Gauteng City Region
GEM	Geospatial Empowerment Matrix
GGDI	Global Geographic Data Infrastructure
GIS	Geographic Information System
GKI	Geospatial Knowledge Infrastructure
GPD	Gauteng Planning Division
GSDI	Global Spatial Data Infrastructure
ICT	Information and Communication Technology
IGIF	Integrated Geospatial Information Framework
IGRF	Intergovernmental Relations Framework Act No. 13 of 2005
INSPIRE	Infrastructure for Spatial Information in Europe
ISO/TC211	Technical Committee of the International Organization for Standardization

LUPA	Western Cape Land Use Planning Act, No.3 of 2014
MDB	Municipal Demarcation Board
MPT	Municipal Planning Tribunal
MSDF	Municipal Spatial Development Framework
NDP	National Development Plan
NES	National Exchange Standard
NGI	National Geospatial Information
NLIS	National Land Information System
NMA	National Mapping Agency
NPA	New Public Administration
NPG	New Public Governance
NPRS	National Programme for Remote Sensing
NSDF	National Spatial Development Framework
NSDI	National Spatial Data Infrastructure
NTIS	National Topographic Information System
OGC	Open Geospatial Consortium
OPA	Old Public Administration
PA	Public Administration
RCMRD	Regional Centre for Mapping of Resources for Development (RCMRD)
SABS	South African Bureau of Standards
SABS /TC211 South	African Bureau of Standards Technical Committee
SAEON	South African Earth Observation Network
SAGIMS	South African Geospatial Information Management Strategy
SALGA	South African Local Government Association
SANSA	South African National Space Agency
SDDF	Spatial Data Discovery Facility
SDF	Spatial Development Framework
SDI	Spatial Data Infrastructure
SDI Act	Spatial Data Infrastructure Act N0. 54 of 2003
SGO	The Office of the Surveyor General
SLA	Service Level Agreement
SOP	Standard Operating Procedure
SP4	Strategic Pathway 4: Data - Global Consultation Draft
SP7	Strategic Pathway 7: Partnerships - Global Consultation Draft
SPLUM	Spatial Planning and Land Use Management
SPLUMA	Spatial Planning and Land Use Management Act No.16 of 2013
Stats SA	Statistics South Africa
ToR	Terms of Reference
UNDP	United Nations Development Programme
UN-GGIM	United Nations Committee of Experts on Global Geospatial Information Management
US SDI	United States Spatial Data Infrastructure
VGI	Volunteered Geographic Information

Chapter 1

INTRODUCTION

1.1 Introduction

The United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) is the international committee to facilitate cooperation amongst member states in the field of geospatial information (UN-GGIM 2011). Their most recent publication is the Integrated Geospatial Information Framework (IGIF). The essence of the IGIF is integration and inclusion of various spheres, sectors and disciplines to optimise geospatial information management at the national level. Countries, especially those with a lower income may find the IGIF beneficial for addressing their national strategic objectives and for contributing to international programmes for sustainable development (UN-GGIM 2018a).

The idea of the IGIF is to enhance the usability of geospatial information by aligning government programmes such as e-governance, engaging a wider pool of stakeholders and improving the existing initiatives. Platforms such as spatial data infrastructures (SDIs), can play a prominent role, however the IGIF calls for a revamp of the traditional SDI (UN-GGIM 2018a, 2019a).

With the advances in technology and the changing role of government, SDI has gone through a few iterations (Rajabifard et al. 2006, Masser 2009). According to the literature, these iterations may be referred to as, first, second and third generation SDIs (Masser 1999, Rajabifard et al. 2002, Budhathoki et al. 2008). The evolved SDI is concerned with a sound governance structure that leads to a sustainable SDI. It also advocates inclusivity, where even users have an influence over the SDI (Rajabifard et al. 2006, Masser et al. 2008). SDI researchers also refer to an 'open' SDI that allows users access to unrestricted geospatial data (Vancauwenberghe & van Loenen 2017, van Loenen 2020). In reality though, SDIs are still predominantly controlled by national governments and key role players like sub-national government and service providers, are still overlooked. Hence, the challenges that the SDI aims to address, persist: important datasets are still inaccessible, data producers create data that only serves a small number of stakeholders, organisations spend their budget on data that should be readily available and organisations are locked in by service providers and their propriety formats etc. (Box 2013, Scott 2019, Coetzee et al. 2021, Siebritz et al. 2021). As a solution to these problems, the SDI coordinating bodies should engage their stakeholders pro-actively, especially those that have been neglected.

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Secondly, stakeholders need to be provided with the tools that equip and enable them to participate in the SDI. Previous research has demonstrated how organisational instruments can be utilised effectively for SDI institutionalisation (Verhoest et al. 2007, Vancauwenberghe & van Loenen 2017, Crompvoets et al. 2018, Sjoukema et al. 2020, 2021).

The challenges described above, resemble the state of the South African SDI (SASDI) and geospatial information management in government, that is, inadequate governance, no bottom-up influence from sub-national and other users, limitation with accessing fundamental geospatial data etc.

1.2 Context: The South African Spatial Data Infrastructure

The goal for South Africa is to eradicate poverty and reduce inequality by the year 2030 (National Planning Commission 2010). The National Development Plan (NDP) outlines how the Government of South Africa intends to address the primary inequalities that resulted from the Apartheid legacy. The Apartheid government enacted legislation that promoted racial exclusion, denying minority groups access to education, basic services, safety and shelter. To signify the end of the Apartheid era and usher in the new democracy, the Constitution of the Republic of South Africa No.108 was adopted in 1996 (South African Government 1996). The provisions of the Constitution nullify any contradicting laws or conduct (refer to section 2 of the Act). Consequently, all of the previous regime legislation was repealed, and new legislation was enacted. Applicable to this thesis, are the new order municipal legislation and the legislation that enables this new system of government. In particular, the Spatial Data Infrastructure (SDI) Act No.53 of 2003 and the Spatial Planning and Land Use Management Act (SPLUMA) No.16 of 2013 are foundational to this research.

1.2.1 The Spatial Data Infrastructure Act No.53 of 2003

Prior to the establishment of the SDI Act, role players within the national sphere were pioneering a SDI. At the time, the goal of such an infrastructure was to provide access to standardised geospatial data produced at a national scale. Sometime after, the SDI Act was promulgated to establish the official South African spatial data infrastructure (SASDI). Siebritz et al. (2022) (see Chapter 5) presented longitudinal review of the SASDI since it was first envisioned, to its current state. The authors trace the trajectory of its development and implementation over four decades, and the primary influences that contributed to its successes and failures.

According to section 3 of the SDI Act, the SASDI is the "national technical, institutional and policy framework to facilitate the capture, management, maintenance, integration, distribution and use of spatial information". The Act lists a number of objectives to qualify such a national framework, ultimately to ensure that all users have easy access to good quality, authoritative spatial information. Furthermore, section 5 of the Act establishes a Committee for Spatial

Information (CSI), that is the coordinating body for the SASDI responsible for implementing the SASDI. The responsibilities of the CSI include, the appointment of data custodians, who are organs of state that capture, manage and distribute spatial information (South African Government 2003a). Further distinction is made in the Base Data Set Custodian Policy for a 'base data set custodian'. The criteria for the base data set custodian includes a legal responsibility to the data and the resources to maintain such custodianship (Committee for Spatial Information 2015).

The Act is not applied to a particular national objective, such as environmental preservation or sustainable development etc., though geospatial information is fundamental to achieving these goals. Hence, there has been limited integration with other pertinent legislation. Cooper et al. (2014) and Siebritz & Coetzee (2022) highlight this in the context of SPLUMA - the SASDI should be providing cross-sector support for geospatial data governance and management.

1.2.2   The Spatial Planning and Land Use Management Act

A big part of the NDP is dedicated to overcoming the spatial divides that still exist across South Africa (National Planning Commission 2010). SPLUMA is seen as instrumental legislation for transforming the spatial injustices of the past, through the provision of equitable access to land. In terms of forward planning, the Act also promotes sustainable and resilient spatial planning and land use management practices within all three spheres of government, that is local, provincial and national.

As the title suggests, SPLUMA has two components, spatial planning and land use management. Of interest to this thesis, is the land use management and more specifically, the land use application process that is implemented within local government. This refers to the process whereby the municipality, in consultation with the affected stakeholders, decide on the legal use of land. SPLUMA requires that the municipality captures and maintains a spatial record of every land use application, which for the purpose of this thesis will be referred to as the land use rights data(set).

1.3   Problem Statement

To date, the CSI has appointed a number of national government departments as base data set custodians who are now obligated to capture, maintain, manage, integrate and distribute fundamental geospatial datasets. However, the governance details of geospatial datasets have not been specified. In practice, custodianship and geospatial data governance is far more involved than appointing custodians. As a result, access to various fundamental geospatial datasets is still a challenge.

1.4   Aim and Objectives

The aim of this research is to propose a solution for the governance challenges related to geospatial datasets in the context of SASDI, which has led to limited access to the data. The municipal land use application process was used as a case study because several fundamental geospatial datasets are required for the assessment of an application and because fundamental geospatial data is derived from this process i.e. the land use rights data and the zoning data. Many diverse stakeholders are involved, and municipalities make the final decisions on applications. To achieve this aim, four objectives were identified:

1. to understand possible governance options based on an investigation of the theory for SDI governance, SDI coordination approaches, and collaborative stakeholder theory;

2. to review the status quo of the SASDI development and implementation, with a focus on governance and municipal involvement

3. to understand and identify the shortcomings of the governance structure and business processes for the municipal land use application process in South Africa; and

4. based on the above, propose a collaboration framework for SASDI stakeholders to improve governance of and access to fundamental geospatial datasets.

1.5   Case Study Delineation

With the new Constitution in 1996, came a new system of government for South Africa, the national, provincial and local spheres was introduced; the spheres are distinct, interrelated and interdependent (South African Government 1996). Municipalities make up the local sphere and are categorised into three types, district, metropolitan and local municipalities. Their respective powers and functions are defined in section 155 of the Constitution (South African Government 1996). Depending on the category, a municipality either has exclusive or shared legislative and executive authority in its area. According to SPLUMA, land use management is a function of metropolitan and local municipalities, while district municipalities must offer a supportive function.

Using the case study method, the municipal land use application process was selected for this study to inform the recommendations for the SASDI stakeholder collaboration framework. The land use application process comprises various phases from when the application is received, to when a final decision is taken, and the land use rights are captured in the system. As per the spatial planning and land use management legislative framework, municipalities must consult all the stakeholders that are affected by an application. The legislation also entitles municipalities to receive support and guidance from both the provincial and national spheres for this undertaking.

Semi-structured interviews were conducted with representatives from various municipalities in the Western Cape and Gauteng provinces. The interview participants provided detailed descriptions of their land use management, their geospatial data management and inadvertently, the organisational culture within their respective municipalities. Further to this, the flexibility of the interviews gave participants a sense of comfort, which led them to provide information beyond the structured questions.

1.6   Significance of Study

The inaccessibility to fundamental geospatial data means that South African organisations are still operating in silos. It is not the norm for organisations to voluntarily pool their resources with external stakeholders though collaborative efforts, for the provision of geospatial information. The negative impact of this is seen throughout government, but especially in the local sphere, where access to fundamental geospatial information is still a great challenge. Municipalities are unable to provide public services, as per their mandate if they cannot access the data they need. The people of South Africa end up suffering, as result.

This work is the first contribution toward the implementation of the UN-GGIM IGIF in South Africa. The recommendations for the collaboration framework align with the principles of the IGIF and supports the evolution from the current state of the SASDI, which is coordinated hierarchically to one that is open, inclusive and enables bottom-up influences from various stakeholders.

The SASDI governance has been lacking for many years; this collaboration framework proposes the structures and instruments that removes the uncertainty of stakeholder roles and responsibilities. The collaboration framework supports the Constitutional requirements for an interdependent government by proposing intergovernmental structures for governing and managing geospatial information. Additionally, the framework gives special attention to the participation of the local sphere who has been a neglected SASDI stakeholder over the past four decades.

The recommendations presented in chapter 8 may inform a future SASDI strategy.

1.7   Researcher Background

This section provides a brief description of the researcher's involvement with the SASDI and SASDI stakeholders. The purpose is to provide context for the discussion on maintaining objectivity during the interview process as discussed in section 3.5.1. In addition, it explains why the researcher has knowledge on related aspects that are not documented officially.

The researcher holds a BSc degree in Geomatics and a MSc degree in Engineering with the

University of Cape Town. For the last 16 years she has been employed by the National Geospatial Information (NGI), a chief directorate within the national Department of Agriculture Rural Development and Land Reform (DARD & LR). As the National Mapping Agency (NMA) of South Africa, the NGI has been participating in the SASDI for a number of years. It was also appointed a custodian of certain fundamental geospatial data and a coordinating custodian for the acquisition and distribution of aerial imagery.

Between 2015 and 2016, the researcher worked in the National Spatial Information Framework (NSIF), the directorate responsible for the implementation of the SASDI. Her duties included development of technical tools for the SDI, implementation of geospatial data standards, review of SDI policies, stakeholder engagement and capacity building in the technical aspects of SDI implementation. She actively participated in SASDI activities through her membership on committees and subcommittees until 2020. During this period, the researcher had the opportunity to engage various SASDI stakeholders.

In 2019, the researcher, in collaboration with a consortium of organisations initiated the Municipal Capacity Building Project (refer to Chapter 4 and Chapter 5). The purpose of the project was to assist municipalities in South Africa to better manage their geospatial resources, to develop an SDI culture and thus, enable SDI implementation. To date, the project team has developed the Geospatial Empowerment Matrix (GEM), which is a framework employing an intergovernmental, tiered approach to SDI implementation. The team also developed other instruments such as questionnaires etc.

1.8   Thesis Outline

The thesis starts with a review of the literature on SDI in Chapter 2 - the evolution, governance approaches and methods for assessing the success and impact of SDIs. This is the main chapter that contributes to the first research objective, to understand possible governance options for the proposed collaboration framework. Chapter 4 and 5, both of which were published as articles, review the development and implementation of the SASDI over the last four decades. Chapter 4 presents a critique on the role of municipalities over the study period. Chapter 5 presents a detailed review of the SASDI for each decade and concludes with a proposed governance framework for SASDI participation which includes all three spheres of government. Chapters 4 and 5 both contribute to the second research objective, which is to review the status quo of the SASDI, focusing on governance and municipal involvement. Chapter 5 includes a review of the international SDI trends and thus, also contributes to the first research objective.

Chapter 6, which was also published presents the first phase of the analysis, a statutory study of the spatial planning and land use management legal framework to determine the stakeholders influences on the municipal land use application process. The method for the second phase, the empirical analysis is described in Chapter 3 and the results are discussed in Chapter 7. The three

chapters contribute to the third research objective, to understand and identify the shortcomings of the governance structure and business processes for the municipal land use application process in South Africa. The recommendations for a SASDI stakeholder collaboration framework are presented in Chapter 8. Chapters 3 and 7 contribute to the fourth research objective, to propose a collaboration framework for SASDI stakeholders and Chapter 8 presents the collaboration framework. Chapter **??** outlines the main conclusions of the study.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This chapter aims to address the first research objective:

> to understand possible governance options based on an investigation of the theory for SDI governance, SDI coordination approaches, and collaborative stakeholder theory

This is achieved by starting with a review of SDIs more generally, that is the SDI evolution, both from the international and national perspectives. The next section focuses on SDI governance - how it is defined, how it is integrated into broader government programs and the methods to assess the governance. In Chapters 4 and 5, the pragmatic State of Play was applied to assess the SASDI (Vandenbroucke et al. 2008b). For completeness, the other SDI assessments are presented in last section of this chapter.

2.2 The Evolution of the SDI Concept

2.2.1 Defining SDI

The SDI concept emerged because there was a need for the holistic management of spatial resources to ensure that all users have access to good quality spatial data, whenever they need it. It is the mechanism designed to oversee, guide and facilitate the spatial data management activities (i.e. data capture, maintenance, dissemination, value-adding, sharing etc.) of the public sector, private sector and users of spatial data. SDIs must facilitate access to spatial data and coordinate the associated activities to maximise resources. From the perspective of government, its value is seen in improved organisational functioning (Rajabifard et al. 2002, Dessers et al. 2010, van Loenen 2020), which must translate into an improvement in society. Because SDIs have mainly been driven by governments, improvements in society may be measured through improved service delivery and conservation and preservation of the environment.

Different countries have taken on different perspectives of SDI based on their understanding of the concept and their social system (Coleman & McLaughlin 1998, Rajabifard et al. 2002, Maguire & Longley 2005). As such, SDIs are defined in terms of the components and the arrangement of those components, which differ from one country to the next (Coleman & McLaughlin 1998). The 1996 White Paper for the development and program of action for the implementation of the Global SDI (GSDI), identified the following components as essential for an SDI, "technology, legacy data, culture, academic resources, professional organizations, governmental agencies, and legal and regulatory structures" (McKee 1996). Also at the global level SDI level, Coleman & McLaughlin (1998) provided a working definition for the Global Geographic Data Infrastructure (GGDI), which considers a number of SDI definitions, including the GSDI definition: "A Global Geospatial Data Infrastructure encompasses the policies, technologies, standards and human resources necessary for the effective collection, management, access, delivery and utilization of geospatial data in a global community." The authors emphasize that the definition cannot be applied to all countries but may be contextualised for a specific environment.

Table 2.1 provides some examples of country level SDIs from different parts of the world. Hendriks et al. (2012) used two main criteria for SDI definitions, 1. the description of the SDI components and 2. the SDI objectives. These two criteria are further expounded to distinguish between the various types of SDI definitions. In Table 2.1, the third column refers to the objectives of the SDI, as proposed by Hendriks et al. (2012).

The purpose of highlighting these varying definitions for SDI is to demonstrate that the NSDI definition is influenced by the intended purpose and the context of a country. Understanding the context is achieved through careful consideration of the driving forces, such as international policies and agendas, international donors, political unrest and war, the state of economic development, system of government, technological advances, user needs etc. (Masser 1999, Rajabifard et al. 2002) The driving forces not only influence the definition of SDI but shapes how it evolves over the time. In early developments of SDI, the focus was narrow, allowing only those driving forces of direct interest to shape the SDI (Masser et al. 2008). However, the thinking behind SDI has evolved considerably since then.

2.2.2 The SDI Evolution

First Generation SDI

The evolution of SDIs has been a topic of discussion since the late 1990's, when the term SDI started becoming a more universally accepted concept. Toward the end of the 20th century, Masser (1999) presented an investigation into eleven country level initiatives that the author categorises as first generation SDIs. For each initiative the driving forces, status, scope of stakeholder participation, access to fundamental data, approach to implementation and the resource coordination (cost versus benefit) were evaluated. At that stage these initiatives were characterised as first generation SDIs based on the fact they had national interest, made

Country Level SDI Definitions		
Country	Definition	SDI Objective (Hendriks et al. 2012)
United States	"...the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data." (Clinton 1994)	Data-related: data utilization
	"...the technology, policies, criteria, standards, and employees necessary to promote geospatial data sharing throughout the Federal, State, Tribal, and local governments, and the private sector (including nonprofit organizations and institutions of higher education)". (Federal Geographic Data Committee 2020)	Data-related: data sharing and user-related
Australia	"The ASDI comprises the people, policies and technologies necessary to enable the use of spatially referenced data through all levels of government, the private sector, non-profit organisations and academia." (The Intergovernmental Committee on Survey and Mapping n.d.)	Data-related: data access and utilization and user-related
Canada	"CGDI is the relevant base collection of standards, policies, applications, and governance that facilitate the access, use, integration, and preservation of spatial data." (Natural Resources Canada n.d.)	Data-related: data access, utilization and preservation
Namibia	The National spatial data infrastructure is established as the national technical and institutional framework to facilitate the capture, management, maintenance, integration, distribution and use of spatial data." (Namibian Government 2011)	Data-related: data access, utilization

Table 2.1: Country level definitions for NSDIs

reference to geographic or geospatial resources and operated within an infrastructure or system.

Second Generation SDI

Subsequent to the investigation by Masser (1999), around the early 2000's Rajabifard et al. (2002) introduced second generation SDIs, making a clear distinction between the two categories of SDI: while first generation SDIs are product-focused (or data centric), the second generation SDIs are focused on processes. With each approach comes a different way in which the SDI is utilised and taken up by its participants, and thus how it is able to respond to the objectives of the SDI. With the first generation of SDIs, the objective was more simplistic - producing data, generally from within central government and making it accessible to users (Rajabifard et al. 2006). There was less consideration given to the people aspect of SDI (e.g. user needs) (Rajabifard et al. 2006, Masser et al. 2008). Second generation SDIs promote data-sharing

(Rajabifard et al. 2006) and are dynamic because it makes allowance for the interactions between stakeholders, and the interactions between stakeholders and the components of SDI through policies, frameworks, networks etc. These dynamic second generation SDIs are intended for quality decision-making on issues such as governance, national planning and sustainable development. The United States (US) NSDI presents a good example of SDI transition from a first to a second generation SDI (Federal Geographic Data Committee 2020). With the decision to establish a new approach to SDI in 2002, there was a shift from a technical focus to the coordination and alignment of geospatial activities and the inclusion of all government stakeholders, the private sector as well (i.e. shift to governance focus) (Maguire & Longley 2005). Maguire & Longley (2005) noted how the US NSDI geoportal quickly gained acceptance by the community, following the shift in approach. Many years later, the US NSDI strategic plan for 2021-2024 still emphasizes the importance of including a broad range of stakeholders to ensure successful implementation of the SDI goals and objectives (Federal Geographic Data Committee 2020).

Process-driven SDIs emerged because a different approach for managing spatial resources was required. The rapid developments in Internet technology, specifically the emergence of Web 2.0 was the inspiration for this change in approach (Rajabifard et al. 2006, Masser 2009). Unlike Web 1.0, Web 2.0 is user-centric - it allows users to be active participants and contributors of web content, making it dynamic (Masser 2009). The new approach to SDI implementation did not necessarily require new SDI components, but rather required a change in the way the components interacted with each other, with a strong focus on stakeholder interactions. According to Rajabifard et al. (2002), the definitions of these interactions may be referred to as SDI governance. SDI governance is discussed in more detail in the sections that follow.

Third Generation SDI

In the early 2000's, SDI researchers were already discussing a third generation of SDIs (Rajabifard et al. 2006, Budhathoki et al. 2008, Masser 2009). Within third generation SDIs, sub-national government, the private sector and data users are allocated greater influence (Rajabifard et al. 2006, Masser et al. 2008). Rajabifard et al. (2002) uses the term "user-centric SDI", to describe SDI development and implementation that is driven by the needs of the users. This was also emphasized by (Masser 1999). The relationship between people and data must be well-defined and also adapted according to changes in user needs and changes in the other SDI components (Rajabifard et al. 2002). According to Masser et al. (2008), an SDI that is able to support a broader set of stakeholders contributes to a more inclusive SDI governance structure, toward the vision of a spatially-enabled society. In addition to inclusive SDI governance, the authors identify transparent technical platforms and increased data-sharing amongst organisations as the key strategic challenges to address in the pursuit of a spatially-enabled society. Based on this same ideology, Hennig & Belgiu (2011) proposed a framework for the inclusion of user needs at each of the SDI development phases to enhance the interactions between the users and the respective SDI components; they apply the concept of usability. The authors conclude that

education and capacity building is the primary method for taking the concept of a user-centric SDI into practice. With the emergence of Volunteered Geographic Information (VGI), platforms where any user can create and contribute geographic information, authors like Budhathoki et al. (2008) and Cooper et al. (2011) proposed a specific stakeholder role to accommodate for VGI producers in official SDIs.

Vancauwenberghe & van Loenen (2017) argue that this inclusive stakeholder approach to SDI governance leads to 'open' SDIs, where, "...non-governmental actors are considered as key stakeholders and beneficiaries of the infrastructure". Open in this case means that the data is available to all users without restrictions (such as costs, licensing restrictions and propriety data formats, etc.) on its use and reuse (van Loenen 2020). Essentially, as Vancauwenberghe & van Loenen (2017) state, open SDIs are achieved by applying the open data principles to SDIs. The open data principles are provided through the Open Data Charter, which is a collaboration between over 150 countries from around the world. Their mission is "to make data open and freely available, while protecting the rights of people and communities" and their focus is on anti-corruption, climate change and pay equity (Open Data Charter n.d.). Vancauwenberghe & van Loenen (2017) highlight an important aspect about open SDIs, that the governance structure itself needs to be open or geared toward openness, and not just making the data open. The authors state that open governance means opening the SDI to non-governmental actors, which may be enabled through various public organisation instruments (e.g. strategy plans, vision documents and open standards to reduce organisations' reliance on propriety formats from service providers (Geospatial World & United Nations Statistics Division 2021)).

Beyond SDI: The Geospatial Ecosystem

Coetzee et al. (2021) advocate for a future state, beyond the SDI concept; they refer to a 'geospatial ecosystem'. The geospatial ecosystem is a subset of a wider digital information ecosystem in which "...all members of the global community ubiquitously interact with each other directly or indirectly, leveraging quality and reliable location-based information and powerful geo-analytics which are communicated through dynamic geomedia". The ecosystem is sustained through self-regulation (i.e. collective control), competition and collaboration. One such wider digital information ecosystem is the Geospatial Knowledge Infrastructure (GKI) proposed by in the 2021 White Paper by Geospatial World and the United Nations Statistics Division (UNSD) (Geospatial World & United Nations Statistics Division 2021). The aim of the GKI is to move from the traditional data provision focus to knowledge creation; it aims to maximise the "power of location" with fundamental geospatial being the base element (Geospatial World & United Nations Statistics Division 2021). According to the Paper, the GKI is a mechanism whereby governments, through the IGIF, can collaborate with industry and academia to address wider digital agendas.

2.3 A Global Perspective

In 1992, at the United Nations Conference on Environment and Development held in Rio de Janeiro, it was resolved that geographic information was an essential resource for addressing the deteriorating state of the environment (GSDI 2004). In response to this resolution, the first conference for establishing the GSDI was held in 1996, in Germany. The purpose of the GSDI was to provide a shared vision across countries which is, "improving the quality of life and preservation of the global environment", to be achieved through the implementation of SDIs (McKee 1996). At the global level, the GSDI community recognised that the existing National and Regional SDIs were the participants and contributors of the global network (McKee 1996). Thus, the GSDI was about harmonising existing SDI efforts from the various countries and providing assistance to those who were still in the process of building their SDIs. The GSDI Association, which was established in 2003 provided guidance on the development and implementation of SDIs at different scales (GSDI 2004). In 2018, the GSDI Association was dissolved and its vision and mission were adopted by other international entities that had the necessary resources available, such as the UN-GGIM (?).

The UN-GGIM was established in 2011 with the aim to facilitate coordination and dialogue between UN Member States, to enhance cooperation in the field of global geospatial information (UN-GGIM 2011). Five regional UN-GGIM committees were established in 2014 and they undertook the work on the development and implementation of NSDIs, toward the effective and efficient management of geospatial information.

The UN-GGIM Integrated Geospatial Information Framework

In 2018 the UN-GGIM published the IGIF in collaboration with the World Bank. The IGIF provides a holistic framework that integrates intergovernmental aspects and national needs to enhance the role and capabilities of existing architectures like NSDIs (UN-GGIM 2018a). The IGIF is intended to create an enabling environment for governments to achieve their national objectives and participate in the 2030 Agenda for sustainable development through the "...efficient and effective use and sharing of geospatial information for policy formulation, decision-making and innovation" (UN-GGIM 2019a). NSDIs form part of the integrated national geospatial programme, which is supported by various national information systems, as shown in Figure 2.1 (UN-GGIM 2018a). A national geospatial programme, as promoted by the IGIF is more comprehensive and addresses the shortcomings of NSDIs. Firstly, it is able to incorporate diverse data and secondly, data from various sources can be integrated (UN-GGIM 2019a).

The IGIF consists of three interconnected parts namely, Part 1: Overarching Strategic Framework, Part 2: Implementation Guide and Part 3: Country-level Action Plan (still to be published). Part one discusses the global drivers that call for a change in government and a call to action, which includes alignment with international agendas, maintaining relevance with community expectations, transforming government and bridging the digital divide (UN-GGIM 2018a).

Figure 2.1: NSDI contributes to the national geospatial programme to address the 2030 Agenda for Sustainable Development (UN-GGIM 2018*a*)

The implementation guide recognises three areas of influence, that is governance, technology and people, where people are seen as the most important because they enable the IGIF. Furthermore, the implementation guide comprises nine strategic pathways that respond to the three areas of influence; each pathway provides actions and principles to guide countries with the implementation of each framework component. As shown in Figure 2.2, the pathways exist as individual components that have to be integrated to form the framework, like a puzzle. The connections between the pathways are also described in the implementation guide (UN-GGIM 2019*a*).

Part 3, the Country Level Action Plan is where countries develop plans for implementing the IGIF, which is specific to a country's national objectives and context. Once a plan has been established, the implementation plan must be developed, which will enable operationalisation of the IGIF.

2.4 SDI Governance

2.4.1 Governance

A dictionary definition for governance is "the act or process of governing or overseeing the control and direction of something (such as a country or an organization)" (Merriam-Webster n.d.). There is an important distinction between "governance" and "government", although

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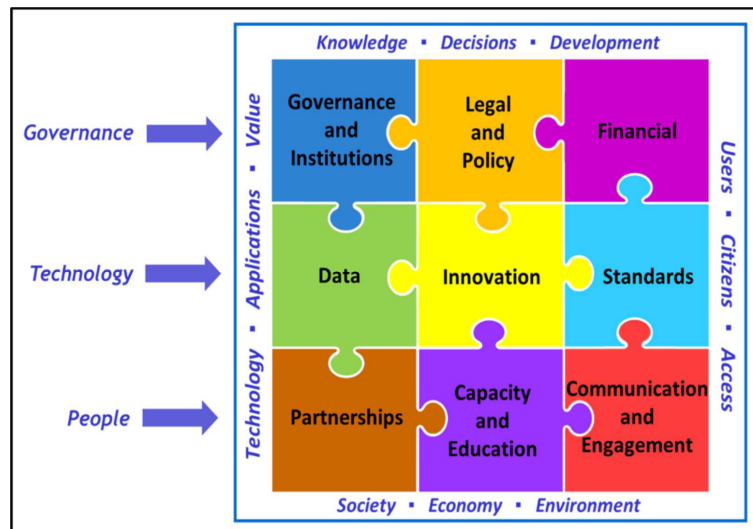
Figure 2.2: IGIF Nine Strategic Pathways (UN-GGIM 2018*a*)

the terms are often used synonymously because both refer to the exercise of power (Carino 2016). According to Singh (2009), Elahi (2009) and Iftimoaei (2015) however, governance exceeds government. These authors explain that governance encompasses the totality of the interactions between government and society, including both the formal interactions and the informal arrangements. Furthermore, while government refers to control, governance refers to management and allows for outside influence from its stakeholders (Carino 2016). As Box & Rajabifard (2009) state, "....governance is seen as a framework that enables a community to collaborate".

In public administration, governance definitions are either normative or descriptive and countries operating under a democratic government tend to subscribe to normative definitions of governance (Elahi 2009, Georgiadou & Reckien 2018). The normative dimension provides the principles, values and norms of governance to guide government in the policy-making process for different administrative levels (Iftimoaei 2015). 'Good governance' falls under the normative dimension as per New Public Management. The descriptive dimension refers to the implementation of the principles, values and norms and is achieved through policies and regulations (Iftimoaei 2015). Although, some argue that the descriptive definitions for governance are independent of ethical behaviour of the actors (Georgiadou & Reckien 2018).

2.4.2 UN Perspective on Good Governance for Sustainable Development

In a 1997 policy paper, the United Nations Development Programme (UNDP) adopted the concept of "good governance" as indispensable for sustainable development and eradicating poverty (Elahi 2009, Rajabifard et al. 2010, Iftimoaei 2015), (Rajabifard et al. 2010). Good governance requires a shift from a state of government to governance (Maloba 2015).

Good governance is characterised by a set of principles, which have been presented differently

over the years by different sources. The World Bank has played a leading role in establishing a generic governance framework for good governance in developing countries, based on these principles. Over time, greater efforts have been made toward mechanisms for decentralised decision-making and private sector participation (Kulshreshtha 2008). The principles are summarised below (Elahi 2009):

- Participation (or legitimacy and voice) - all people have the right to express the views on public decisions
- Rule of law - legal frameworks are implemented fairly for the protection of human rights and punish law-breaking
- Transparency (or accountability) - the information around policy-making is easily accessible to all people concerned
- Responsiveness (or institutional performance) - the ability of institutions to provide for the interests of all stakeholders
- Equity - all people have equal opportunities to improve their lives
- Effectiveness and Efficiency (or institutional performance) - the institutions' ability to provide quality services to meet the needs of the public through optimisation of resources
- Accountability - the decision-makers on policy are accountable to all stakeholders, including the public

SDI for good governance

Jacoby et al. (2002), Craglia & Johnston (2004), Maguire & Longley (2005), Crompvoets, Rajabifard & Loenen (2008) and Crompvoets et al. (2018) motivate that a well-functioning SDI has the potential to contribute to good governance in a significant way. Jacoby et al. (2002) presents how the partnerships between state and local governments in Australia have resulted in significant improvements in the SDI, which in turn can inform the agenda on sustainable development. In the study, the state acknowledged that the participation of local government was critical for the longevity of up-to-date geospatial data. Thus, the participation of local government was formalised through the partnership agreements. Craglia & Johnston (2004) reviewed the impact of the European INSPIRE initiative. They state that SDI has the potential to facilitate all stages of the policy process (i.e. formulation, implementation and evaluation) through the provision of reliable and suitable geospatial information. However, sub-national governments are best positioned to determine the policy requirements. Therefore, the data that is created and managed at the local level becomes very important. Georgiadou & Stoter (2008) echo this sentiment; they state that embedding SDIs into public governance information infrastructures has the power to improve "...policy formulation and implementation, inter-governmental operations and the provision of information services to citizens". Crompvoets et al. (2018) state that the transition from analogue to digital systems created the opportunity to implement the principles of good governance because digital systems allowed for measurable indicators, and SDIs provide the ideal platform for making the required geospatial information available. The authors also raise the importance of inclusive governance for SDI, by expanding the scope of stakeholders and ensuring all stakeholders accept the SDI.

2.4.3   A Public Administration Perspective

Governance may be implemented via various modes or approaches. From the public management literature, three implementation approaches are presented, namely the hierarchical, market and network (Meuleman 2008). The hierarchical governance mode stems from the Old Public Administration (OPA) (also referred to as PA) model which was about centralised control by the state. Bureaucratic systems and the functional division of labour were used to maintain the hierarchy of power. In the OPA, which was widely implemented in the 20th century, the political aspects, such as policy-making are kept separate from the implementation of those policies (i.e. administration). The OPA was popular in developing countries who saw the model as a mechanism to reform, as it was associated with economic growth (Robinson 2015).

In the 1990's however, the New Public Administration (NPA), which was introduced in the 1980's gained traction as an alternative to the OPA. The NPA had a completely different approach: cost containment through the principles of market competition and private sector management, which led to significant changes, such as the outsourcing core government services to the private sector and non-profit organisations. This approach placed great focus on performance monitoring - one of the mechanisms employed to avoid individual self-interests and corruption that was empowered through bureaucratic systems in the OPA. Though some developing countries saw positive outcomes from this model, like increased tax returns, the model was criticized for its failure to prioritise citizens and their needs. Furthermore, political support and institutional capacity was a pre-requisite for success and this was very often not the case (Robinson 2015). The NPA had strong elements of hierarchical governance (Osborne 2006). The lifespan of NPA was short-lived and in 2006 Osborne (2006) advocated for New Public Governance (NPG) - it had a strong focus on public service that adequately responds to citizen interests (Robinson 2015). Citizens are seen as co-producers of the policy-making process (i.e. a pluralist state) and the state is not seen as the most influential stakeholder. NPG also assumes the notion of a plural state, in which multiple actors that are inter-dependent can participate in the provision of public services (Osborne 2006). Because of the inter-dependent nature for both the policy processes and service delivery, NPG places great emphasis on interorganisational relationships (i.e. networks) and consequently the trust and reciprocity that is required within such relationships. This was a deliberate departure from the previous models (Robinson 2015). Kooiman (1999) emphasizes that the role of government throughout these changes in governance models, did not shrink but rather the role of government has shifted to accommodate other role players such as the private sector and citizens.

2.4.4   eGovernance and SDI

eGovernment refers to the use of Information and Communication Technology (ICT) to improve public services (UN E-Government Knowledgebase 2021). It may also enable new processes that would otherwise be impossible - referred to as egovernance (Bannister & Connolly 2012). Essentially, as Bannister & Connolly (2012) state, egovernance changes the underlying governance model, for example, a change in legislation or a change in the scope of stakeholders. This is

premised on the earlier statements that governance exceeds government.

SDI for eGovernance

eGovernment has been one of the major driving forces for SDI development and has thus influenced how SDI evolves (Masser 2005, Crompvoets et al. 2018). Consequently, SDI researchers have emphasized the importance of embedding SDI into broader government information infrastructures and integrating it with related strategic infrastructures, such as egovernment (Craglia & Johnston 2004, Budhathoki & Nedovic-Budic 2007, Masser & Crompvoets 2018). SDI is part of the solution for spatially enabling governments (SEGs) (Rajabifard et al. 2010), which is referred to as "the geo-IT realm of e-governance" (Georgiadou et al. 2006). In a 2011 report on the progress of SDIs in European countries under the INSPIRE Directive of 2007/2/EC (European Parliament 2007), one of the main trends presented was the link between SDIs and egovernment initiatives (Vandenbroucke 2011). The report highlights the best practices from different countries, such as the Czech NSDI, which had been embedded into egovernmnent. This approach was established through the 2014 Czech GeoInfoStrategy, which states that the strategy contributes "to the effective use of ICT in public administration" and furthermore, that the "NSDI development is necessary for the modernization of public administration" (Čada & Janečka 2016). Another example from the European context, is the GIDEON Approach and Implementation Strategy for the Netherlands NSDI, which states that "GIDEON too will be emphatically positioned within the (government) e-services framework", so that the use of geoinformation to support government processes, are maximised (Ministry of Housing & the Environment 2011). The same trend is seen in the United States (US). As stated earlier, in 2002, when the US NSDI underwent the significant transition from a first to second generation SDI, one of the important changes was the alignment with the egovernment programme, which was specifically aimed at improving government services for citizens (NSDI Future Directions Planning Team 2004, Maguire & Longley 2005). In 2005, Maguire & Longley (2005) stated that the US NDSI geoportal contributes to egovernance maturity, which allows for highly integrated services. Their 2021-2024 NSDI Strategic Plan also includes goals for an integrated approach to data access and usability (Federal Geographic Data Committee 2020).

2.4.5   A Data Governance Perspective

Data governance has gained more importance in recent years, both in the private and public sectors. Of the main drivers for this growing importance, is the volume of digital data that is growing at an unprecedented rate i.e. big data (Abraham et al. 2019, Baijens et al. 2020). In terms of governments' responsibility, there is pressure to adequately respond to citizens' needs through informed decision-making. In the private sector, while the opportunities for advanced data solutions are increasing, the laws that protect sensitive information and the need for high quality, credible information presents new challenges (Cheong & Chang 2007, Abraham et al. 2019).

Various definitions have been proposed for data governance. Generally, it refers to the authority, control and accountability over data, to maximise its value (or its usefulness) within an organisation (Khatri & Brown 2010, Abraham et al. 2019, Ladley 2019, Mahanti 2019). Although the definitions for data governance are centred around control and regulation, data governance should not be restrictive, but should lead to improved functioning of the organisation as a whole (Mahanti 2019). Data governance and data management are often used interchangeably, however they are not the same - data management executes what is defined by the data governance, such as principles, policies and rules (Khatri & Brown 2010, Ladley 2019). From this perspective, data is seen as a strategic asset (Cheong & Chang 2007), (Mahanti 2019, Alhassan et al. 2016, Fadler & Legner 2021) - a notion which has also been adopted in the private sector to improve performance and thus, increase the return on investment (Fadler et al. 2021).

Implementing Data Governance

The data governance should be contained within a framework, which enables the organisation to steer the implementation pro-actively, otherwise they run the risk of responding with short-term solutions (Cheong & Chang 2007, Mahanti 2019). Fadler et al. (2021) state that the previous research on data governance frameworks was often centred around data quality. As echoed by Mahanti (2019): "How well the data are governed has a direct influence on the quality of the data", and also Cheong & Chang (2007) who state: "Effective master data management ensures good data quality through the use of a data governance program". One prominent example is the decision domains framework, as proposed by Khatri & Brown (2010). They include five interrelated decision domains, which are in agreement with those from IT governance and thus, allows for integration between IT and data assets within the organisation. The five decision domains for data governance are: data principles, data quality, metadata, data access, and data lifecycle. Another well-known framework design taken from IT governance and applied data governance, is the mechanisms approach - structural, procedural and relational mechanisms (Peterson 2004). Structural mechanisms are the formal groupings of stakeholders, their roles, responsibilities and the level of decision-making power they possess. Procedural mechanisms encompass all the interrelated business processes, the rules and standards that are embedded within those processes. The author also includes monitoring of performance with respect to IT governance. Relational mechanisms facilitate collaboration, coordination and knowledge sharing amongst stakeholders.

Abraham et al. (2019) apply the governance mechanisms to their conceptual framework for data governance. In their concept, they demonstrate how the data governance mechanisms are applied to the contextual aspects: organisational scope, data scope and domain scope (e.g. data quality). They also include the influence of antecedents on the organisation (i.e. external and internal influences). According to the authors, the conceptual framework may be used as a starting point for organisations to develop a framework that is suitable to the organisational context and antecedents. Fadler et al. (2021) argues that data governance, including the aforementioned forms have been operationally-focused, but "data has evolved

into a strategic asset", which requires strategic approach. In their study they apply the data governance mechanisms of Peterson (2004) to determine how organisations have adapted their data governance approaches in this regard. They found that organisations no longer have a narrow focus on operational aspects such as data quality, but are broadening their scope to include strategic aspects like, coordinating "a network of data professionals". Furthermore, they found that the governance mechanisms are dedicated to data, it does not fall under other domains such as IT.

2.4.6 Defining SDI Governance

Coetzee & Wolff-Piggott (2015) showed that the literature available on SDI governance remained low between 1994 and 2014, with the first articles only becoming available after the year 2000. From the available literature, there is no agreed upon definition for 'SDI governance'; SDI researchers have adopted governance definitions from other disciplines. Because SDIs are typically still government mandated, governance definitions from public administration are often adopted (Crompvoets et al. 2018). Box & Rajabifard (2009), who evaluated governance definitions from various disciplines argued that SDI governance and public governance face the same challenge, which is to find the balance between bottom-up and top-down coordination, in order to reconcile collective and individual needs. They proposed an SDI governance model from a socio-technical perspective, with less focus on the institutional aspects. Their aim is to achieve interoperable geospatial resources amongst a wide pool of stakeholders that are involved in the SDI (Box 2013). Their governance model comprises three dimensions: who are the stakeholders, what is the governance scope and how will it be achieved.

Sjoukema et al. (2017) applied the following public management definition for governance by Kooiman (2003), to SDI governance: "Governing can be considered as the totality of interactions, in which public as well as private actors participate...; attending to the institutions as contexts for these governing interactions; and establishing a normative foundation for all those activities. Governance can be seen as the totality of theoretical conceptions on governing". Compared to the model by Box & Rajabifard (2009), the definition also comprises the three dimensions: 1. 'the who', i.e. public and private sectors, 2. 'the what' (or scope), i.e. institutions for governing interactions and 3. 'the how', i.e. by establishing a normative foundation for all activities.

From the above definitions, SDI governance is less about control and more about defining and managing the relationships between the various stakeholders in order to achieve a specific purpose. This distinction becomes very important in light of SDI evolution, where the pool of stakeholders is becoming wider and their influence on the SDI is evolving. This characterisation of SDI governance resembles that of a network in which a number of stakeholders collaborate to achieve a specific goal (see section 7.5.5). In fact, Bree et al. (2008) state that, "the NSDI can be seen as a number of networks of collaborating organisations".

SDI Governance: The Hierarchical Model

Early work by Rajabifard et al. (2002) has been influential in the way SDI governance has been defined and applied by countries. The authors proposed a hierarchical SDI model, where SDIs are defined at each level of public administration and the SDIs are inter-connected. According to the model, SDIs at each level can support a specific organisational structure, i.e. strategic, management or operational. As shown in Figure 2.3, global and regional SDIs may support the strategic level of the organisation structure, national SDIs may support both the strategic and management levels and state and local SDIs may support the operational level to achieve their respective mandates.
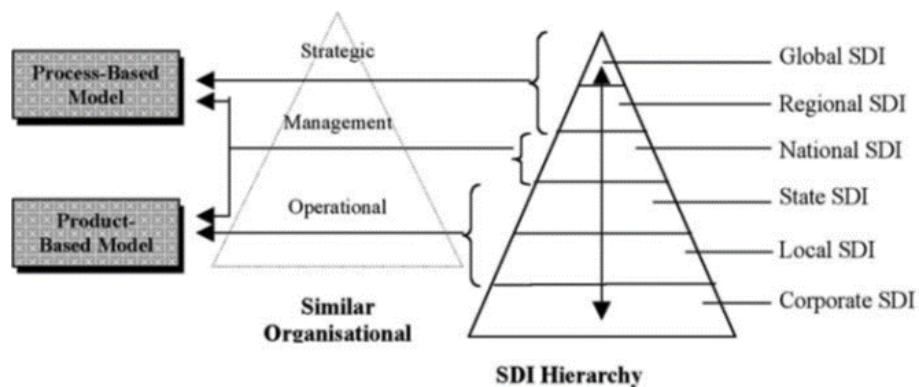
Figure 2.3: Hierarchical SDI model proposed by Rajabifard et al. (2002)

The hierarchical SDI model lends itself to different coordination (or implementation) approaches, such as the hierarchical, market and network approaches from public administration (see section 2.4.3). If a purely hierarchical approach is utilised, national government would maintain control and sub-national SDIs would have very little say on the SDIs they are required to maintain. If a network approach is undertaken, no SDI is greater than another and there is opportunity for various stakeholders to influence the SDIs. Applying a market approach strictly is less likely, because that would mean the the private sector maintains control and the SDI is led by competition, which goes against the intention of the SDI. Rather, as Lance et al. (2009), Sjoukema et al. (2017) and Vancauwenberghe & van Loenen (2017) demonstrate, these approaches are often used together to strengthen the SDI governance. Similarly, in South Africa, Siebritz et al. (2022) propose that the top-down coordination from national government should be supplemented by a bottom-up influence from sub-national government.

SDI Governance: The Complex Adaptive System

SDI governance has often been viewed from the perspective of systems theory (Dessers et al. 2010, Grus et al. 2010, Sjoukema et al. 2017, 2020, 2021). A system may be defined as "a recognisable whole, which consists of a number of parts (called components) that are connected up in an organised way (the system's structure)" (Waring 1996). Typically, a system takes inputs and processes them to produce an output, which meets a predefined objective as shown

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in Figure 2.4. From this perspective, the governance looks at the entire system through which the SDI operates, which requires the input and participation of a wide variety of stakeholders. Crompvoets, Bouckaert, Vancauwenberghe, Orshoven, Janssen, Dumortier, Dessers, Hootegem, Geudens, Macharis & Plastria (2008) stress the importance of developing the SDI from a multi-view perspective (that is, social, economic, technology, public administrative and legal) involving multiple actors from across disciplines (Geudens et al. 2009).
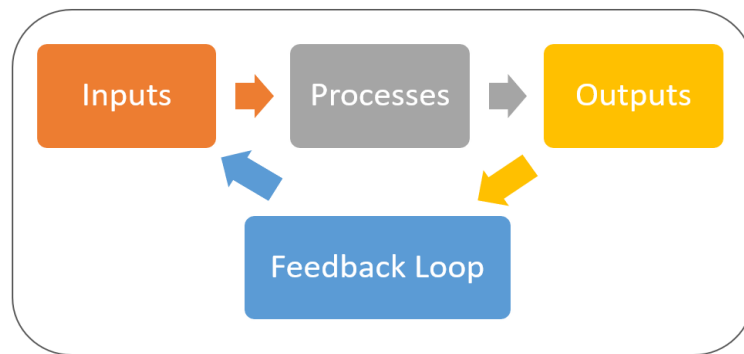
Figure 2.4: Input, throughput, output system

Systems are classified according to their nature, for example, with deterministic systems the output can be predicted with certainty based on the inputs. In probabilist systems on the other hand, the outcomes are not certain, and predictions provide likely outcomes (Thakur 2022). Adaptive systems are non-linear and self-organising (Lansing 2003). SDIs have been described as adaptive systems, which are systems that adapt to the changing environment. More specifically, SDIs may be viewed as complex adaptive systems (CAS) (Grus et al. 2010). SDIs are deemed complex, because a number of stakeholders and stakeholder interactions are required for the SDI to function effectively and efficiently. As described in the previous section on SDI evolution, increasingly stakeholders have become part of SDIs. Therefore, third generation SDIs, which are decentralised, self-regulating and user-driven (Coetzee & Wolff-Piggott 2015) align with the nature of CASs. CASs have distinctive features and behaviours, and based on these Grus et al. (2010) adopt the following systems theory definition for SDI from Barnes et al. (2003): "open systems in which different elements interact dynamically to exchange information, self-organize and create many different feedback loops, relationships between causes and effects are nonlinear, and the systems as a whole have emergent properties that cannot be understood by reference to the component parts". The features and behaviours are listed below:

CAS Features:

1. sensitivity to initial conditions - even small initial actions have a big effect on the system
2. openness - it interacts with the external environment
3. unpredictability - the outcomes of the system are not certain because multiple actors take independent actions
4. scale dependence - different levels in the hierarchy have a similar structure

CAS Behaviours:

1. Adaptability - able to adjust and adapt to changes
2. Self-organisation - able to develop a new system structure due to its internal constitution, which is influenced by external factors
3. Non-linear - the input-output relationship is dynamic, resulting in changes in the strengths of the interactions between components
4. Feedback loop mechanism - system outputs are used to adjust the inputs and processes

Sjoukema et al. (2017) assessed the governance of two European SDIs over ten years and found that the SDI governance for both SDIs had been adaptive, displaying significant changes in the coordination mechanisms employed over the period of study. Sjoukema et al. (2020) proposed a framework for assessing SDI governance dynamics based on the view that the SDI is a CAS. The assessment framework made it possible to identify the strengths and weaknesses in the SDI governance. However, the framework does not take external factors into consideration, which is an important aspect of CASs. In 2021, Sjoukema et al. (2021) used agent-based modelling to simulate SDI governance interactions. The model allows the user to influence the interactions to determine how it would affect the success of the SDI. The model can assist decision-makers on the direction of the SDI. Since the focus was on governance styles (or implementation approaches), the model does not include the adaptability aspect. Siebritz et al. (2021) also confirm that the South African SDI (SASDI) resembles a CAS. As part of their critique, the authors state that without the ability to adapt, the SASDI is unable to adequately respond to stakeholder needs.

2.4.7 Methods for Assessing SDI governance

SDI researchers have undertaken studies to analyse and assess the governance of NSDIs. Lance et al. (2009) demonstrate the shifting role of government in SDI coordination. In their review of the SDI network-hierarchy governance dynamics in Canada and the USA, they were able to confirm that SDI networks are strengthened by external hierarchical steering. The effort by government to support SDI is motivated by the need for policy reform with the aim of improving service delivery. In this context, government provided a "'softer' form of oversight or steering" (e.g. capacity building and guidance), unlike the rigid, authoritarian approach of traditional hierarchies, where the SDI coordinating bodies maintained the mandate for SDI implementation.

Sjoukema et al. (2017) evaluated the SDI governance approaches in the Netherlands and Flanders over ten years. They interpreted the governance in terms of the hierarchy, network and market implementation approaches. In both case studies, the governance approaches had to be adapted, and radical actions were taken to prevent failure of the SDI. Both SDIs started off using a network approach, but eventually hierarchical instruments were introduced to allow for centralised coordination, i.e. a mixed governance also referred to as meta-governance (Meuleman 2008) as cited in (Crompvoets et al. 2018).

As mentioned earlier, Sjoukema et al. (2020) proposed a framework that can be used to assess the governing system of an SDI. Based on the theoretical concept by Kooiman (2003), the framework comprises four elements, images (or the perceived problem), actors, interactions and structures, all operating within the SDI governing system. The concept is depicted in Figure 2.5. Indicators and attributes were defined for each element, as well as the SDI performance which allowed for a qualitative assessment. This type of assessment framework provided information about individual actors and the effect of their decisions and actions. However, because the SDI is viewed as a system the assessment also provides a more holistic understanding about governance trends for specific periods and the impact of the governance on SDI (e.g. enabling versus disabling).
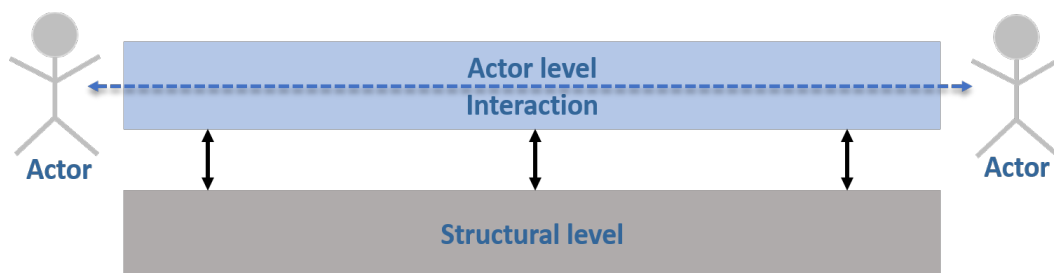
Figure 2.5: Conceptual framework for governing system (Sjoukema et al. 2020)

The agent-based model by Sjoukema et al. (2021) allows the operator to simulate different SDI systems (e.g. the hierarchy, network and/or laissez-faire governance styles and constant, piece-meal and pay-per-user funding models). Governance approaches are represented by the type of messages between actors, for example, hierarchy messages correspond with hard instruments such as decisions on laws and policies, network messages correspond with soft instruments and the laissez-faire messages is when no action is taken. After rigorous testing, the model was scrutinized by various SDI experts. They concluded that the network governance approach with constant funding produces the most favourable results. The general consensus amongst SDI experts was that the model was credible and provided an innovative approach to understanding SDI governance in a more tangible way.

Vancauwenberghe & van Loenen (2017) analysed the openness of NSDI governance for three European countries applying the approach introduced by Verhoest et al. (2007), which looks at the the organisational instruments employed in the public sector to enhance organisational functioning. The results of the study showed that several of the instruments from the original approach are in fact utilised to open up the governance of the NSDIs; the authors thus found the approach "relevant and useful". Crompvoets et al. (2018) also applied the approach by Verhoest et al. (2007) to analyse the governance of NSDIs in Europe over a 25-year period, and the impact of the INSPIRE Directive on the instruments utilised by the respective countries. The method provided useful insights into the governance of NSDIs, the impact of various instruments on the governance and how the governance changed over time - such as adapting existing instruments to cater for stakeholder relationships at the European level.

2.5   SDI Assessment

One of the objectives of this research is to review the status quo of the SASDI development and implementation. The assessment of the SASDI is presented in Chapters 4 and 5. The authors state that the assessment undertaken was from the governance perspective, and "is comparable to the pragmatic State of Play approach proposed by Vandenbroucke et al. (2008*b*)". However, their indicators were adjusted to suit the South African context. For completeness, this section reviews the other methods for assessing SDIs.

A number of SDI assessment methods have been presented over the last two decades (Crompvoets, Rajabifard & Loenen 2008), (Geudens et al. 2009). Though these assessments evaluate the SDI from different perspectives, ultimately, the purpose of undertaking such assessment is to determine whether the SDI is likely to be successful (i.e. proactive evaluation) or if it has been successful in achieving the intended purpose (i.e. retrospective evaluation). The evaluation may also be used to justify whether the benefits of the SDI outweigh the cost of the resources invested into the SDI (Craglia & Johnston 2004). According to Grus, Crompvoets & Bregt (2008) SDI evaluation is either for accountability (cause and effect questions), development or knowledge (understanding), although these are not mutually exclusive and should in fact inform each other. The intention of the evaluation should inform the evaluation approach. Georgiadou & Stoter (2008) provide an evaluation decision-making guide based on how well the SDI objectives are defined and how well the impact of the SDI is known. Depending on the level of uncertainty of these two aspects, the most suitable evaluation may be determined; the purpose of which may either be for control (i.e. for accountability), learning, sense-making or exploration (i.e. development and knowledge) (refer to Figure 2.6). Some of the SDI assessments are discussed in the sections that follow.

| | | Uncertainty as to cause and effect | |
		Low	High
Uncertainty as to objectives	**Low**	Evaluation as control Nature: answer machine Purpose: goal monitoring Evaluator role: auditor	Evaluation as learning Nature: learning machine Purpose: experiment Evaluator role: knowledge creator
	High	Evaluation as sense-making Nature: dialogue machine Purpose: consensus Evaluator role: facilitator	Exploratory evaluation Nature: idea machine Purpose: exploration Evaluator role: catalyst

Figure 2.6: SDI evaluation decision-making guide by Georgiadou & Stoter (2008)

2.5.1   The INSPIRE State of Play

The conceptual framework for the INSPIRE State of Play was developed in 2002 (Vandenbroucke et al. 2008*b*). The original assessment was based on the five SDI components as defined in the

GSDI Cookbook (legal framework and funding, reference data and thematic data, metadata, access and other services, and standards (GSDI 2004)) and a sixth component, the status of environmental information was added (Vandenbroucke et al. 2008a). From this framework 30 indicators were developed and used to assess the status of 34 NSDIs in Europe. In 2011 Vandenbroucke (2011) provides a second report documenting the state of play of those 34 European countries. Though the state of play assessment was originally developed for the European context, Makanga & Smit (2010) and Siebritz et al. (2021) adapted the framework for the African and South African contexts, respectively. The state of play assessment is mainly a qualitative assessment, evaluating the state of an SDI against the ideal, although for some of the indicators, metrics may be assigned (Vandenbroucke et al. 2008a).

2.5.2 SDI Assessment from the Organisational Perspective

The SDI assessment from the organisational perspective is based on the idea that the SDI environment changes over time and thus, what is seen as the ideal SDI, also changes over time through an iterative process (van Loenen & Van Rij 2008). As such, this assessment proposes four stages in SDI maturity from the organisational perspective. Moving from one stage of maturity to the next, means stand-alone organisations move toward a collaborative environment where individual organisations work together in a network with a common SDI vision (i.e. more mature SDI). The results of the four stages are represented in a maturity matrix. With subsequent stages, the uptake of SDI, (i) increases with a broader set of participants, (ii) participant roles become clearer and more formalised, (iii) greater emphasis is placed on specific user needs, (iv) SDI solutions and applications become more innovative and (v) the organisations become more inter-dependent. Importantly, the authors note not every SDI will follow this trajectory from stand-alone to network and that in fact, networks may become less efficient when they become too large and complex. Thus, the maturity matrix may be seen as a tool to guide SDI strategy development.

Siebritz et al. (2022) proposed a Geospatial Empowerment Matrix (GEM) for the development and institutionalisation of SDI for the respective public administrative spheres in South Africa. The idea for the GEM came from the maturity matrix described above, and the Ordinance Survey Maturity Assessment (Ordnance Survey 2021). With the GEM, the SDI is implemented in tiers - moving from one tier to the next, equates to an improvement in the existing SDI model (or SDI-like initiatives). The GEM provides the generic components that comprise an SDI and organisations are responsible for the details of the SDI, since they are regarded the experts for their jurisdiction.

2.5.3 SDI Assessment from the Legal Perspective

Janssen (2008) developed a conceptual framework for assessing the SDI from the legal perspective. Three evaluation phases are described in the framework: firstly, the compliance of the SDI components with the relevant legislation (i.e. legislation specific to SDI and geographic information

and legislation that is affected by the SDI), secondly, coherence of the SDI framework (i.e. complimenting versus contradictory rules) and thirdly, the quality of the SDI legal framework (i.e. how well the framework enables the SDI to meet its goals). The author states that the methods for analysing an SDI legal framework remain unclear, therefore the article provides sufficient detail for such a framework. Furthermore, a more generic evaluation is proposed for application in other countries, outside of the European Union (Janssen & Dumortier 2007). The application of the conceptual framework has not been developed yet.

2.5.4   Other SDI Assessment Methods

Other well-known quantitative assessments are the SDI Readiness Index, which as the name suggests, assesses how ready a country is to implement an SDI (Fernández et al. 2008) and the Clearinghouse Suitability Assessment, which measures clearinghouse developments from around the world (Crompvoets & Bregt 2008).

Because of the multi-faceted nature of SDIs and the diversity in assessments, Grus, Crompvoets & Bregt (2008) proposed a multi-view assessment, which incorporates nine assessments in total. However, the framework may be extended to include other assessments as well. The multi-view assessment serves all three purposes of accountability, knowledge-building and development. The assessment was tested on ten NSDIs from around the world; it included four assessments, using quantitative indicators (Grus, Crompvoets, Bregt, van Loenen & Fernández 2008). Each assessment provided a view of the SDI and the combined results, an overview of the status of the SDIs. The authors argue that a multi-view assessment minimises the potential for bias, which they demonstrated by obtaining high correlation results between assessments.

2.6   Chapter Summary

This chapter reviewed the evolution of the SDI from a first, to a second and then third generation. There was a shift from the emphasis on making standardised national datasets available, to improving the processes to make more data available and the inclusion of sub-national government and the private sector. What followed then, was a move toward more inclusive governance, where users are empowered to influence the development and implementation of the SDI. In other words, opening up the SDI, which is referred to as 'open' SDIs. Another international trend in geospatial data management is the UN-GGIM's IGIF. The IGIF is a framework to assist national governments with optimising the use of geospatial information through an across-sector, integrated approach to address their national objectives for sustainable development. SDIs are an important enabling platform for implementing such an approach. There is also the 'beyond SDI' discussion that is on-going amongst geospatial experts. They propose the 'geospatial ecosystem', which are networks that encompass the formal, government-led initiatives and programs, as well as the agendas, approaches and technologies from the private sector, academia and all users of geospatial information. Underpinning this concept is self-organisation,

competition and collaboration.

With all these changes, it became increasingly important for SDI coordinating bodies to understand, define, strengthen and implement SDI governance. There is no one definition for SDI governance, but researchers have applied governance definitions from other disciplines. Definitions from public administration have been applied often in the SDI context. From this perspective, SDI governance is about managing the stakeholder dynamics, balancing the needs of individual stakeholders and the collective, in order to achieve the objectives of the SDI. The developments in data governance presents an appealing alternative for defining and implementing SDI governance. Although, originally defined as an enterprise solution, the idea of data as an asset has made this suitable for government as well. Adequate SDI governance has the potential to contribute to good governance especially when it is embedded into other government programmes, such as egovernance.

Conceptually, SDI governance have been modelled using the hierarchical SDI by Rajabifard et al. (2002) and the Complex Adaptive Systems approach from systems theory. Both approaches have proven useful in SDI assessment. SDIs must be assessed periodically to determine its effectiveness in achieving its objectives and the impact on sustainable development. To this purpose, a number of assessments have been presented, each serving a different purpose. Of particular interest to this thesis, is the INSPIRE State of Play which is a qualitative assessment of the state of SDI components.

Chapter 3

METHODOLOGY

3.1 Introduction

This chapter describes the methods followed to address the third and fourth research objectives:

> to understand and identify the shortcomings of the governance structure and business processes for the municipal land use application process in South Africa; and

> based on the above, propose a collaboration framework for SASDI stakeholders to improve governance of and access to fundamental geospatial datasets.

A qualitative research method was undertaken using the case study approach. Case studies are useful for understanding the context of the phenomenon under investigation, it provides understanding about social realities (Yin 1994, Flick et al. 2004, p. 3). The purpose of a case study may be to provide description about phenomena, to test existing theories or to build and extend theories (Eisenhardt 1989), (Yin 1994). Case studies enable the researcher to generate in-depth interpretations to specific questions (Hays 2004, p. 218). Often these interpretations are about identifying and explaining causal relationships between the aspects of the phenomena being studied (Hays 2004, p. 218). If the researcher is able to gather sufficient data, that is a number of instances of the same phenomena, then analytical generalisation is possible (Yin 1994, Hays 2004, p. 219). Neuman (2006) as cited in Phondej et al. (2011) states, "case studies help researchers connect the micro level, or the actions of individual people, to the macro level, or large-scale social structures and processes".

The chapter is structured as follows: a description of the case study design, the method of data collection, analysis of the data and a discussion about the objectivity, validity and reliability of the study.

3.2 Case Study Design

3.2.1 Case Study Approach

The purpose of this case study was to provide 'illumination and understanding', but also to provide generalisations, where possible (Hays 2004, p. 218). In qualitative research, these two purposes are generally represented or investigated using different approaches. However, for this research they were combined because the overarching objective was to make recommendations for a SASDI stakeholder collaboration framework, which is informed by the generalisations that were derived from the case study. Therefore, the case was analysed for a few scenarios to "illuminate variable aspects of reality" (Hays 2004, p. 175) and then, draw conclusions based on those findings .

The case study is divided into a first phase, in which data was collected and analysed from secondary sources (i.e. the statutory study) and a second phase, where empirical data was collected and analysed. The results from the first phase were presented quantitatively and qualitatively, while results from the second phase are only qualitative. For the latter, the results are presented as an indicator assessment and as in-depth discussions of the themes that emerged. Both the outcomes of the first phase and the analysis of the second phase informed the SASDI stakeholder collaboration framework. An overview of the case study approach is provided in Figure 3.1. The method and results of the phase one study were published in the article, by Siebritz & Coetzee (2022) and were presented in Chapter 6. Therefore, the bulk of the remaining sections are dedicated to the phase two study.
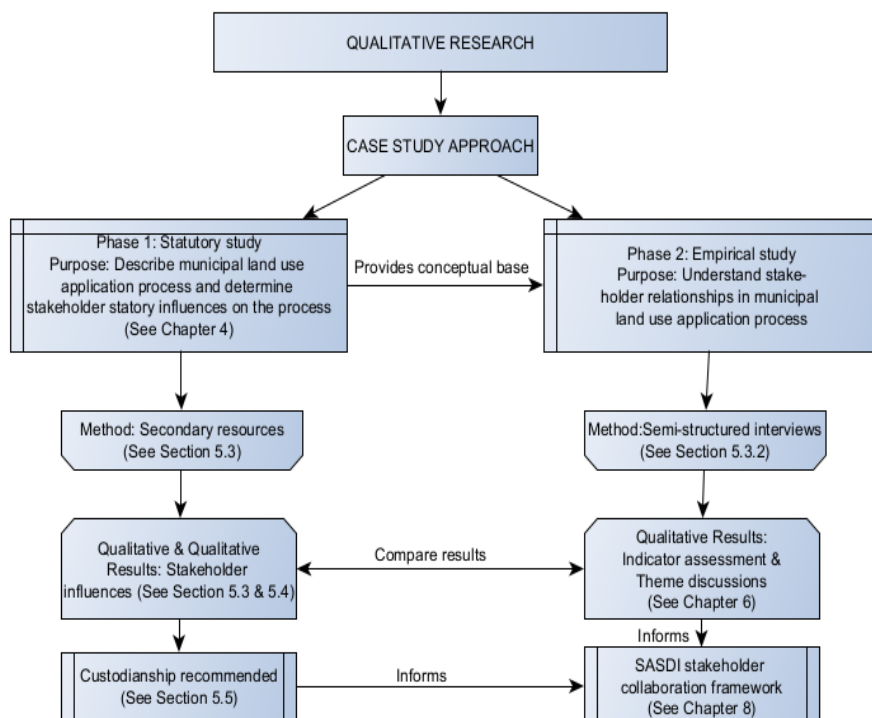
Figure 3.1: Overview of case study approach

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3.2.1.1 Unit of Observation

Under the SASDI and also internationally by the UN-GGIM, land use is listed as a fundamental geospatial theme that is required to address national and international objectives for sustainable development. Because the geospatial datasets that describe this theme are crucial, the accessibility and usability of this data has to be known to all users, such as policy-makers, researchers, citizens etc. In South Africa, a custodian is appointed for each of these fundamental datasets, to fulfil the afore-mentioned requirements (see Section 6.2.3 for a more detailed discussion). However, (at the time of writing) no custodian had been appointed for the geospatial land use rights data, which is part of the land use theme. This data is created by local municipalities as a product of their land use application process. Importantly, as discussed in chapter 6, this process is not confined to municipalities, the provincial government monitors municipal land use management to provide support as may be required, and national government (specifically the DARD & LR) is responsible for SPLUMA and thus, provides strategic support to the other spheres. Further to this, local municipalities also rely on the interactions of a number of stakeholders. The stakeholder interactions differ from one land use application to the next and from one municipality to the next. Therefore, it is difficult to appoint a single custodian for this dataset. The SASDI does not have any governance instruments to guide such a multi-stakeholder dataset. As argued in Chapter 6, the absence of such a framework eventually results in, (i) duplicate data capture and maintenance efforts amongst data custodians, (ii) datasets that are not interoperable and (iii) limited access to authoritative datasets for informed decision-making and sustainable planning. The land use application process was chosen as the unit of observation for this case study, because it involves multiple stakeholders, various pieces of legislation and sets the explicit requirement for the spheres of government to work together. This case presents valuable insights for the future development of such a SASDI stakeholder collaboration framework. The bounds of the case study were guided by SPLUMA, that is, municipalities are the final authority for decisions on land use applications, however they must consult all stakeholders that are directly affected by the application (South African Government 2013) [section 14.1.e]. Provincial and national government are required to provide support to municipalities in this regard, by monitoring municipal implementation of the SPLUMA requirements and providing them with the guidance and resources they may require.

3.2.1.2 Explorative Study: Statutory Approach

In the first phase, an explorative study was undertaken to determine the influence of the various stakeholders on the municipal land use application process. A statutory study was undertaken, whereby the roles and responsibilities of stakeholders were derived directly from the applicable legislation (such as the Constitution of South Africa (South African Government 1996), SPLUMA, the Municipal Structures Act (South African Government 1998b)). Drawing on existing stakeholder analysis techniques, the average influence for each stakeholder was determined (see Section 6.3.2 for more information). The explorative study provided a conceptual base for the second phase, the explanative study (Kallio et al. 2016).

3.2.1.3 Explanative Study: Empirical Approach

The purpose of the second phase, which was an explanative study was to understand how the land use application process is implemented in local municipalities. This involves understanding the stakeholder relationships within this process, the factors that impact (both negative or positive) the process and how the geospatial land use rights data is derived from this process. Semi-structured interviews were conducted at the municipal level as a means to collect the data. Questionnaires were not considered as a method for data collecting data because they are notoriously ignored and would not provide the in-depth qualitative information required for this study. Workshops and focus group discussions were also not considered as a viable option, firstly because participants do not always give their 'uncensored' responses and secondly it does not allow enough time for every participant to give their responses. The semi-structured interviews on the other, hand gave participants the opportunity to provide as much information as they preferred. This is specifically useful since interviews could not conducted with all municipalities due to time constraints. The structured questions guided the discussions, however the flexibility with this type of interview allowed the participants to volunteer information beyond the questions, which was very useful to understand the organisational context, and even the participant's individual views. Some drawbacks experienced with the semi-structured interviews include: the non-response from invitees and it was time consuming and labour intensive (securing the interview, transcribing and verifying the transcript and analysing the interviews).

A constructivist paradigm (or ontology) was used as the foundation for the semi-structured interviews. This means that the participants in this study play an active role in constructing their reality, which may be observed through constructed processes (Guba & Lincoln 1994, pp. 110-111), (Flick et al. 2004, p. 88), (Hays 2004, p. 133). These constructions are relative to the context and are thus continuously changing or developing as the context changes. Social worlds are continuously being restructured, moving away from what is prescribed or fixed (Flick et al. 2004, p. 5). There is no one truth but rather versions of truth, provided from different perspectives (Guba & Lincoln 1994, p. 111). This approach enabled participants to provide the type of contextual information that would improve the researcher's interpretations of the interviews.

There is another motivation for choosing the constructivist paradigm. Siebritz (2020), in their critique on the SASDI development and implementation explain how the lack of bottom-up governance mechanisms have limited municipal participation. Instead, top-down, uninformed decisions are imposed on municipalities. This research aims to address this issue by making recommendations for a collaboration framework that is informed by the realities of municipalities and their context. Therefore, the empirical data was collected through semi-structured interviews, where the participants were able to provide thick descriptions to questions (Flick et al. 2004, p. 3).

The results of the statutory study were compared with the results obtained in the empirical

study - whether they support or challenge the results (see section 7.9). The comparison makes specific reference to the following aspects, as mentioned in Chapter 6:

- how municipalities have implemented the SPLUMA land use application process
- the actual influence of stakeholders on the process
- identification of de facto stakeholders that are not explicitly mentioned in the legislation
- the stakeholder urgency with respect to the process and the data
- the recommended custodianship

3.3   Data Collection for Semi-structured Interviews

3.3.1   Research Context

The research context was discussed in Section 6.2 in terms of the geographic demarcations and the political and administrative structure of the South African government. It also provided the background for spatial planning and land use management in South Africa: the effect of the Apartheid legacy on spatial justice and how SPLUMA aims to address those injustices by relinquishing the legislative power over land use decisions from national and provincial government, to the local sphere. Therefore, this section only provides a summary of the context.

3.3.1.1   Administrative Structure

South Africa is governed by the three spheres of government: national, provincial and local. Geographically, the country is divided into nine provinces and within each province there are wall-to-wall municipalities covering the extent of the country. According to the Constitution of South Africa, there are three municipal categories based on the executive system and their powers (South African Government 1996). The Category A municipality, or metropolitan municipality "has exclusive municipal executive and legislative authority in its area" (South African Government 1996, p. 75). The Category B municipality "shares municipal executive and legislative authority in its area with a category C municipality within whose area it falls" (South African Government 1996, p. 75), and a Category C municipality, or a district municipality "has municipal executive and legislative authority in an area that includes more than one municipality" (South African Government 1996, p. 75). In total there are 278 municipalities (at the time of writing), eight metropolitan, 44 district and 226 local municipalities. The nine provinces and three municipal categories are depicted in Figure 3.2.

3.3.1.2   Spatial Planning and Land Use Management in South Africa

Through SPLUMA, land use decision-making is seen as an intergovernmental process that is informed by spatial development frameworks (SDFs) (i.e. forward planning), and the expertise of those who are responsible for the various services in their respective jurisdictions (e.g. water and sanitation services). Municipalities are required to consult those stakeholders that are directly affected by a land use application. However, the municipality, through the delegated
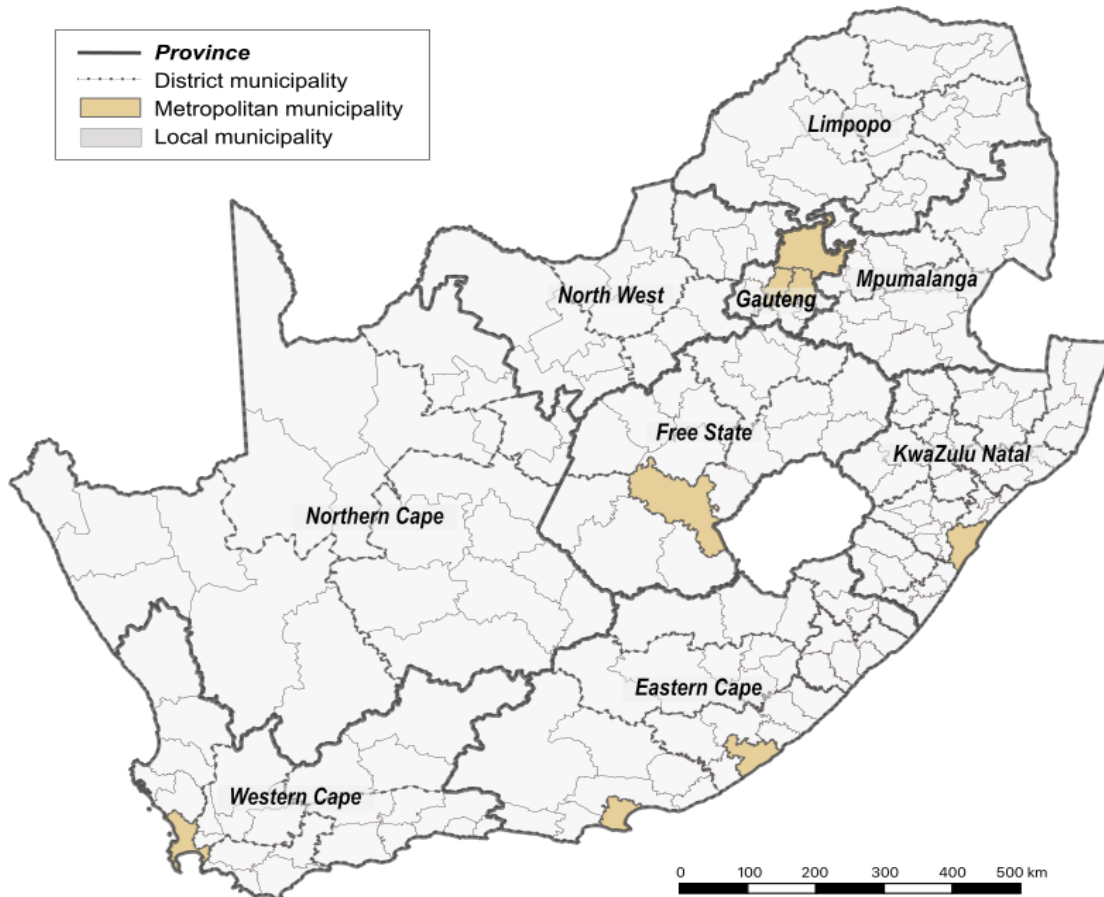
Figure 3.2: South African municipal provinces and three municipal categories. (Source: Siebritz et al. (2022))

official or Municipal Planning Tribunal (MPT) makes the final decision on an application (South African Government 1996)[section 35.1-4]. Beyond the decision-making, national and provincial government are by law required to provide guidance and support to municipalities with their spatial planning and land use management (South African Government 2013)[sections 9-10].

The implementation of SPLUMA differs between provinces (Siebritz 2020). A number of factors influence the implementation process, which includes but is not limited to: the provincial political leadership, the provincial governance structure, the number and categories of municipalities within the province, the intergovernmental relationships and the financial state of municipalities. For example: in the Western Cape, the provincial Department of Environmental Affairs and Development Planning (DEA & DP) monitors municipal land use management in the province, so that support and guidance can be provided to municipalities that need it (Siebritz 2020). In the Gauteng province, this responsibility lies with the Gauteng Planning Division within the Office of the Premier (Gauteng Planning Division 2016). As will be discussed in this chapter, these offices have provided support to their municipalities very differently.

3.3.2 Interview Protocol

Two interview protocols were designed, the first one focusing on the land use application process and the second, a follow-up questionnaire, focusing on stakeholder collaborations. The second protocol was never used, because none of the interviewees mentioned formal interorganisational collaborations in their first interview (see Appendix I.9). The first interview protocol (the only one discussed further) covered four main topics: 1. the land use application process, 2. interdependencies and signs of collaboration, 3. geospatial land use data needs and 4. SASDI awareness (see Appendix H.8). The questions mainly referred to the land use application process, but where relevant (mainly with the collaboration and SASDI awareness), further questions were asked that applied to the municipality more generally. Questions on the land use application process were asked first, rather than questions on SDI or geospatial data management. Also, the more straight-forward land use questions were posed at the start of the interview. This was done for two reasons, firstly to put participants at ease by discussing what they are familiar with first (Kallio et al. 2016). Secondly, the interviewer wanted to create an opportunity for the interviewees to voluntarily describe their awareness of SDI and the SASDI, and for them to describe any SDI-like initiatives or efforts that the municipality may have undertaken.

A variety of question types were included, but as far as possible, the questions were posed in a way that allowed the participant to provide descriptive answers, that is, open-ended questions (Kallio et al. 2016). Openness is an important characteristic of qualitative research (Flick et al. 2004, p. 8). Other questions asked for the participants' opinion or perception on certain aspects (Louise & Alison 1994), but subtly. As an example: 'Do you consider your organisation a custodian of geospatial land use data?'

The interview protocol, together with a cover letter (see Appendix F.6), were sent to invitees prior to the interviews, so that the most suitable person would be selected to participate in the interview. Though the interview was intended for one-on-one sessions, for one municipality a group of five people attended the session and thus, the interview was opened for all attendees to respond to any question. The participants appeared to be well-prepared for the interview, because for each question, the person responsible for that particular activity, responded and provided sufficient details. Even so, the interviewer also got the impression that all participants were welcome to provide any additional comments to their colleagues' responses. The participants did not speak over each other and they did not provide repetitive or contradictory responses - the interview was coherent.

At the start of the session, participants were informed that deviation from the set questions was allowed. They were also encouraged to provide as much detail as they preferred; in most cases they gave additional information, which was useful to understanding their context. There was only one interview where the participant did not follow the structure of the interview questions. Because the interview questionnaire had been provided to the participant prior to the interview, the participant could speak to some of the questions. Although enough detail

was provided on the internal aspects of the land use application process, there was not much opportunity to discuss external stakeholder interactions and the geospatial data management of the municipality.

The researcher assumed active listening during the interviews. This was demonstrated as follows: repeating certain parts of the participants' responses, acknowledging that they have answered the questions fully, acknowledging their efforts within the municipality to improve processes and asking probing questions, especially when it was evident that the topic was of importance to the participant (Hays 2004, p. 64), (Adams 2015, p. 501) and (DeCarlo 2018, pp. 365-366).

3.3.2.1 Methodological modification

During the initial interviews, it became evident that follow-up interviews would be required for the SASDI awareness and data management questions. The participants had expertise and experience in land use and/or spatial planning, but they were not comfortable with answering questions beyond their roles and responsibilities. Instead, they referred the remaining questions to their colleagues who were directly involved with geospatial data management. As Adams (2015)[p.499] states, the interview guide should be seen as a work in progress", which remains "subject to change". Consequently, a third questionnaire was drafted that focused on SASDI awareness (also referred to as the follow-up interview) and geospatial data management in the municipality. The interview questionnaire contained the following topics: 1. strategic management of geospatial data, 2. technical aspects of data management, 3. SDI/data management culture and 4. stakeholder interactions (see Appendix J.10).

The invitation for a follow-up interview was sent to the municipalities that had been interviewed previously, with the exception of two. The first municipality had already provided information on their geospatial data management and SASDI awareness (also see section 3.4.2.3). The second municipality was a district municipality, which operates very differently to the local and metropolitan municipalities, because they have a different function. One municipality in the Western Cape did not respond to the follow-up invitation and therefore no follow-up interview was conducted. Two of the Gauteng municipalities were not willing to participate in an interview and thus, submitted written feedback to the questionnaire. Compared to the interviews, the written responses provided less information. Nonetheless, these responses were included in the analysis, since the first participants had provided information on the municipalities' contextual aspects, and because the written responses did, at least, answer the questions. For the remaining municipalities, the same interview process was followed as previously described.

3.3.3 Sampling Method

After a draft of the first interview protocol was developed, a semi-formal discussion was held with representatives from Western Cape: DEA & DP. The purpose of the meeting was to

present the research to them, which included the phase one results (see section 3.2.1.2), for them to provide guidance on and assistance with the case selection process, and for them to give feedback on the draft interview protocol. The discussion was captured in meeting notes, which were distributed to all attendees for their verification. Following the discussion, they provided a list of with a few municipalities in the Western Cape with the respective contact persons. In their list, municipalities were categorised according to their progress in land use management implementation (i.e. high, medium or low), as per the SPLUMA requirements. The researcher's intention was to have a range of municipalities represented in the study, so as to avoid a skewed interpretation of the findings (Louise & Alison 1994). This provided a good starting point for case selection and avoided "cold-calling" (Adams 2015). This method of stakeholder identification is considered as top-down and analytical, although it is from the perspective of provincial government, rather than the researcher (Reed et al. 2009).

As mentioned earlier, an email including a cover letter and the interview protocol was sent to everyone on the list provided, noting the referral from the DEA & DP. Many of the municipalities did not respond to the invite, despite follow-up emails and phone calls. In total, five local municipalities and one district municipality were interviewed in the Western Cape. To get a different perspective, the study was extended to municipalities in the Gauteng province. Through mutual contacts, interviews were secured with three municipalities and an additional interview with the Director: Land Use Management (at that time, now Director: Integrated Development Planning) from the Gauteng: Office of the Premier. The purpose of the interview was to gain insights on two fronts: firstly, a more general perspective on municipal implementation of SPLUMA. Unlike the Western Cape, only Category A municipalities were interviewed in Gauteng, therefore the researcher wanted to know how municipalities in Category B compared. The second purpose was to gain insight into the provincial-municipal relationship with respect to municipal land use management in the province. Thus, the line of questioning focused on how the provincial office was providing support (e.g. assisting municipalities to draft their planning by-laws) and monitoring (e.g. periodic reporting on land use decisions) to the municipalities.

Because land use management is reliant on the intergovernmental relationships between the spheres of government and the structure of the provincial government, it was important to select sufficient cases within a province, rather than spread out across the country. Also, it was not possible to do a qualitative study for all provinces in the country. As with the Western Cape, the follow-up interviews were conducted with the same municipalities as the first round of interviews in Gauteng. In total 16 municipal semi-structured interviews were conducted; the interview details are shown in Table 3.1:

3.3.4 Ethics, institutional authorisation and informed consent

Prior to undertaking the interviews, an application was submitted to the University of Pretoria ethics committee, in which the research methodology was explained, and the research protocol was included for approval. A second submission was made to the committee for approval of the

Summary of Municipal Interviews in the Western Cape and Gauteng Provinces				
No.	**Province**	**Municipal Alias**	**Municipal Category**	**Interview Date**
1	Western Cape	Municipality 1	Metropolitan	16 March 2021
2				25, 30 May 2022
3		Municipality 2	Local	5 March 2021
4				22 November 2021
5		Municipality 3	Local	22 February 2021
6				13 June 2022
7		Municipality 4	District	25 March 2021
8		Municipality 5	Local	18 March 2021
9		Municipality 6	Local	30 March 2021
10	Gauteng	Municipality 7	Metropolitan	23 April 2021
11				3 May 2021
12		Municipality 8	Metropolitan	13 April
13				4 June 2021
14		Municipality 9	Metropolitan	3 May 2021
15				4 May 2021
16				30 May 2022

Table 3.1: List of municipal interviews held between 2021-2022

follow-up interview questionnaire.

Only one municipality required a formal application to the municipal management before any interviews could be conducted. Otherwise, invitees were simply provided with the letter of invitation, the interview protocol and the consent form (see Appendix G.7), which they signed. At the start of the interviews, the participant and municipal anonymity were guaranteed. Furthermore, no personal questions were asked.

3.3.4.1 Interview recording and transcription

Due to the COVID-19 pandemic and the mandatory lockdown in South Africa from March 2020, the interviews were conducted virtually, using either the Microsoft Teams or Zoom applications. With the consent of the participants, all the interviews were recorded on the application, as well as on the researcher's cellphone as a back-up. After the interviews, the recordings were transcribed and then sent to the respective participants for verification. The transcripts were captured verbatim as far as possible (DeCarlo 2018), unless the recording was unclear, or if the conversation diverged from what was relevant to the interview (e.g. if a joke was made). A limitation of the virtual interviews, is that it was not always possible to observe participants' non-verbal cues - either their cameras were switched off or it was unclear on the computer screen.

For one municipality in Gauteng, two participants from different units volunteered to be interviewed. The first participant provided information on the land use process and the second provided a spatial planning perspective. Both interviews were done via telephone due to limited internet connectivity at the municipality. The first interview was however unscheduled and was therefore not recorded, instead the researcher captured notes during the discussion. For two of the

follow-up interviews (one in Western Cape and one in Gauteng), the invitees decided to submit written responses only.

3.4 Data Analysis

3.4.1 Analysis Approach

Section 3.2.1.3 described one part of the philosophical underpinning for the semi-structured interviews, the constructivist paradigm. The second part to this, which was used for the analysis of the interviews, is the interpretive approach (or epistemology) (Honiball 2018). With this approach, the researcher must have the capability to reflect and interpret participant responses; the researcher's interpretation is not seen as a disturbance (Flick et al. 2004, p. 8). For this study, the interpretation process involved reasoning, explaining or finding meaning and drawing conclusions. Figure 3.3 depicts the interpretive process that was followed, which is explained in the next sections.
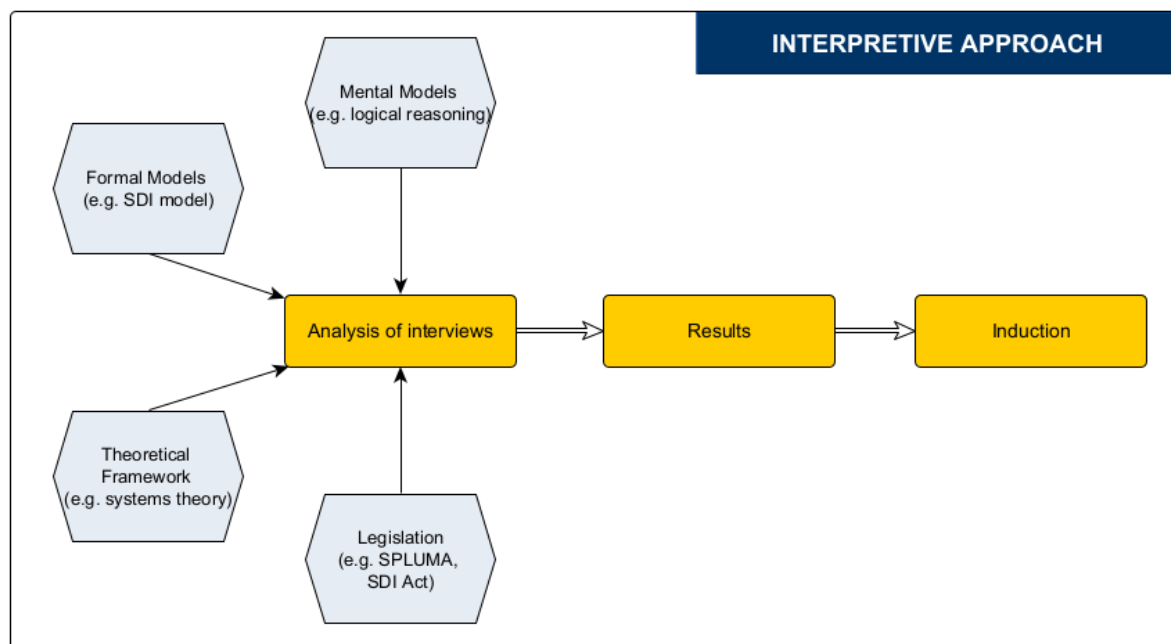
Figure 3.3: Approach for interpreting semi-structured interviews

3.4.1.1 Analysis of Semi-structured Interviews

Reasoning, given a simplistic and generic definition, is "the action of thinking about something in a logical, sensible way" (Google search). Galotti (1989) compares three approaches to reasoning within the context of formal and informal (or every day) reasoning, 1. reasoning with components as the fundamental unit, 2. inference rules as the fundamental unit or 3. mental models. Reasoning based on mental models is the cognitive process whereby the

researcher draws on their own mental models - their thoughts, beliefs, knowledge etc. to come to conclusions about a given premise. An important part of this process is considering alternative models to derive different conclusions, as a means of checking the plausibility of the researcher's original conclusion. With the remaining two approaches, the author describes them as being less flexible than reasoning with mental models; they are more suited to quantitative reasoning. The mental models approach may therefore be applied to open-ended issues such as social issues and it even allows for imagined mental models. Galotti (1989) concludes that though all three approaches are applicable to both formal and informal reasoning, out of the three approaches, the mental model approach offers more use to informal reasoning. The literature renders reasoning with mental models more applicable to this empirical study because of the nature of the interviews, which may be considered more informal, than formal (Hays 2004, p. 53). Formal reasoning is deterministic; strict rules are applied with which the outcome can be accurately predicted. Alternatively, informal reasoning is dependent on the context and therefore the validity of the conclusions may be questioned (Bronkhorst et al. 2020). These two approaches may however be used together (Kuhn 1993, Teig & Scherer 2016, Bronkhorst et al. 2020). Section 3.4.1.3 describes how the interpretive approach in this study, supports a combination of informal and formal reasoning.

The major shortcomings of this approach are the lack of empirical data and vagueness of models (Galotti 1989). Both shortcomings are addressed in this research - the semi-structured interviews fulfil the requirement for empirical data. On the second point, as shown in Figure 3.3, reasoning in this study was based not only on mental models, but also on the legislation (e.g. SPLUMA and the SDI Act), the theoretical framework (literature review) and formal models (e.g. SDI governance model by Rajabifard et al. (2002)). This also assisted the researcher to consider alternative conclusions.

To summarise, the analysis of the semi-structured interviews (i.e. participants' reality) is influenced by mental models (i.e. perception of reality), formal models (i.e. description of reality), the theoretical framework (i.e. system or supposition of ideas to explain reality (School of Social Work 2022)) and legislation (i.e. rules that govern reality).

3.4.1.2 Results

Reasoning happens in the researcher's mind and is not necessarily expressed. Explanation on the other hand, requires the researcher to convey what they have reasoned - the next step of the interpretive approach. To find meaning, the researcher looks for relationships between variables, such as causal relationships (DeCarlo 2018). DeCarlo (2018) distinguishes between idiographic and nomothetic causal explanation. Idiographic causal explanation, which is rooted in the constructivist paradigm is when the researcher seeks to explain the participant responses exhaustively. Nomothetic causal explanation on the other, hand seeks to generalise broadly so that the explanation is universally applicable. According to Hays (2004), if the idiographic causal explanation is chosen as the approach, the researcher does not make any generalisations.

Hermans (1988) concluded that the researcher can alternate between idiographic and nomothetic explanations, as the research questions may require. Salvatore & Valsiner (2010) argue that both approaches seek to provide generalisations in their own way, and that the the two can be applied as complementary approaches, which is what was done in this study. In Section 3.2.1 it was stated that this study aims make generalisations where possible, for the purpose of making recommendations for a SASDI stakeholder collaboration framework. Since the previous sections have already emphasized the differences that exist between municipalities and provinces, the generalisations in this study are limited by these boundaries. Furthermore, though the study aims to assess the municipality and not individuals (i.e. the participants), this aspect of uniqueness cannot be ignored (Hermans 1988). The idea is to not make generalisations based on individual views or perceptions, but rather to discern as far as possible when participant responses are founded in unique experiences.

3.4.1.3 Induction

The last step of the interpretation process is to derive conclusions (refer to Figure 3.3). Conclusions may be derived inductively, deductively and abductively. With inductive inferences, the researcher looks for patterns or themes that are used to generate generalised statements. With the deductive approach, data is collected and analysed for the purpose of testing some hypothesis based on theory (DeCarlo 2018). Abduction is deriving conclusions that would best fit the given information; it is associated with creating new ideas or knowledge (Salvatore & Valsiner 2010). Following these definitions, the analysis of the semi-structured interviews was primarily done inductively. However, because the theoretical framework, formal models and legislation influenced the construction of the indicator framework (explained in section 3.4.2.3), as well as the themes presented, there is an element of deduction. As DeCarlo (2018) writes, the inductive and deductive approaches are sometimes used together. This thinking supports the earlier discussion about integrating the idiographic and nomothetic causal explanations.

It is important to note that the process described above and depicted in Figure 3.3 is not linear, where the researcher simply moves from one step to the next to derive conclusions. It is an iterative thought process to find the most applicable conclusions.

3.4.2 Conceptual Model for Analysing Semi-structured Interviews

The conceptual model for analysing the semi-structured interviews utilises systems theory. Section 2.4.6 described how systems theory was used to assess SDI implementation. More specifically, the SDI was likened to a CAS. For this part of the study, the aim was to assess the land use application process and not the SASDI. However, because the land use application process greatly depends on geospatial data that is relevant to the SASDI, it was necessary to include those SDI components/elements into the analysis system. Also, the system for analysing the land use application process does not exist in isolation, there are factors from within the municipality and external factors that have an impact on this process. Therefore, as shown in

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Figure 3.4, the conceptual model for analysis included both internal and external influences. The system components and the influences are explained in the sections that follow.

3.4.2.1 Input, Throughput, Output

As previously explained, in a system there are three components (input, throughput and output), which operate as a whole (see section 2.4.6). Certain processes are applied to the input to produce a pre-defined output. Applied to the land use application process, the input refers to a land use application, the throughput to the consideration of the application and the output refers to the decision taken on the application, as depicted in Figure 3.4 (also refer to Figure 6.1). In the figure, the various aspects that constitute each of the system components are listed, which correspond to the indicator framework and the assessment thereof (see Appendix K.11). This configuration of the land use application process as a system is described for each municipality in Sections 7.3.2 and 7.4.2 for the Western Cape and Gauteng provinces, respectively.
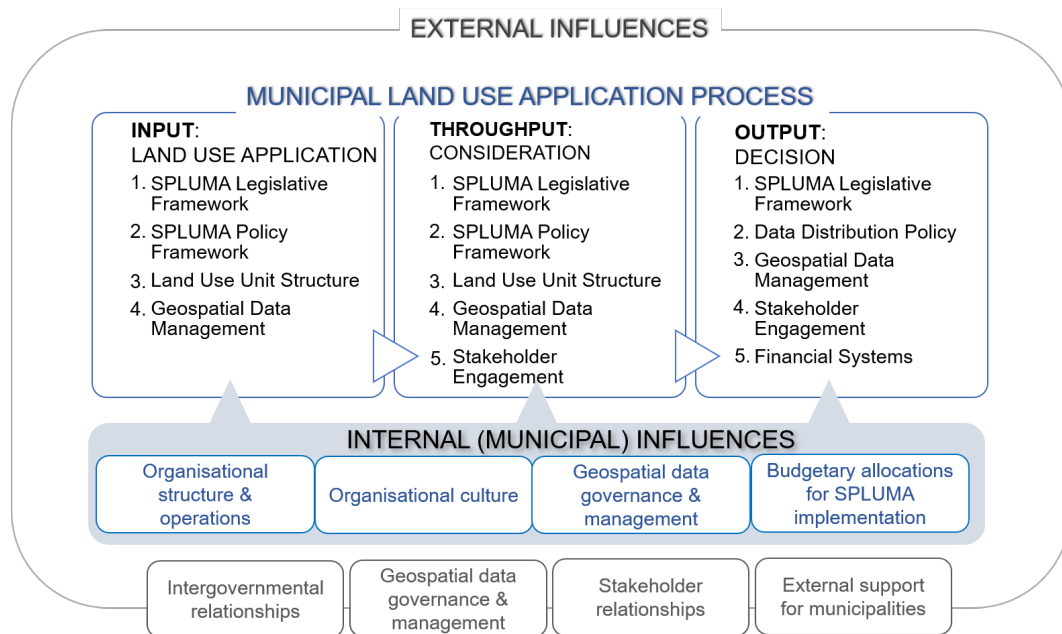
Figure 3.4: Conceptual model for analysing the semi-structured interviews based on systems theory

3.4.2.2 Internal and External Influences

The land use application process is also influenced by both internal and external factors. These are represented in Figure 3.4 as internal (municipal) and external influences, respectively. The internal influences apply to the municipality as a whole and the external influences relate to the South African government context (i.e. provincial and national government). Unlike the system components of the application process, which were mainly guided by the SPLUMA legislative framework, identification of the internal influences was mainly guided by participant responses

(i.e. emergent). The participant responses were varied; therefore the interviews were analysed iteratively to decide on the most compelling influences to assess. The external influences that relate to the geospatial data governance and management and the SASDI were derived from the participants' responses, but also from the review as presented in Chapters 4 and 4. As an example, in Chapter 4 Siebritz et al. (2021) explains how the disjuncture between the spheres of government has negatively affected the accessibility to useful fundamental geospatial data. From this, three indicators (discussed in next section) related to data accessibility were developed: 1. access to & re-use of external fundamental data, 2. standardisation of land use rights data and 3. provincial coordination of land use rights data. Figure 3.5 shows an extract of the afore-mentioned indicators with their definitions and attributes shaded in grey (explained in next section).

			Access to & re-use of external fundamental data (pricing, unsuitable data, no sharing, unawareness)	The ease which the municipality is able to access the data they require to fulfil their mandates.	High: No restrictions, easy access	Medium: Some restrictions, limited access	Low: High restrictions, little/no access
60	EXTERNAL FACTORS	Geospatial Data management					
61			Standardisation of land use data	Provision of geospatial data standards and support for standards implementation for municipal land use rights data from national or provincial government.	High: Standards & support available	Medium: Standards available, limited support	Low: No standards available
62			Provincial coordination of land use data	The process whereby the responsible provincial office coordinates municipal land use and provides the necessary support for the implementation of the land use application process.	High: Coordination & support available	Medium: Limited coordination & support	Low: No coordination, no support

Figure 3.5: Extract showing indicators to measure municipal access to fundamental data

Lastly, the identification of internal and external influences was also guided by the objective to understand the stakeholder relationships that form part of the municipal land use application process. The term stakeholder relationships is used here to encompass the formal, informal relationships and anything in between. Collaborations, which are of particular interest to this research, are formal stakeholder relationships that are enforced through agreements and/or project documents. This is not to say that other less formal collaborations were not analysed or considered important. It follows the idea of building on the existing mechanisms that municipalities utilise to fulfil their mandates (Siebritz et al. 2022).

The interview questions were designed to address the system components and the influences on that system (i.e. the land use application process). However, the researcher could not burden the participants with a long list of questions to address every aspect of the system. Instead, the questions were structured in a way that required participants to provide descriptive responses that would address a number of aspects. An example of such a question is: 'What is the municipality's culture on data access and data sharing, both within the organisation and externally to users?' Though, the question refers to the municipality's culture on data sharing and data access, participants highlighted how the intergovernmental relationships are lacking in this regard, and also the consequences of this issue, which is duplicate data capture activities. In this way, the indicators could be assessed without having to ask the participants on every indicator.

3.4.2.3 Developing the Indicator Framework

Indicators and corresponding attributes were developed for the internal and external influences described in the previous section. The indicators may be viewed as the characteristics of the influences that are measurable and the attributes denote the measure of the indicators. Because this was a qualitative assessment, the attributes comprised three rankings to describe the level of or impact of the indicator, such as 'high', 'medium' or 'low'. Often, these three categories provided further descriptions such as 'high: fully implemented', 'medium: in process - developed, not implemented/ not fully implemented' or 'low: not developed'. For indicators that evaluated adherence or compliance, a percentage category was given, such as 'high: 100-85%', 'medium: 85-65%', 'low: ¡65%'. In other instances, 'enabling', 'restrictive' or 'not applicable (N/A)' was more suitable for the type of impact. Again, deciding on the final list of indicators was an iterative process.

It was never intended to use the indicator framework to allocate average scores to the individual municipalities. The indicators vary significantly, therefore it becomes challenging to allocate the same attribute rankings across the framework. As will be demonstrated in the discussions that follow in Chapter 7, there are a number of influences that act on municipal business processes and thus, an average score does not provide much meaning. However, the indicator assessment provided a valuable base and standard for the theme discussions - it allowed the researcher to assess the municipalities against a pre-defined standard (i.e. the ideal or aspired state), and to assess, compare and understand the municipalities relatively.

The three components of the conceptual model (input: land use application, throughput: consideration and output: decision) and the internal and external influences, were evaluated in stages. The indicators for one component were evaluated for all municipalities before moving to the next component/influence. Bearing in mind that for municipalities where two interviews were undertaken, the process was done twice. Once all the components and influences had been evaluated, cross-checks were done for any overlapping or duplicate indicators. Duplicate indicators were removed and overlapping indicators were combined. Additionally, indicators with insufficient participant responses and were deemed not critical, were removed. In total, 62 indicators were assessed for each municipality. Once a final list of indicators was selected, the definitions were added for each indicator. This iterative process also helped to identify whether a follow-up interview was still required for the geospatial data management aspects or if the first interview provided enough information for a fair assessment.

3.4.2.4 Cross Checks

Generally, the participants' feedback between the first and follow-up (for same municipality) interviews were very different. This may be attributed to the functional division of labour that is often the organisational structure of municipalities, as observed during the interviews (further discussed in Chapter 7). Also, there is the limitation that the participants give their individual perceptions (refer to section 3.4.1.2). However, it was possible to compare participant responses

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for some of the geospatial data management indicators. Further to this, for the Western Cape province, the discussion with DEA & DP and for the Gauteng province, the interview with the Director: Land Use Management also served as a cross check on the interviews to a certain degree. Other sources, such a municipal by-laws, policy documents, process documents and provincial reports were also reviewed to verify what participants said during the interviews.

For the preliminary interpretations, it appeared that some indicator evaluations had a bearing on others. These were also considered as first-level checks. Some participants made these connections explicitly. As an example, the indicator 'political/managerial support for GIS' under the internal factor 'organisational/SDI culture' may have an influence on the 'input' indicators 'data management/GIS strategy' and 'centralised/decentralised GIS'. If there is high level support for GIS from the top (i.e. senior managers and/or political leaders), then the evidence of that may be seen in the effort toward GIS implementation (e.g. a GIS strategy) or improvements in the existing systems and approaches to implementation.

3.5 Ensuring objectivity, validity and reliability

3.5.1 Objectivity

The municipal cases were selected objectively by the researcher. As described in section 3.3.3 municipalities in the Western Cape were contacted on the advice of the DEA & DP based on the status of their progress with land use management, which was determined by the DEA & DP. Except for participants from two Western Cape municipalities who the researcher had previously engaged for SDI-related matters, the researcher had no previous knowledge or existing relationships with the municipalities. In these two follow-up interviews, the researcher assumed the posture of not knowing anything about the municipality, maintained professionalism and followed the questionnaire as closely as possible. Interviews with municipalities in Gauteng were secured through mutual contacts, however the researcher had no prior knowledge of these municipalities.

The researcher's background may also contribute to the bias. Since 2015, the researcher has been actively involved in the SASDI (refer to Section 1.7 for more details). In 2018, the researcher undertook the Municipal Capacity Building Project (refer to Chapters 4 and 5. As part of the project, initial stakeholder engagements were conducted with representatives from a few municipalities in the Western Cape. They provided information on their issues, such as data access, data sharing and data standardisation. Thus, to minimise researcher bias and to avoid confirmation bias, the researcher followed the approach of giving the participants the benefit of the doubt. In other words, the researcher tried to identify the efforts that contribute to effective and efficient organisational functioning. The SASDI has been compliance-driven and the coordinating body has even emphasized punitive measures for non-compliance (Department of Rural Development and Land Reform 2014). For this study, the researcher completely avoided these kinds of topics. Instead, participants were encouraged to describe their own efforts, for

example, mechanisms for avoiding duplicate data capture. Furthermore, the researcher was conscious of not leading the participants or forcing a certain line of questioning to produce a response that was pre-meditated by the researcher. Also, the researcher placed more emphasis on the participants' expertise.

During the researcher's SDI journey, it became evident that the way municipalities operate, vary significantly in South Africa. This fact was beneficial to minimising the researcher bias - it was impossible to generalise or infer prior to engagement because each municipality is different.

3.5.2 Validity

In qualitative research, validity refers to the accuracy of the results - is the information presented true? It is difficult to prove validity when the semi-structured interviews are used as the main data collection method (Louise & Alison 1994, Bronkhorst et al. 2020). An important point to emphasize here is that this study did not intend to find a single truth, that is, to provide broad generalisations that are applicable universally (Maxwell 1992, Guba & Lincoln 1994, p .111) (also see Sections 3.4.1.2 and 3.4.1.3). Doing this, would lead to a top-down solution that is unsuitable for the SASDI stakeholders, and as Siebritz (2020) and Siebritz et al. (2021) have argued, this top-down approach has led to limited stakeholder participation, especially from municipalities, which has hampered SASDI implementation. Instead, the aim was to find similarities between municipalities to find patterns or themes (DeCarlo 2018), enough to argue valid perspectives of the truth and thereby provide solutions that considers these diversities (Maxwell 1992).

3.5.2.1 Descriptive Validity

A few measures were put in place to improve the validity. Questions that were not part of the interview protocol were purely based on the participants' feedback. As stated in previous sections, generally the participants were very generous in their responses. Asking probing questions was a way of showing interest in what they had to say, but also, more information allowed the researcher to gain a deeper understanding of the context of the municipal space (DeCarlo 2018, Louise & Alison 1994). The researcher avoided leading questions and instead summarised or paraphrased participant responses to confirm their statements. Also, the researcher was careful not to push certain terminologies (especially those related to SDI) but took the lead from the participants. As Louise & Alison (1994) state, it is important to convey the same meaning to different respondents even if different terminology is used. Lastly, as previously stated, the interviews were recorded, and the recording was transcribed verbatim. All of these measures contribute to the descriptive validity.

3.5.2.2   Evaluative Validity

Maxwell (1992) distinguishes evaluative validity from the other types of validity, 1. it is not descriptive, 2. less crucial for making generalisations and 3. "...involves the application of an evaluative framework to the objects of study...". The indicator evaluations provided the status quo on the municipal land use application process and the geospatial data management. The evaluations, that is assigning attributes to the indicators by the researcher, were based on participants' responses as far as possible. In some cases, other sources of information had to be consulted (e.g. municipal by-laws).

3.5.2.3   Interpretive Validity

The qualitative descriptions which are presented as themes in the next chapter, seek to provide meaning to the indicator evaluations. Interpretive validity refers to how well the researcher is able to present the meaning behind participant responses (Maxwell 1992). The most obvious way to try and verify the interpretive validity is to ask the participant if the researcher has interpreted their response correctly. But this may be unreliable because, "...the participant may be unaware of their own feelings or views, may recall these [accounts] inaccurately, and may consciously and subconsciously distort or conceal their views" (Maxwell 1992). For this study, where possible, interpretations were tied to the theoretical framework (e.g. stakeholder theory, the theory of planned behaviour, collaboration theory, systems theory, logical reasoning) and the SDI models (e.g. as described by Rajabifard et al. (2002)). The theoretical framework, together with the previous knowledge gained from the phase one study, legislative framework and other available documentation collected in the phase two study (e.g. the Gauteng City Region Implementation Plan for SPLUMA (Gauteng Planning Division 2016)) served as a means of triangulation.

3.5.3   Reliability

"Reliability in measurement is about consistency" (DeCarlo 2018). (Yin 1994, p.46) refers to 'replication logic', which means that the same method or procedure to collect the data can be applied to different cases. In this study, the same interview protocols were used to interview participants from different municipalities, in two provinces.

Louise & Alison (1994) state that equivalence of meaning, probing, 'good' respondents and researcher friendliness all contribute to the validity and reliability of the study - all of which have been discussed in the previous sections. Limitations that were unavoidable with this method of data collection, is the sample size and the fact that individual views influence responses. Also, municipalities are too varied in structure, thus a generalised view cannot be offered confidently on certain aspects, for instance, the impact of the organisational structure (i.e. functional versus process focused) on the land use application process and the geospatial data management. Interviews with other municipal units may provide enough information to provide

a fair assessment.

3.6   Chapter Summary

This chapter presented the method used to investigate the governance structure and business processes for the municipal land use application process in South Africa. The case study method was used to collect qualitative information in two phases. The first phase followed the statutory approach to determine the influences of various stakeholders on the land use application process, and to recommend custodianship for the geospatial land use rights data. This work is presented in Chapter 6.

In the second phase, semi-structured interviews were conducted at the municipal level to acquire information about the implementation of the land use application process in two provinces. A second, follow-up round of interviews were conducted to obtain information specifically related to SASDI awareness and the geospatial data management aspects. The researcher also reviewed other relevant documentation provided by the participants, which was either used to verify participant responses or to provide supplementary information.

The analysis of the interviews followed an interpretive approach, where the researcher applied mental models, the theoretical framework and formal models for SDI to draw suitable conclusions. The analyses were provided in two parts, the evaluation of the indicator framework and the in-depth discussions of emerging themes both of which were qualitative. The indicator assessment provided a valuable base and standard for the theme discussions. The indicators were modelled with a systems approach. In this case, the system refers to the land use application process. There are also internal and external factors that impact the process, thus these were also included in the assessment. The analysis will inform the overarching objective of this research which is to make recommendations a SASDI stakeholder collaboration framework.

Chapter 4

CAPACITATING LOCAL GOVERNMENTS FOR THE DIGITAL EARTH VISION: LESSONS LEARNT FROM THE ROLE OF MUNICIPALITIES IN THE SOUTH AFRICAN SPATIAL DATA INFRASTRUCTURE

This chapter was published as an article in the International Journal of Digital Earth (Siebritz et al. 2021). It contributes to the second research objective:

> to review the status quo of the SASDI development and implementation, with a focus on governance and municipal involvement.

The article was compiled as part of the Municipal Capacity Building Project, which was initiated in 2019 by employees of the South African NMA. The purpose of the project is to assist municipalities with their data management plans and practices with the aim of establishing SDIs that are suitable for the local sphere.

Representatives of various organisations participated as project team members. There were also project sub-groups that focused on specific objectives of the project. One such group reviewed the development and implementation of the SASDI, which culminated in the publication of two articles, i.e. this chapter and chapter 5. The author of this thesis led the work on the article, to which co-authors contributed as follows:

1. Ahmad Desai. The project creator (original idea, project scope and methodology) and

initiator. The researcher contributed to the project method, as well as the critique and recommendations.

2. Serena Coetzee (supervisor). As supervisor, she guided the writing of the article by commenting, making suggestions and language editing.

3. Antony K. Cooper. Based on his longstanding involvement in geospatial data in South Africa and SASDI, he contributed to the historical SASDI research, the critique and recommendations sections of the article.

The aim of this research is to propose a solution for the governance challenges related to geospatial datasets in the context of SASDI, which has led to limited access to the data. The SDI assessment presented in this chapter, yielded valuable insights into the state of the SASDI governance over time. The critique, which is based on the assessment, was centred around the role of municipalities in the SASDI. It provides a general perspective on the state of geospatial information in the local sphere - a useful foundation for the thesis case study. It therefore contributes to the second objective, by providing information about the status quo of the SASDI development and implementation, with a focus on governance and municipal involvement.

Abstract

The Digital Earth vision foresees the availability and accessibility of geospatial information to achieve the goals of sustainable development, economic growth and social well-being. In the case of urban areas, up- to-date geospatial information is essential for managing a city towards achieving these goals. The rapid shift from rural to urban areas globally puts pressure on local governments and they often struggle to find and organise the resources required to collect and maintain geospatial information that can help to address urban growth challenges. A spatial data infrastructure (SDI) can facilitate the availability and accessibility of geospatial information towards addressing national objectives, however, the involvement of local governments in an SDI can be a challenge. In this paper, we critique the role of municipalities against the backdrop of the developments of the South African SDI (SASDI) to date. The critique identifies five high-level shortcomings of the SASDI that have led to the limited participation of municipalities. Based on the shortcomings, we provide recommendations for capacitating municipalities through SASDI so that the Digital Earth vision can also be achieved for municipalities. These recommendations are aimed at involving the local sphere of government in a national SDI and are equally applicable to other countries.

4.1   Introduction

Geospatial information is essential, not only for the management of cities but also for planning and facilitating the transition from rural to urban areas. The Digital Earth vision foresees the availability and accessibility of geospatial information to achieve the goals of sustainable

development, economic growth and social well-being. However, due to rapid urbanisation, local governments in many parts of the world are under-resourced and often struggle to find and organise the resources required to collect and maintain geospatial information.

A spatial data infrastructure (SDI) can facilitate and coordinate the exchange of geospatial information and services between stakeholders from different levels in a community (Hjelmager et al. 2008). Increasingly, countries are adopting a national SDI approach. A functioning SDI has become imperative for addressing national objectives towards sustainable planning and development, which requires the participation of all role players. However, involving local governments in an SDI has its challenges (Harvey & Tulloch 2006, Coetzee et al. 2018, 2019). One of the crucial elements of effective and efficient functioning of local governments is the availability of authoritative geospatial information, facilitated by the geographical information systems (GISs) for efficiently capturing, storing, retrieving, maintaining, manipulating, analysing and displaying this information (Cooper 1993). Moreover, it is the proper management of this data that ensures sustainable planning and service delivery for the country. The involvement of local government in SDI is especially challenging in developing nations, which have a scarcity of resources and thus cannot afford duplication of data. The Integrated Geospatial Information Framework (IGIF), developed by the United Nations Expert Committee on Global Geospatial Information Management (UN: GGIM), was originally developed with the intention of addressing the data management challenges in developing countries but was expanded to include all nations.

In South Africa, beyond the organisational data management practices, the Department of Agriculture, Rural Development and Land Reform (DARD & LR) is responsible for providing a governance framework for all public sector geospatial information that ensures access to all users, promotes data sharing amongst data producers and eliminates duplicate data capture. This governance framework, the South African spatial data infrastructure (SASDI), comprising the technical, institutional and policy framework, is legislated by the Spatial Data Infrastructure Act No. 53 of 2003, which also provides for the coordinating body, the Committee for Spatial Information (CSI), and the online plat- form for accessing public geospatial information, the electronic metadata catalogue (EMC) (South African Government 2003a). There is no doubt that the SASDI, through its fundamental principles of access to data, sharing of data and no duplication of data capture, holds great potential to improve the data management practices in the local sphere of government which can have a significant impact on service delivery. South African municipalities are one of the most important role players but have been sorely overlooked in the development and implementation of the SASDI (refer to Appendix A.1). More- over, they have not been sufficiently capacitated to meet the SASDI requirements and to achieve its benefits, even though they are required to comply with legal obligations of SASDI. In response to this predicament, the Municipal Capacity Building Project was initiated to assist municipalities with their data management plans and practices in the context of SASDI.

The purpose of this paper is to assess the role of municipalities in SASDI based on SASDI developments to date and to make recommendations for enhancing the role of municipalities

within SASDI towards finding sustainable solutions for their data management plans and practices. This assessment forms part of the project (explained in Section 4.3.1). Other than the study by (Makanga & Smit 2010), which presented the status of many African SDIs, including the SASDI, more than a decade ago, no other review on the progress of the SASDI has been undertaken.

The paper is structured as follows: Section 2 provides background about the role of municipalities and geospatial information in the context of the three spheres of South African government. In Section 4.3, we present the Municipal Capacity Building Project and explain how we assessed the role of municipalities in SASDI developments as part of this project. Section 4.4 discusses the central findings of the assessment, based on which recommendations are presented for capacitating municipalities and other stakeholders with SDI implementation. Section 4.5 concludes.

4.2 Background

4.2.1 The three spheres of South African government

The 1996 Constitution of South Africa, in section 40(1), defines the three distinct, interdependent and interrelated spheres of government: national, provincial and local (South African Government 1996). As illustrated in Figure 4.1, the local sphere comprises three categories of municipalities, metropolitan (category A), local (category B) and district (category C), which collectively make up the nine provinces and cover the whole territory of the country ((South African Government 1996), section 151(1)). Local municipalities "share municipal executive and legislative authority in its area with a category C [district] municipality within whose area it falls" ((South African Government 1996), 75). Section 88 in the Local Government Municipal Structures Act No. 117 of 1998 states that district and local municipalities are required to cooperate with and support each other, whether technical, administrative or financial support (South African Government 1998b). Local municipalities comprise several departments, each of which is responsible for providing a different aspect of public services. As a result, local municipalities programmatically capture and maintain a wide variety of geospatial data, spanning various disciplines and needs. Generally, local municipalities tend to be the most under-resourced, which impacts their ability to deliver services, such as water, sanitation and refuse removal for their area of jurisdiction (Department of Cooperative Governance 2019). This often-times culminates in unrest and protest, which ultimately reflects in poor audit reports and lack of investment. Local municipalities, therefore, in most instances require the support of the other spheres of government and often outsource data capture services to the private sector. District municipalities, on the other hand, mainly acquire the data they need from different sources to respond to specific requests.

4.2.2 Geospatial information and the three spheres of government

Each sphere of government has the responsibility toward the availability and management of geospatial information. However, the management practices differ significantly between spheres
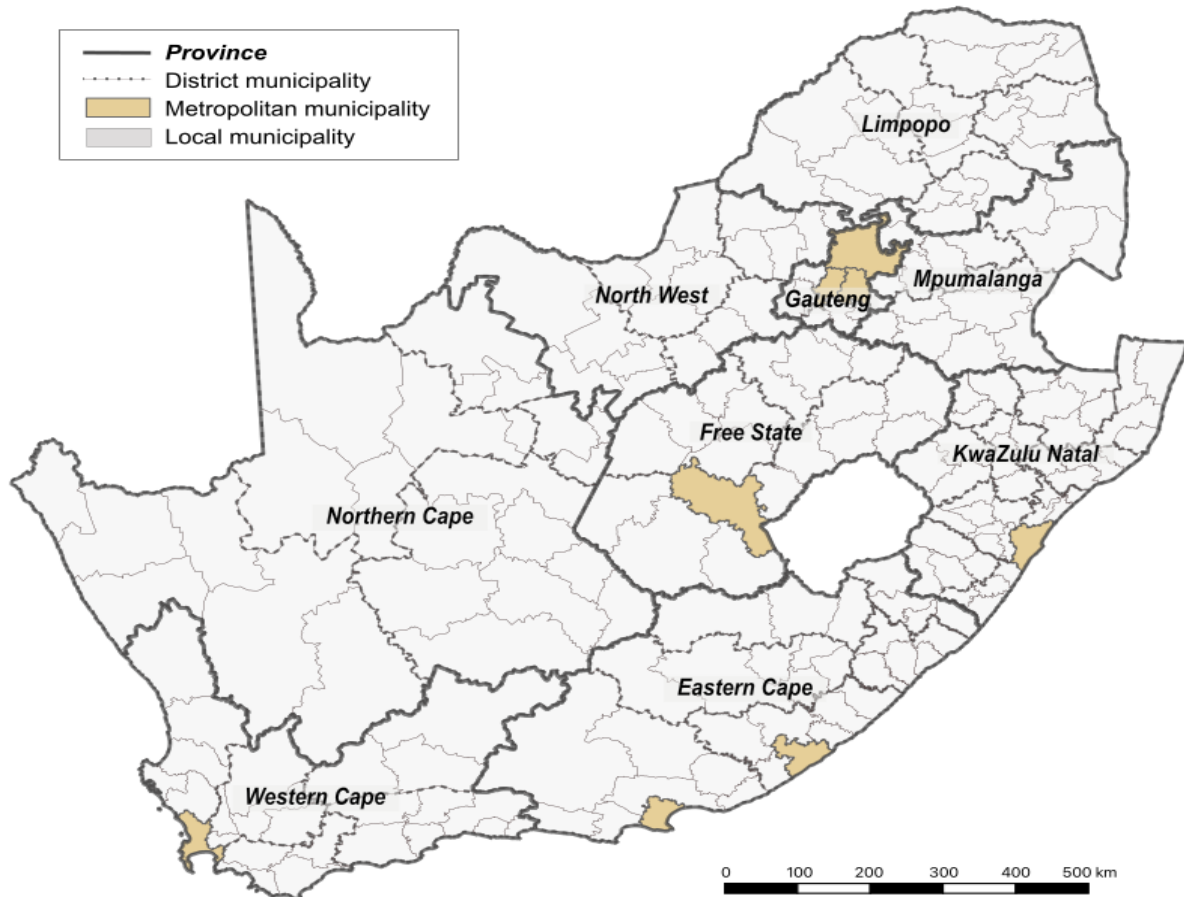
Figure 4.1: South African municipal provinces and three municipal categories

and even between organisations. Typically, within the local sphere, geospatial information is captured on local computers and may be connected to a central server, but very often a server is not available or the human capacity to set up, manage and maintain such infrastructure and systems is not made available. Nevertheless, there are examples of municipalities that have managed to implement centralised systems (enterprise GIS), often developed by service providers, that link geospatial information to revenue processes, e.g. in the Drakenstein Municipality (Drakenstein Municipality 2020) and the City of Cape Town Open Data Portal (see url: https://web1.capetown.g web1/opendataportal/) in the Western Cape (City of Cape Town 2016). At the provincial level, more sophisticated systems have been adopted. These systems centralise data for the various provincial departments and may provide public access via the internet; they may even provide basic mapping or analysis capabilities. National departments may operate on similar principles as provincial departments, although national departments may only provide the discipline-specific data for which they are mandated e.g. see Department Environmental Affairs EGIS website https://egis. environment.gov.za/ (Department Environmental Affairs Forestry and Fishery 2021).

4.3 Method

4.3.1 SASDI and the municipal capacity building project

The Municipal Capacity Building Project (hereafter referred to as 'the project') was initiated in August 2019 by employees of the National Mapping Agency (NMA). The following year, the project was endorsed by the CSI under the subcommittee that is responsible for educating and training organisations in SASDI implementation. The project team includes representatives from the National Geospatial Information (i.e. the NMA), Western Cape Department of Local Government (provincial government body with the specific mandate to capacitate municipalities), City of Cape Town Metropolitan Municipality, Garden Route District Municipality, the University of Pretoria and the Council for Scientific and Industrial Research.

The purpose of the Municipal Capacity Building Project is to assist municipalities with their data management plans and practices with the aim of establishing SDIs at the local level. The project was initiated for three reasons, first, many stakeholders still have difficulty in understanding the concept of the SASDI and how it is intended to improve organisational functioning. SDI is perceived as an abstract concept, thus when the structures and instruments that provide guidance on the practical implementation are lacking or not available, SDI remains intangible. Second, the SASDI message has been focused on organisational compliance, rather than capacity building that would enable organisational compliance. Third, and more specifically to the municipal context, municipalities do not have a bottom-up influence on the development and implementation of the SASDI.

Establishing local SDIs builds on the hierarchical SDI governance model introduced by (Rajabifard et al. 2002), where SDIs are established for each sphere of government and are aligned with the public administrative structures of government. In their hierarchical model, the SDIs between spheres are interrelated (vertical relationships), while SDIs within the same sphere may have a similar structure (horizontal relationships) (Rajabifard et al. 2002). (Rajabifard et al. 2006) provide further discussion on the role that local (or sub-national) governments can play within the hierarchical SDI model: the authors propose that local government implement an SDI with an operational focus (i.e. data collection and production), while NSDIs take on a strategic SDI approach, allowing for national coordination of SDI activities.

Figure 4.2 shows a simplified roadmap of the project, where the hierarchical SDI model is used as the starting point for informing the Geospatial Empowerment Framework. The Framework, which is based on the Ordnance Survey Maturity Assessment (van Loenen & Van Rij 2008, Ordnance Survey 2021), was adapted by the project team for the South African context. It was designed to understand the data management challenges that municipalities face so that appropriate SDI implementation plans may be developed to address those challenges. Therefore, periodic user needs analyses, an aspect that has been missing in SASDI development is a critical part of the Framework. However, as with the model by (Rajabifard et al. 2002), SDIs at different levels are interlinked and there are aspects of SDIs at other levels that the local SDI will have

to align with (e.g. national metadata standards). In this way, no SDI is operating as a silo.

As shown in Figure 4.2, the process of implementing local SDIs will be tiered and for each tier, the capacity-building opportunities are identified and undertaken. Capacity building refers to any activity (e.g. training sessions) or instrument (e.g. collaboration agreements) that improves SDI knowledge and implementation, both at the individual and organisational level. Ultimately, this process will empower municipalities in their data management, which will enable them to improve their service delivery. The approach for this project was specifically designed to respond to the issues around inclusive SDI governance and the practicality of the SASDI requirements for municipalities that will lead to an inculcated SDI culture.
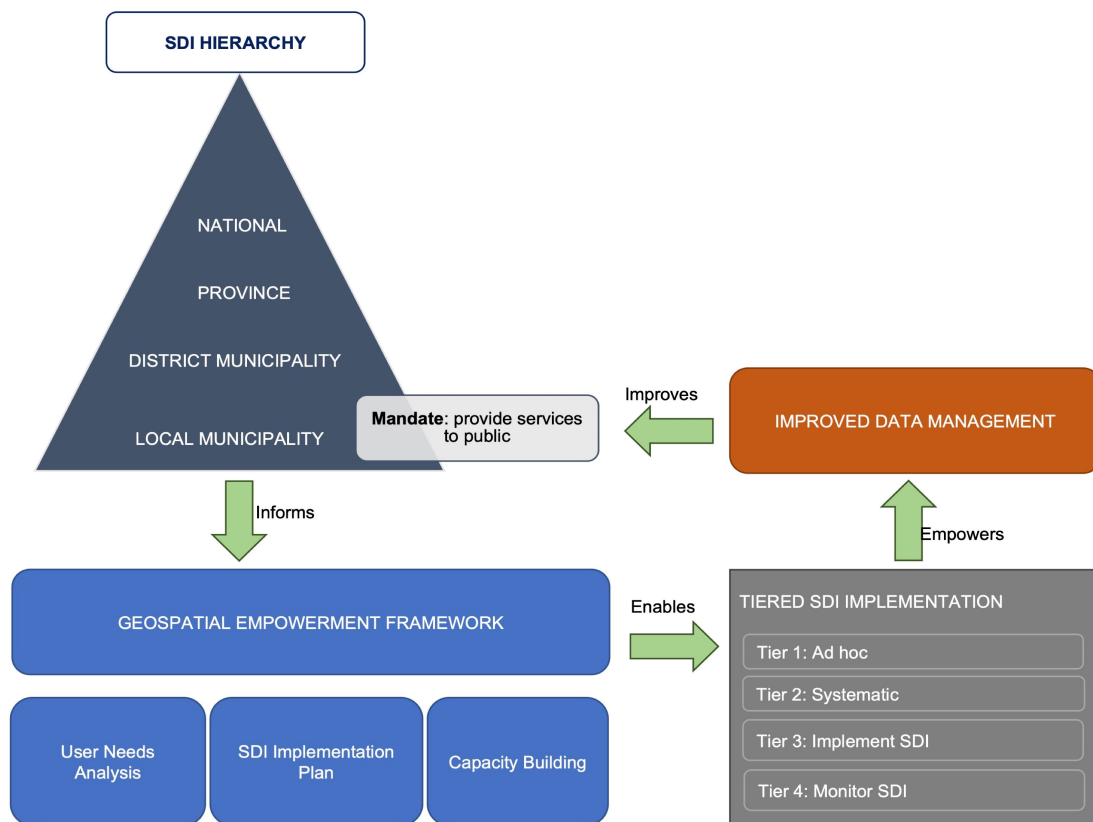
Figure 4.2: Roadmap of Municipal Capacity Building Project adapted from (Rajabifard et al. 2002)

The project has an overarching objective to reach 100 of the 278 municipalities by the year 2022 (Desai & Siebritz 2020a,b). Figure 4.3 outlines the project objectives and key results. This paper responds to the 'SASDI review and analysis' (highlighted in Figure 4.3) under objective 3, 'Establish Alignment', i.e. to establish balance between the SASDI requirements and the municipal needs. Instead of prescribing to municipalities how they should function in order to comply with the SASDI ('one-size-fits-all' solution), the requirements for a functioning SDI are divided into tiers, where each tier responds to the status of the municipalities' ability to manage their data and to implement an SDI (see Figure 4.2). Moving from one tier to the next demonstrates an improvement in SDI implementation. For tier 1, we assume there

is no SASDI awareness, that their data management practices are undertaken in an ad hoc way and that municipalities at this level have limited resources. As capacity is built over time and resources become available, municipalities progressively improve their data management (i.e. tier 2: systematic level) until they have a local SDI (i.e. tier 3: implement SDI). Once they have implemented their SDI, they then need to monitor its progress, implementation and impact on their organisational processes (i.e. tier 4: monitor SDI).
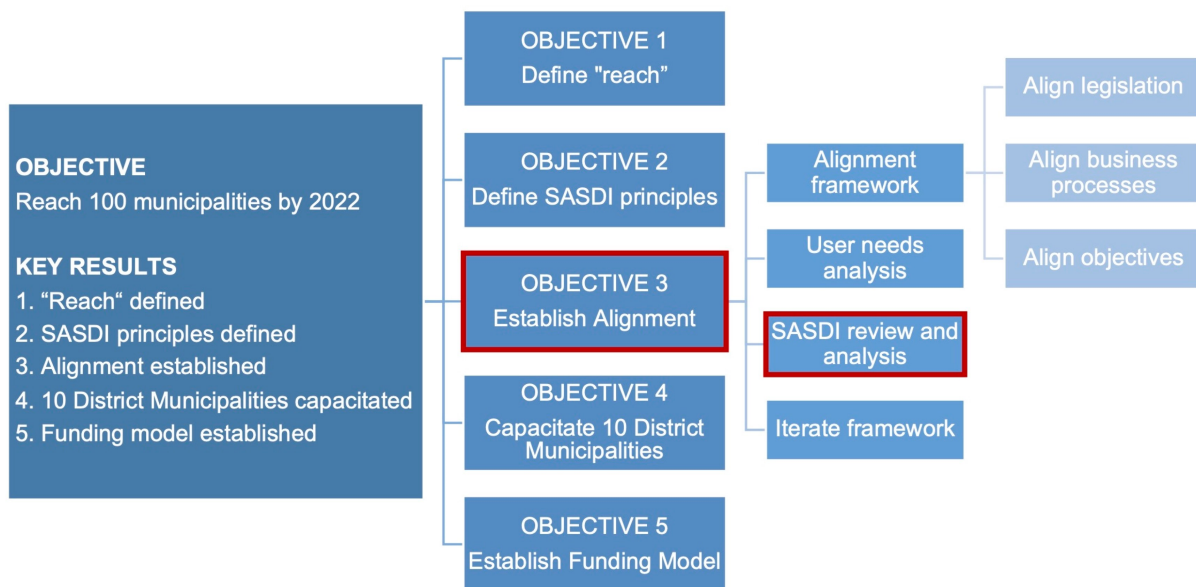
Figure 4.3: Objectives and key results of the Municipal Capacity Building Project (Doerr 2018)

The purpose of the SASDI review and analysis is three-fold, first, it is to ensure that the capacity building solutions presented to municipalities align with the vision, intention and objectives of the SASDI; second, it is to determine how the SASDI structure and operations have responded to organisational needs, especially within the local sphere. Third, the review should report on the resources that are available through the SASDI for municipal SDI development and implementation. This paper supports the second purpose of the SASDI review and analysis by assessing the role of municipalities in the SASDI structure and operations from a governance perspective. The process of alignment is iterative: it can be refined, based on periodic reviews of the project outcomes and their impact on municipalities.

4.3.2 Assessment approach

A number of methods for assessing SDIs have been developed over the years, each one designed to address a specific goal (Grus, Crompvoets & Bregt 2008). For this research, we wanted to assess the SASDI from a governance perspective. As ((Sjoukema et al. 2017), 4) states: 'each SDI component, the interactions between them, as well as the SDI itself are in need of governance'. We wanted to provide a qualitative description of: (i) how the SASDI components developed over time; (ii) the current status of the components; (iii) how the components have

influenced each other over time; and (iv) the overall impact of the SASDI on organisational processes. This approach closely aligns with the INSPIRE State of Play assessment introduced in (Vandenbroucke et al. 2008a, Crompvoets et al. 2018). More specifically, our assessment is comparable to the pragmatic State of Play approach proposed by (Vandenbroucke et al. 2008b), except that our indicators are aligned with the South African context. Figure 4.4 maps the relevant INSPIRE State of Play indicators to the indicators that we assessed.

Figure 4.4: Mapping applicable INSPIRE State of Play indicators to our method of assessing SASDI (Vandenbroucke et al. 2008b)

The figure only shows those INSPIRE State of Play indicators that were relevant to our assessment. In some cases, we combined the State of Play indicators (e.g. 'legal framework' and 'policy and legislation on access to PSI') and in other cases more than one of the SASDI indicators (e.g. 'participants' is covered by the 'coordinating bodies' and the 'role of municipalities' in our assessment) relates to a State of Play indicator. In Figure 4.4, this is depicted by arrows of the same colour. We included two additional indicators, 'international context' and 'international involvement' (shown in italics). These two aspects allowed us to determine how the SASDI evolution relates to international SDI trends and whether it was influenced by these developments and/or South African participation in international events.

We collected information about the indicators by reviewing the SASDI legislation, SASDI policies, CSI minutes, reports and newsletters, CSI subcommittee minutes, scientific articles, and additional information found through internet searches. As part of the Municipal Capacity Building Project, we also conducted workshops (two in total), which were preceded by an online questionnaire. In the questionnaire, we asked various municipalities in the Western Cape province to provide us with information on their geospatial data management with specific

reference to municipal spatial planning, since all municipalities are required to undertake spatial planning within an integrated plan, as per their legislative requirements (Johnstone 2019). We received four completed questionnaires. After the workshops, we undertook follow-up unstructured interviews (four in total) and semi-structured interviews (12 in total) with municipal representatives. The semi-structured interviews were actually undertaken as part of a Ph.D. thesis of one of the authors, but since the areas of interest overlap, the interviews were used as a supplementary source for the project. The interviews were undertaken with municipal representatives in two provinces; they included spatial planners, town planners and GIS experts. The questions relate to the municipal business processes for land use management, which includes the legislative requirements, stakeholder interactions, geospatial data capture aspects, SDI awareness and resource issues.

The table in Appendix A.1 summarises our review of the seven indicators for four periods: before 1994, 1994–2000, 2000–2009 and 2010 onwards. Based on this review, we identified five cross-cutting themes that hindered the progress of SASDI and limited municipal participation over the years: stakeholder involvement, disjuncture between different government spheres, limited involvement of municipalities in SASDI, lack of vision and strategy and shortcomings in the legal framework. We decided on the themes because it allowed us to demonstrate the interrelatedness of the seven indicators and the impact thereof, rather than simply reporting on the indicators chronologically. For example, in Section 4.1, we discuss how the CSI (relates to assessment indicator 'coordinating bodies' in Figure 4.4) has been unsuccessful in providing sustainable technical systems (relates to indicators 'available resources' and 'outputs' in Figure 4.4) which has caused stakeholders, such as municipalities to lose interest in the SASDI (relates to indicator 'role of municipalities' in Table 1), first because they cannot find the data they need for their day-to-day operations and second, they cannot contribute their own metadata, which facilitates access to users.

4.4   A critique on the role of municipalities in SASDI

4.4.1   Stakeholder involvement

After 1994 various organisations, mainly national departments were participating in the South African SDI on a voluntary basis, up until 2003 when the SDI Act (No. 54 of 2003) was promulgated and obligated all public institutions to participate and comply with the requirements of the Act. With the establishment of the statutory CSI, the subcommittees, legislative framework and technical platforms, some periods saw progress in the implementation of the SASDI. However, for other periods, these components were missing, impeding the progress of the SASDI. Almost 20 years on, the SASDI is again undergoing a period where much of the momentum gained in the first half 2010–2020, has been lost. Reasons such as delaying the appointment of CSI and subcommittee members for more than a year, including only some stakeholders in SASDI and the unavailability of the EMC since 2018 all contribute to this situation. This situation has caused an increased loss of stakeholder interest and stakeholder

participation over the years.

Initially, the concept and implementation of SDIs were promoted and developed by national governments mandated to collect and map small-scale geospatial data, that is, a top-down approach was followed. Establishing an infrastructure was seen as a national role, especially in developing countries where sub-national and local governments are generally not well developed (Rajabifard et al. 2006). A top-down approach made sense in the 1980s leading up to the 2000s where centralised databases were managed by NMAs because bandwidth was limited. However, with the introduction of Web 2.0, more providers of geospatial data emerged (e.g. Google, OpenStreetMap), which not only made data more accessible, but also the services that relied on the data. These services are important because users are interested in the services based on geospatial data, rather than the data itself, which should be an important driver for data producers. It seems that these international developments were lost on SASDI, as there is still limited involvement of municipalities and users (see also Section 4.4.3).

Though the hierarchical coordination from national government provides for standardisation, the bottom-up influence of sub-national government allows for diversity and inclusive governance (Masser 2005). When policies are enforced top-down from the national level, there is no real driving force for municipalities and the private sector to participate in SDI development. In other countries, the involvement of municipalities and the private sector, who are not as coordinated as national governments, led to more uncoordinated SDI activity (Rajabifard et al. 2006), which inevitably led to duplicate data capture and services. Ultimately, both municipal and private sector activities should form part of the SDI to improve the coordination of data capture amongst stakeholders. South Africa could better harness the potential of geospatial information by a top- down approach (from the NMA) supplemented by a strong bottom-up influence (from municipalities and other users). This offers a mechanism to use the already limited resources more effectively, thereby relieving financial and delivery demands placed on both the NMA and the municipalities.

Globally, third generation SDIs emerged in the second half of the 2000s to promote proactive inclusion of all stakeholders, including sub-national government, the private sector and general users, whose geospatial information needs were seen as an important driver for evolution (Rajabifard et al. 2006, Hennig & Belgiu 2011, Crompvoets et al. 2018). Further to this, the recently developed UN-GGIM IGIF seeks to strengthen geospatial capacities of nations at a strategic level through the integration of the various sectors, policies, programmes and enabling technologies while at the same time leveraging existing information systems such as those that form part of an NSDI. The Framework emphasises the inclusion of local knowledge, skills and needs (e.g. through partner- ships) to ensure well-informed decision-making and suitable, sustainable solutions (UN-GGIM 2020, 2022). In South Africa, this role is taken up by local authorities (e.g. platforms for public participation and public participation through various bodies) with the support of the other governmental spheres, highlighting the important role that municipalities have to play in the SASDI (further discussed in Section 4.4.3).

Recommendations:

- A SASDI governance structure that describes the various SDI stakeholder roles must be defined, including all spheres of government, as well as the private sector. Not only will it allow for accountability but it will assist to protect the interests and resources of the vulnerable stake- holders, in this case, municipalities. The governance structure should be dynamic, it must allow for changes in the way stakeholders interact with each other and their resources. In South Africa, the local sphere has experienced fundamental changes with the introduction of new legislation (e.g. Spatial Planning and Land Use Management Act) and government pro- grammes (e.g. the District Development Model). The SASDI governance structure must able to accommodate such changes.

- The SASDI, as part of its development planning, should make provision for wider consultation with stakeholders across disciplines, that travels upwards (i.e. user-centric focus). When stake- holder interests are taken into consideration, they are more likely to participate and respond to the requirements of the infrastructure. This is a good way to raise awareness not only of the SASDI but of geospatial information in general.

- A sustainable online system that provides free access to public geospatial data, as per the SASDI Policy of Pricing of Spatial Information Products and Services (Committee for Spatial Information 2015) should be made available. The policy states that public geospatial data for which organisations are mandated, must be made freely available to the public; organisations may charge a fee for the medium used to distribute the data or product. Access to good quality geospatial data may be one of the easiest ways to encourage stakeholder participation – if they can see the direct benefit to them, they are more likely to engage with SASDI.

4.4.2 Disjuncture between different spheres of government

In the years preceding the establishment of the SASDI, many municipalities had established GISs for capturing and maintaining their geospatial data. These GISs served their own needs; they required geospatial data to plan, manage and maintain the infrastructure and services for their respective jurisdictions. Nationally, the perspective on the need for geospatial data was very different. For example, the NMA established a GIS for topographic mapping with national coverage and the national Department of Environmental Affairs established a GIS for nature reserves and protected areas (Department Environmental Affairs Forestry and Fishery 2021). Therefore it was the national departments who drove the first initiatives for coordinated GIS activities in the country, such as the transversal National Land Information System (NLIS) established by the NMA in 1988. Initially, the NMA was the main pioneer on the journey to establish a South African SDI. Since then, alternative providers of topographic information have emerged (Google Maps, here maps, OpenStreetMap, etc.), often with more current topographic information; however, the NMA still has a strategic focus on topographic mapping with national coverage that does not support any operational objectives of municipalities. The role of the NMA has never been revisited and redefined in the context of decentralised data management by municipalities, emerging technologies and trends or national and international sustainability

goals. This makes the role of the NMA increasingly irrelevant in any geospatial data-related developments supporting national imperatives. In contrast, the geospatial data maintained by the Department of Environmental Affairs is widely used for environmental impact assessments and conservation studies.

There is little influence of the provincial sphere on geospatial data management and the implementation of the SASDI as can be seen in Appendix A.1, where there is no mention of the provincial sphere in our findings. According to legislation, the provincial sphere has to provide a supportive and coordinating role to municipalities, which includes the institutionalisation of systems to support geospatial data management for effective and efficient service delivery (South African Government 1996). SASDI has always been owned and driven by national government – all instructions regarding the SDI are thus prescribed from the top, down to the provinces and municipalities (refer to Appendix A.1). The SDI Act (No. 54 of 2003) provides for representation on the CSI by each province, as well as the national department of Provincial and Local government on the CSI, but in reality, not all provinces have nominated representatives. No specific role has been defined for the provincial departments to coordinate SDI implementation in municipalities. Aside from provincial geospatial forums where municipalities can voice their concerns (WCSIF 2019), their needs are not formally communicated upward, to the CSI. In the Western and Eastern Cape provinces, the provincial forum is established by the Office of the Premier. Quarterly forum meetings are held where representatives from various institutions are invited to present on geospatial-related information and technologies. Generally, the invitations are limited to the list of invitees held by the forum; it is not an open platform for all municipalities. During the meetings, a brief question-and-answer session is allowed but there are no in-depth discussions on the challenges related to the SASDI implementation. The provincial forum meetings are largely equivalent to a town hall meeting – the real issues (e.g. why there is no online platform where municipalities can access the data they need, why do some national custodians refuse to share public data freely and why are complaints about data quality disregarded by the responsible custodians, etc.) are not discussed, and the message never gets heard at the decision- making level which leads to frustrated, disgruntled communities. Provincial forums are not coordinated nationally; every province may establish this type of forum as they see fit.

These developments in the SASDI evolution have led to a disjuncture between the spheres of government in terms of the objectives for managing geospatial data, reflected in the way geospatial data is still being managed today. National departments capture fundamental geospatial datasets at scales that are inappropriate for municipal requirements, which results in municipalities recapturing the same data at the scale they require. As an example, there is no coordination or collaboration between the NMA and the municipal sphere, other than an agreement with some municipalities that the NMA will provide topographical data at the NMA's scale of capture to them (Chief Directorate: National Geospatial Information 2020), (Chief Directorate: National Geospatial Information 2021) bypassing the provincial sphere. This agreement does not meet the end users' needs of large-scale topographic data to plan, manage and maintain the infrastructure

and services within their jurisdictions (Anonymous 2021d). Similarly, the aerial photography provided by the NMA does not meet municipalities' temporal and spatial resolution, which means they either spend their budget on acquiring their own imagery or on field verification, which can be a very time-consuming process (Anonymous 2021a,b,c,d). Currently, the NMA acquires aerial imagery for South Africa over a three-year period at a ground sample distance (GSD) of 25 cm, while municipalities require better than 10 cm GSD annually, to meet their planning and service delivery needs. An NMA that sup- ports provinces and municipalities with their data-specific requirements can make a significant contribution to SASDI and service delivery. This disjuncture between different spheres of government is not unique to geospatial data management. The public governance structure of South Africa defines clear-cut roles for the three spheres, but the interrelatedness of those spheres and thus the support structures mandated by the Constitution, from national government to the local sphere is not clearly defined (Van Wyk & Oranje 2014, Johnstone 2019).

Recommendations:

- To implement a hierarchical SDI model, existing organisational mandates, administrative structures and institutional instruments must be acknowledged and leveraged. South African municipalities in particular are driven by legislation and directives given through their political and administrative structures. Anything outside of this structure is not prioritised. Secondly, organisations over time, develop their own culture of working and it is important to acknowledge those efforts instead of requiring them to readjust to something completely new that may hinder their progress.

- There is an opportunity and need to establish objective-based, coherent provincial forums geared toward municipal support for SDI implementation. These forums have to be interactive, allowing municipalities to voice their challenges and collectively propose solutions with the support of provincial coordinators. It may be feasible to elect officials at the district level to represent the local municipalities in their respective jurisdictions at the provincial forums. This may allow for better vertical alignment of SDIs.

- The NMA should review its role and its strategic direction, with a specific focus on how it could provide coordination, guidance and support to municipalities with respect to the availability and access to relevant geospatial information.

4.4.3 Limited involvement of municipalities in SASDI

The SASDI was intended to eliminate duplicate data capture in the country by coordinating the data capture activities of organs of state. The top-down focus (i.e. hierarchical coordination approach) followed since its inception has made it difficult to reduce the duplication of data. Over the years, most of the SASDI resources were spent on capacitating national data custodians but hardly any progress on SASDI objectives is evident, aside from the appointment of custodians for fundamental datasets and the publishing of the two policies. Though a top-down approach is necessary to establish standardisation of geospatial data and good practices, concurrent mechanisms for incorporating the diversity and local perspective that the municipal sphere has to offer are equally important for an SDI. SDIs should serve local needs effectively in

order to contribute to sustainable urban planning (Nedovic-Budic et al. 2004, Budhathoki & Nedovic-Budic 2007). In Belgium, with the Flemish SDI, the data capture and maintenance responsibilities were decentralised to the municipalities in 2011, but activities related to data integration and exchange are coordinated centrally by the regional Flemish Information Agency, responsible for SDI implementation (Coetzee et al. 2019). The authors of this study note that even though municipalities implement decisions directed from the regional level, decision-making processes should not alienate municipalities. (Coetzee et al. 2018) demonstrate how a similar situation exists in the Nether- lands between the municipalities and national bodies. The study reveals the complex governance structure that is required to provide integrated datasets that are adequate for users at different levels of government. These examples could serve as guidance for the SASDI.

Though the SASDI municipal participation, through their CSI representation may be considered high (i.e. municipal representatives are appointed in terms of the SDI Act requirements), in reality one or two individuals to represent the highly diverse 278 municipalities is insufficient. As a result, municipal needs and challenges with SDI implementation are not brought to the attention of the CSI, and secondly, awareness of the SASDI in the local sphere is limited. Up until today, most municipalities remain uninformed of the SASDI (User Needs Analysis Working Group 2020a, Patel 2020), despite their willingness to follow the principles of an SDI, such as providing access to geospatial data and avoiding duplicate data capture (Anonymous 2021a,b,c,d). It makes sense for municipalities to follow these principles as much as they are able to because they under- stand that by not following them, their already scarce resources will not be used effectively and efficiently, and they risk failure to meet their mandates and provide adequate forward planning through their various programmes. One such municipality that has demonstrated their proactive pursuit to implement a local SDI is the City of Johannesburg (Anonymous 2021a). Over the years, it has made great strides to establish a data governance structure and promote sustainable data practices within municipal departments (Anonymous 2021a). In many cases though, data management and data governance structures that facilitate these principles, are sorely lacking in municipalities and the mechanisms to support such structures through provincial government and national departments have not proved useful in many cases (User Needs Analysis Working Group 2020b,a).

Recommendations:

- Municipalities have to be capacitated for local SDI implementation. A tiered approach to SDI implementation for municipalities should be provided. In the Municipal Capacity Building Project, we propose four tiers (see Figure 4.2). For each tier, the practical guidance is provided to implement a local SDI. As discussed in Section 4.3.1, local SDIs must but interlinked with provincial and national SDIs. Nationally this role is assumed by the CSI, although it could be done in conjunction with the Department of Cooperative Governance and Traditional Affairs (CoGTA) and the South African Local Government Association (SALGA). Provincially there is an opportunity for the CSI to engage with the respective provincial CoGTA departments to co-ordinate municipal SDI capacity building.

4.4.4 Lack of vision and strategy

The lack of a vision that is clearly defined and accepted by all stakeholders (refer to Appendix A.1) is a concern because this is a crucial element of an SDI according to (Kok & van Loenen 2005) and (Crompvoets, Bouckaert, Vancauwenberghe, Orshoven, Janssen, Dumortier, Dessers, Hootegem, Geudens, Macharis & Plastria 2008). Another concern is the absence of a national geospatial data management strategy and the action plan to implement such a strategy. The United States SDI, the Netherlands SDI and the Australian SDI (ASDI) are three examples that demonstrate the value of a strategic plan to guide the implementation of the NSDI. The US SDI strategic plan displays great effort toward integration and harmonisation of information, including non-spatial information (Federal Data Strategy Development Team 2020b,a). Within the Netherlands SDI strategy, municipalities play an important role to capture and maintain fundamental geospatial data, which is integrated by the NMA into a national dataset (Coetzee et al. 2018). The ASDI with its vision to 'provide a transparent supporting structure for spatial decision- making and information access that will be used on a regular basis by all members of society' in its strategic plans, highlights the importance of stakeholder engagement, raising awareness and under- standing user needs (Geomatic Technologies 2008, The Intergovernmental Committee on Survey and Mapping n.d.).

After the SDI Act was passed into law in South Africa in 2003, little happened and the geospatial community of South Africa was 'vocal in their condemnation of the lack of progress' (Clarke 2011). The establishment of the statutory CSI in 2010 provided some drive for the development and implementation of the SASDI with the subcommittees responding to their respective programmes of work. Most CSI members in the first two terms had already been involved in the management of spatial information at their respective organisations before the CSI was established. In other words, organisations already involved in SDI-like practices and the promotion of SDI principles formalised their existing practices through the CSI. However, the establishment of the CSI and the other prescriptions of the Act did not necessarily result in a functioning SDI (e.g. participation of all stakeholders and publishing of metadata).

According to (Sjoukema et al. 2017) adaptability of the SDI governance should be a foremost feature of SDI. A strategy of adapting to a wider pool of stakeholders with changing needs is one of the key drivers for SDI evolution. However, this has not happened in South Africa. The SDI Act mentions only organs of state. The private sector is not currently represented in SASDI, even though most municipalities rely on service providers for capturing certain geospatial data and for providing the systems they require. SDIs in other countries have recognised the importance of the private sector for an SDI, but also acknowledge that balance is required to ensure sustainable partnerships (Rajabifard et al. 2006, Janssen & Dumortier 2007, Coetzee et al. 2018, 2019).

Apart from formalising existing practices, the CSI subcommittees undertook training events, workshops and presentations at conferences, research and research collaborations, identified standards for SASDI, developed the Data Capture Project Register (DCPR), etc. However, all the activities were happening and continue to happen outside a national strategy, creating

an environment amenable to inconsistencies and opportunistic behaviour. The general lack of political support for the SASDI in the last decade has hampered the progress of SDI in South Africa. This in turn has been exacerbated by the incoherent management of SASDI, characterised by the lack of vision and strategy, and lack of implementation of an agreed-upon infrastructure – the antithesis of symbiotic relationship. Furthermore, because the vision and strategy are not clearly defined with reference to national objectives for sustainable development and planning, it is difficult, if not impossible, to monitor and evaluate the impact of the capacity-building activities and of SASDI as a whole. In other words, there is no accountability. Recommendations:

- The CSI must review and establish a clear, coherent vision for the SASDI. This vision which must be understood and accepted by its stakeholders should guide the development of a strategic plan and following that, an implementation plan. As part of the implementation plan, an indicator framework that is tied to national objectives needs to be developed. If the CSI can demonstrate that it has responded to those objectives, it may generate better political support and secure national funding for the development of the SASDI.

- Effort toward a national data governance, data management research and development pro- gramme coordinated between government, the private sector, non-governmental organisations, etc. and supported by SDI relevant education and training at tertiary institutions is required. Such a programme may drive objective-based decision-making toward sustainable solutions because graduates may then be better equipped for the workplace.

4.4.5 Shortcomings in the legal framework

The SASDI legal framework has been lacking. First, the Act is vague in many regards, and does not provide enough information on the institutional and policy frameworks, respectively. These issues have yet to be addressed in the Act. Second, the Act has not been integrated with any other legislation, thus when there were important changes in the way municipalities operate, empowered through pertinent legislation like the Spatial Planning and Land Use Management Act (No. 16 2013), the SASDI has not facilitated in any obvious or significant ways. Third, the CSI has acted with an agency of compliance to the Act even though the lack of stakeholder participation suggests that a different approach is required. During forums and stakeholder engagement sessions, participants have openly expressed their organisations' inability to meet the legal SDI requirements and that suitable capacity building is still required (WCSIF 2019). The CSI proposes punitive measures for non-compliance (Department of Rural Development and Land Reform 2014). This is contradictory to the narrative of dynamic, evolving SDIs which respond to changing user needs, are objective-driven, promote capacity building and inclusive governance. (Janssen 2008) who presented a conceptual model for assessing the legal framework of an SDI argues that an SDI legal framework must be compliant (with the SDI legislation and other legislation related to geographic information), coherent (i.e. assessing complementing versus contradicting rules) and its quality (i.e. if the legislation enables the SDI to meet its goals) must be known.
Recommendations:

- The SASDI legal framework should be assessed in terms of the compliance, coherence and quality as proposed by (Janssen 2008).

- The municipalities are well placed to evaluate the SASDI legal framework in that they already interpret various pieces of legislation and apply it to service delivery. Working with the municipalities to guide the review of the SASDI legal framework would circumvent unnecessary revisions. The vision of 'smart cities' which has been promoted by the South African President in his 2021 State of the Nation address (Ramaphosa 2021), can only be realised through municipalities facilitating the various pieces of legislation that enable this vision.

4.5   Conclusion

In this paper we critiqued the role of municipalities in SASDI developments to date as part of the Municipal Capacity Building Project because we recognised the lack of awareness and participation from the local sphere. At the onset of the Project, three reasons were proposed for the lack of SASDI implementation in municipalities, namely, difficulty in understanding the SDI concept, insufficient capacity building and no mechanisms for bottom-up influence from municipalities. This paper provides a holistic understanding of why those challenges exist: not having a clearly defined SASDI data governance structure, a strategic plan that proactively includes the local sphere and mechanisms to ensure the sustainability of the SASDI (such as tertiary institutions including issues such as data management and data governance within geomatics education).

Municipalities have an important role to play in terms of service delivery and SASDI has the potential to impact access to public services. Five high-level shortcomings of the SASDI provide insight into the lack of municipal participation in SASDI: stakeholder involvement, a disjuncture between the spheres of government, limited involvement of municipalities, lack of vision and strategy and shortcomings in the legal framework.

Municipalities also have a responsibility toward the SASDI principles of making data accessible, sharing data and avoiding duplicate data capture because these contribute to the sustainability goals of government. Many of them are already practicing the principles, even without knowledge of the SASDI, but because they do not know the purpose of the SASDI and its provisions, they do not voice their data-related concerns and challenges to those who are responsible for assisting them in this regard.

There is a significant role that the NMA could fulfil, even though it does not have a specific mandate to support municipalities: their vision is to be "South Africa's foremost organisation supplying fundamental geospatial information" (Chief Directorate: National Geospatial Information 2020). In the 2021 strategic plan of the NMA, it states the need to re-look at its products and services over the next five years, to ensure that user needs are met and that the organisation maintains its relevance. This can be interpreted to include the 'fundamental geospatial information'

required by municipalities. Municipalities recognise the potential value of the data that the NMA could provide to them, but without the necessary engagement and strategic alignment with user needs, the NMA data remains unsuitable for municipalities to utilise in their daily processes.

This study provides a valuable contribution to the body of literature about the South African SDI, but it is also useful for other countries with similar public administrative structures, who have not identified municipalities as a vital SDI stakeholder or who are still finding it difficult to define the role of their municipalities in the NSDI. For example, (Sinvula et al. 2017) in their comparative analysis of SDI stakeholder roles in South Africa, Ghana and Namibia, conclude that further investigation is required to distinguish between local, provincial and national government data producers. Further to the role of the data producer, the authors propose coordinator and integrator roles. In this paper, we have proposed that the NMA take up this type of role in South Africa. The end goals of SDIs around the world may be different, but principles of SDI are common (i.e. access to data, sharing of data and reuse of data/ eliminating duplicate data capture). The recommendations we have provided responds to those principles, making it possible for other countries to apply our approach.

Our study confirms that SDIs may be viewed as, and therefore assessed as complex and adaptive systems (CAS) (Grus et al. 2010). In the case of SASDI, we have observed certain CAS characteristics and behaviours such as the interaction between the different components, sensitivity to initial conditions (e.g. SASDI vision not clearly defined in the earlier years) and non-linear development (e.g. the lack of political support that impeded progress). But, we have also presented how other CAS characteristics, which are not observed with SASDI can be leveraged to improve the development and longevity of SASDI, which may be applicable to NSDIs in general.

NSDI should align its governance and implementation to other governance structures and legislation in the country (i.e. provides clear SDI architecture for different spheres of government (Grus et al. 2010). A national strategy or plan that explains the NSDI objectives and how these align to national imperatives can serve as a road map for getting stakeholders on board. The road map should be developed in consultation with all stakeholders, also those at the 'bottom', such as municipalities, and should align with how they operate (i.e. contributes to an open SDI, (Grus et al. 2010)). 'Going solo' with an NSDI does not support the cause, especially not in resource-constrained developing countries. Our review also shows the need for an SDI to adapt (Grus et al. 2010). Governments are known to move slowly, which provides stability on the one hand but can also lead to stagnation. While a legal framework to support an SDI can mobilise resources and funding, it can also become a significant barrier to SDI implementation if it is not flexible enough to allow the SDI to adapt and evolve (e.g. to include additional stakeholders) or if it is so vague that nobody understands their roles and responsibilities. Finally, an SDI requires endurance and continuous attention. Implementing an SDI in a stop-and-go fashion causes important stakeholders to lose trust and interest.

Africa faces many challenges related to the transition from a mostly rural to a predominantly urban society, and geospatial information is essential for planning and facilitating this transition. NSDIs can play as a strong role in achieving the Digital Earth vision of having geospatial information to achieve the goals of sustainable development, economic growth and social well-being in the transitioning to an urban society, but only if municipalities are appropriately involved.

Chapter 5

THE SOUTH AFRICAN SPATIAL DATA INFRASTRUCTURE – WHERE ARE THE MUNICIPALITIES?

This chapter was published as an article in the International Journal of Spatial Data Infrastructures Research (Siebritz et al. 2022). It contributes to the first and second research objectives:

> to understand possible governance options based on an investigation of the theory for SDI governance, SDI coordination approaches, and collaborative stakeholder theory; and

> to review the status quo of the SASDI development and implementation, with a focus on governance and municipal involvement.

The article was compiled as part of the Municipal Capacity Building Project, which was initiated in 2019 by employees of the South African NMA. The purpose of the project is to assist municipalities with their data management plans and practices with the aim of establishing SDIs that are suitable for the local sphere.

Representatives of various organisations participated as project team members. There were also project sub-groups that focused on specific objectives of the project. One such group reviewed the development and implementation of the SASDI, which culminated in the publication of two articles, i.e. chapter 4 and this chapter. The author of this thesis led the work on the article and prepared the text for the 'since 2010' period. The co-authors contributed as follows:

1. Ahmad Desai. The project creator (original idea, project scope and methodology) and initiator. The researcher contributed to the summary and discussion sections of the article.

2. Serena Coetzee (supervisor). As supervisor, she guided the writing of the article by commenting, making suggestions and language editing. She also prepared the text for the '2000-2009' period.

3. Antony K. Cooper. Based on his longstanding involvement in geospatial data in South Africa and SASDI, he prepared the text for the 'before 1994' and '1994-2000' periods.

The review, which covered four decades showed the development trajectory of the SASDI in the context of international geospatial and SDI trends. The detailed descriptions of the SASDI components over time provided understanding of the specific developments (e.g. enactment of the SDI Act) that enabled the SASDI to progress, and also the events (e.g. end of the contract for hosting an Electronic Metadata Catalogue) and decisions (e.g. dissolution of the commissions that undertook research into an SDI strategy for the SASDI) that hampered its progress and as a result, municipal participation. This paper therefore contributes to the second objective, by providing information about the status quo of the SASDI development and implementation, with a focus on governance and municipal involvement.

Abstract

Many municipalities in South Africa, especially those in rural areas, do not have the resources to maintain the geospatial information required to deliver essential services. Conversely, National Geospatial Information (NGI), the national mapping agency (NMA), captures data themes required by municipalities but not at scales suitable for municipal purposes. In 2003, the South African spatial data infrastructure (SASDI) was initiated through national legislation as the "national technical, institutional and policy framework" to govern public geospatial information. However, involvement of the country's more than 250 municipalities in SASDI has been limited. In order to better understand the role of municipalities in the development and implementation of SASDI, we reviewed this over four periods: (1) before 1994, i.e., before the new Constitution of South Africa came into force; (2) 1994 to 2000, when the idea of an SDI emerged through voluntary participation; (3) 2000 to 2009, when the SASDI legislation was enacted but nothing really happened; and (4) from 2010 to date, starting with the first meeting of the Committee for Spatial Information, the SASDI coordinating body. The review confirms that unless SASDI steps in to provide coordination mechanisms between different spheres of government, the NMA will continue to supply unsuitable data and municipalities will be left to their own devices. A SASDI that caters for diverse user needs through bottom-up influences could greatly improve local municipalities' service delivery. We have used the results of our study to propose a governance framework where all spheres of government are involved in SASDI and municipalities have an opportunity to communicate their data needs from the bottom, upward.

5.1 Introduction

5.1.1 South African Municipalities for Service Delivery

In South Africa, under Constitutional Law, the three spheres of government are established as the national, provincial and local spheres, and collectively they are described as: "distinctive,

inter-related and inter-dependent" (South Africa, 1996). The entire Republic is made up of 278 contiguous municipalities, each one having jurisdiction over the area within its demarcation. Municipalities are supported by their respective provincial government offices; there are nine provinces in total. Provincial offices are supported by national government. The municipal sphere is directly responsible for providing services to the public, such as clean water and sanitation. As such, they rely heavily on good quality spatial information, both from their internal departments and from external organisations. For those municipalities that are under-resourced, a common case in South Africa, access to external fundamental spatial information becomes crucial for the municipalities' day-to-day functioning. Though this inter-dependency exists, the intergovernmental relationships required to meet the needs of municipalities still needs much work. By its very nature, national spatial data infrastructures (SDIs) can facilitate and coordinate those fundamental stakeholder relationships.

5.1.2 SASDI and the Municipal Capacity Building Project

The South African spatial data infrastructure (SASDI) was enacted in 2003 by the Spatial Data Infrastructure Act (No. 54 of 2003) (or SDI Act) as the "national technical, institutional and policy framework" to govern public geospatial information (South African Government 2003a). The SASDI governance structure, which is coordinated by the Committee for Spatial Information (CSI), comprises a variety of stakeholders, including municipalities. The degree of involvement and thus the level of influence of all stakeholders are determined by the CSI. Municipalities have been represented mainly through CSI membership and participation on the various subcommittees, who are responsible for advising the CSI on SASDI development and implementation. According to (Siebritz et al. 2022), the municipal representation on the CSI has been insufficient and, as such, has not offered much assistance to municipalities in their management of geospatial information. Adding to this, there has not been any consultation with the local sphere with respect to the hindrances to effective and efficient data management. This has had negative consequences for the local sphere. Many municipalities, especially those situated in rural areas, do not have the resources to capture and maintain the geospatial data they require to deliver essential services to the public. Other organisations, such as the National Geospatial Information (NGI), the national mapping agency (NMA) of South Africa, captures data themes required by municipalities but not at the scales suitable for municipalities (Siebritz et al. 2021). Unless SASDI provides the coordination mechanisms whereby municipal data needs are relayed to the NMA, the NMA will continue to supply unsuitable data and struggling municipalities will be left without the required support. Conversely, if SASDI is able to cater for diverse user needs through bottom-up influences, it could greatly improve service delivery in the local sphere (Siebritz et al. 2021).

The Municipal Capacity Building Project, initiated in August 2019 was motivated by the need to assist municipalities with their data management plans, based on SASDI principles: access to data, sharing of data and no duplication. The project employs a bottom-up approach whereby municipalities are actively engaged to understand their context and determine their

data management challenges (Siebritz et al. 2021). This article supports the project by reviewing the role of municipalities in the development and implementation of SASDI for the past four decades. This will help us to understand the degree to which SASDI has responded to the municipal data challenges in the past and will provide a baseline for future planning to better assist municipalities.

To this purpose a longitudinal study was undertaken, spanning four periods: before 1994, 1994-2000, 2000-2009 and 2010 onwards. For each period, we briefly review relevant international SDI trends, and then present the SASDI vision and objectives, legal framework, operations, available resources and the role of municipalities available for the period. Our review of these SASDI components allowed us to understand how each component has developed over the four periods and how the interaction of the components have influenced the overall trajectory of the SASDI over time, in other words the SASDI governance. From this, we were able to understand the extent to which SASDI has supported municipalities with their data management to support their core business, which is service delivery. Based on our findings and on our stakeholder engagement through the Municipal Capacity Building Project, we propose a governance structure for municipal involvement in the national SDI. In Siebritz et al. (2021) we present a critique on the role of municipalities in SASDI developments and include recommendations to capacitate municipalities in SDI participation and implementation.

The article is structured as follows. Section 5.2 briefly reviews SDI development trends; Sections 5.3 to 5.6.1 provide a summary of SASDI activities for each period, Section 5.7 presents the summary and results of our study which includes the proposed governance structure for SASDI, and the conclusions are provided in Section 5.8.

5.2   Literature Review

The intended purpose of the SDI concept has changed over time, at first it was seen as a way to centralise and standardise spatial information from the national perspective. According to SDI literature, this first generation of SDIs emerged from the 1980s, following a mostly top-down product-based approach, in which national mapping agencies played a major strategic and operational role (Rajabifard et al. 2006). In the early 2000's a second generation of process-based SDIs took advantage of the capabilities of the Internet and the World Wide Web (Rajabifard et al. 2006, Masser 2009). The focus shifted from data in itself to creating an infrastructure and facilitating information access, e.g. through Web services, so that data can be used (Rajabifard et al. 2006). Up until this point, national government was still taking the lead in SDI development, while the role of sub- national government in NSDIs remained unclear. In an investigation by Harvey & Tulloch (2006), the authors found that data sharing in US local government continued to happen informally and infrequently – i.e. as data is required or requested, despite the national NSDI policies which called for coordinated sharing practices. The authors concluded that second-generation SDIs can only be effective if the uptake of SDI

in local government is improved.

By the mid-2000s a third generation of SDIs had already emerged. With a greater focus on SDI governance, specifically decentralised SDI governance, defining the roles and influences of sub-national government, the private sector and users, became vital (Rajabifard et al. 2006, Budhathoki et al. 2008, Masser 2009). Unlike the second generation of SDIs, which were propelled by technological advances, the third generation SDI required a shift from the prescriptive, top-down approach to promote inclusive governance and to ensure that SDIs respond to user requirements adequately. In other words, empowering the various stakeholders to participate in the SDI in their respective roles became priority - shifting the focus away from data production. Two examples of proactive municipal integration into national SDIs can be observed in the Netherlands and Flanders, respectively. In both cases, municipalities are responsible for producing the data and ensuring the data remains up-to-date, while the coordination and centralised access to the data is undertaken by a dedicated organisation at the national level (Coetzee et al. 2018, 2019).

5.3   SASDI and the Role of Municipalities before 1994

5.3.1   International Context

The term spatial data infrastructure (SDI) first appears in the literature in 1990, in the review report, Spatial Data Needs: The Future of the National Mapping Program, conducted by the National Research Council for the United States Geological Survey (National Research Council 1990). This led to the influential Executive Order, Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure, which defined the National spatial data infrastructure as "the technology, policies, standards, and human resources necessary to acquire, process, store, distribute, and improve utilization of geospatial data" (Clinton 1994).

Of course, primitive SDI-type developments happened around the world before 1990. The term geographical information system (GIS) was first coined in late 1963, in the name for the first such system, the Canadian Geographical Information System (CGIS) (Tomlinson 1988). Indeed, some might consider CGIS to have been an SDI, as well as having been the first GIS. CGIS catered for "physical, biological, social, and economic data [...] for land use planning and management at national, provincial, regional, and local levels" (Fisher & MacDonald 1980). CGIS began as the core of the Canadian Land Inventory (Tomlinson 1988) and has been so successful that it is still in use today, though obviously much changed and it is more comprehensive than it was in the 1960s.

5.3.2   Vision and Objectives

The first geographical information systems (GISs) in South Africa were imported or developed locally during the 1970s, such as a computerized thematic mapping capability developed at the

University of Stellenbosch from 1972 onwards (Zietsman 2002), a computer-aided cartographic facility developed at the Council for Scientific and Industrial Research (CSIR) (Roets 1974), and a collaboration between the CSIR and the University of Saskatchewan in Canada on the automatic vectorization of scanned maps (Peuquet 1981). By the start of the 1980s, several private companies, government departments, municipalities and other organisations began buying commercial GISs, as opposed to using systems cobbled together in-house. The CSIR's research and development led ultimately to the design and development of a comprehensive GIS, handling alphanumeric, vector and raster data, and managing maps and aerial photographs (Cooper 1989). This work laid the foundation for the National Exchange Standard (NES) and the commercial South African GIS, ReGIS (Cooper & Hobson 1991). Geospatial data across organisations, that is, fledgling SDI concepts, were first made at local conferences in the 1980s.

5.3.3 Legal Framework

Before 1994, no legislation was developed in South Africa for SDIs. During the 1980s and early 1990s, the primary legislative concern was over copyright, for two reasons. Firstly, and most obviously, was the concern by those creating datasets of maintaining their income streams. It was expensive to produce datasets, with most data being collected in the field or manually digitised off paper map sheets or mylar overlays (on which data had been transcribed manually). Only limited remotely sensed data were available, from aerial photography or satellites (primarily Landsat). The imagery was so expensive that when a researcher or academic managed to obtain a single image (whether digital or a physical photograph), that was all they had to work on for a long time.

The second concern over copyright related to the manual digitising of paper maps that were then portrayed as being true copies of the original. The quality of the manual digitising varied significantly between different operators (unsurprisingly). The job specifications for digitising map sheets were often limited to specific features (with contours invariably being omitted because of the sheer volume and difficulty of digitising them manually) or even only parts of the map sheet. In addition, the operator was not necessarily given the latest edition of the map sheet; and generally, no metadata was ever provided. Consequently, the major map producers were concerned that their reputations were being tarnished by the quality of all the digitising done in contravention of their copyright and by all the competing digital versions of their maps now in circulation. Hence, several map producers considered prosecuting such contraventions of copyright, but it is not certain that any cases came to court.

5.3.4 Operations

The State inter-departmental Coordinating Committee for the National Land Information System (CCNLIS) was established in March 1988. At that stage, the main objectives of the CCNLIS was to coordinate national land information by:

- "ensuring that all institutions can participate within the National Land Information System (NLIS);
- eliminating duplication of time, data and effort;
- drawing up standards for data and the exchange of geo-referenced information; and
- ensuring that the specifications and standards for the NLIS are adhered to" (Andersen Consulting 1991).

In May 1988, NLIS was declared a transversal system by the then Commission for Administration, with the then Chief Directorate: Surveys and Land Information (now Chief Directorate: National Geospatial Information) of the Department of Public Works and Land Affairs as the secretariat for the CCNLIS (Andersen Consulting 1991). Effectively, this meant that the CCNLIS was responsible for coordinating GIS and related activities in government departments. In practice, its primary focus was on coordinating the capture of aerial photography. The CCNLIS was chaired by the Chief Surveyor General within the Department of Agriculture, Rural Development and Land Reform (DARD & LR) (Cooper 1993).

Founded in 1975, the National Programme for Remote Sensing (NPRS) was one of several National Programmes of the Foundation for Research Development (FRD) that funded scientific and engineering research in South Africa during the 1980s. During 1989, with the re-organisation of the FRD, all the National Programmes were phased out, and the FRD introduced new Special Programmes (Arndt 1988). The National Programmes provided a framework for proposals for research projects in specific fields. In April 1986, the CSIR and the Chief Directorate of Surveying and Mapping (CDSM) (now Chief Directorate: National Geospatial Information) proposed developing a national standard for the exchange of digital geographically referenced information, funded mainly by the NPRS. This resulted in the South African standard for the exchange of digital geographically referenced information, known as the National Exchange Standard (NES) (Clarke et al. 1987, Standards Committee 1991).

5.3.5 Available Resources

During this period, resources were extremely limited and expensive, partially because widespread use of computers only started, but also due to sanctions being imposed on South Africa during the apartheid era.

5.3.6 Outcomes

The National Topographic Information System (NTIS) was developed between 1986 and 1997 by the Chief Directorate: Surveys and Mapping (CDSM). First, maps were scanned, and vectorised, next, geospatial data was structured and populated into a geographic information system. In June 1988, a locally developed GIS software product, called ReGIS, was acquired for this endeavour (Vorster 2003). ReGIS could store non-spatial data in industry standard relational database management systems. In 1994, data from a 'continuous digital database',

captured and maintained with ReGIS, was used in the production of an illustrated atlas of Southern Africa (Reader's Digest 1994).

5.3.7   Role of Municipalities

The Durban Corporation (now called eThekwini Metropolitan Municipality in the Kwa-Zulu Natal province) was probably the first South African municipality to acquire a GIS in the early 1980s. Several municipalities followed during the 1980s, such as Cape Town, Johannesburg, Randburg, Sandton, Midrand and Pretoria.

5.4   SASDI and the Role of Municipalities from 1994 to 2000

5.4.1   International Context

First generation, product-based SDIs tended to be led by data producers and national mapping agencies, focusing on data production, database creation, and centralization. Data was a key driver of product-based SDIs (Rajabifard et al. 2006).

Two international, technical standards bodies were established in 1994, the Technical Committee of the International Organization for Standardization, ISO/TC 211, Geographic information/Geomatics, and the Open Geospatial Consortium (OGC). They have collaborated closely on many standards and related matters. During the early years, important groundwork was laid, so that by the early 2000s the first versions of technical standards were published, including the first metadata standard (ISO 19115:2003), ISO 19139:2007, ISO 19111:2003 and ISO 19101:2002. South Africa, and Africa as a whole, has had very limited participation in the OGC, primarily because of the cost of membership.

5.4.2   Vision and Objectives

The vision to establish the National Spatial Information Framework (NSIF) as a Sub-directorate in the Department of Land Affairs came from the National Mapping Agency in 1999. The NSIF was aimed specifically at establishing an SDI in South Africa. During those start-up years, the NSIF quickly built up a team of young professionals and progress was made on drafting the SDI Act and meetings were held with the nascent Committee for Spatial Information (CSI) and its subcommittees. These were not statutory committees but were rather created from those available and interested. The members of these committees were drawn largely from the public sector but included some participants from the private sector.

5.4.3 Legal Framework

The most important legislation passed during this period was The Constitution of the Republic of South Africa (South African Government 1996). This provided the framework for the Promotion of Access to Information Act (PAIA) (South African Government 2000), which changed dramatically the availability of geospatial data from the three spheres of government, which could now be obtained for free or for a nominal cost. Initially, this caused significant problems for the departments and municipalities with a deluge of requests for data, but this settled down quickly as they streamlined their processes. A key part of this was making datasets available online, though it would be some years before the available bandwidth was sufficient to download even moderately sized datasets. During this period, work began on drafting the SDI Act (South African Government 2003a).

5.4.4 Operations

In 1999, SC71E, Geographic information (now SABS/TC 211), the local mirror committee for ISO/TC 211 was established. South Africa was a member of ISO/TC 211 from the start (ISO/TC 211, 1994), but it was only in 1998 that the first South African participated in an ISO/TC 211 Plenary (in Beijing, China). From 2000 onwards, several South Africans took leadership positions in ISO/TC 211.

5.4.5 Available Resources

Apart from the spatial data discovery facility (SDDF), there was not anything available to help institutions to implement SDI.

5.4.6 Outcomes

The SDDF was established by the NSIF and populated with metadata files, mainly by users outside of government.

5.4.7 Role of Municipalities

From 1994 onwards, major changes were made to the administrative structures across the whole of South Africa, with four provinces and the former homelands (four being nominally independent) being merged and split into nine provinces. Municipalities were also combined in various ways (and sometimes split, because of politics). Consequently, municipalities' primary concerns were over the complexities of merging their different corporate systems (including GISs) and processes, rather than on SDIs.

5.5 SASDI AND THE ROLE OF MUNICIPALITIES FROM 2001 TO 2009

5.5.1 International Context

Since 2000, Western governments started moving away from a market perspective on governance. Concepts such as 'trust' and 'transparency', which are characteristic of the network approach also gained importance (Sjoukema et al. 2017). This led to the 'open government' concept in which the freedom of information was deemed important to ensure accountability, trust and public participation towards facilitating the democratic process (Sjoukema et al. 2017). In Europe, this led to Directive 2003/98/EC on the re-use of public sector information followed by the INSPIRE Directive in 2007, which established an SDI for Europe (European Parliament 2007, 2013).

During this period, around 2004, it became possible to edit and update information on the Web, commonly referred to as Web 2.0, and which resulted in user- generated content, volunteered geographic information and crowdsourcing (Coetzee 2018). Web 2.0 spawned virtual communities or virtual social networks, whose members shared data - with each other and with the public (Cooper et al. 2011). Users, specifically non-professionals, could now play a much more active role, evident from initiatives such as Wikimapia (www.wikimapia.org) and OpenStreetMap (www.openstreetmap.org), which emerged during this period. Siebritz et al. (2012) assessed the volunteer contributions to OpenStreetMap between 2006 and 2011 for different settlement areas in South Africa and concluded that the contributions are strongly correlated to the geographic location – densely populated areas received more contributions than less populated areas. Moreover, at the time, there were no clear trends of increased user contributions over the years.

Web 2.0 led to an increase not only of geospatial data volumes, but also of diversity in geospatial data. For the first time, location-based data produced by anyone on social media platforms, such as Twitter and Facebook, could be mapped and analysed. This new diversity created challenges (e.g. heterogeneous data models) and opportunities (e.g. additional kinds of data) for map production.

Second generation process-based SDIs took advantage of the capabilities of the Internet and the World Wide Web. The focus shifted from data in itself to creating an infrastructure and facilitating information access, e.g. through Web services, so that data can be used. Data sharing drives the process-based SDI, facilitating reuse of data collected by a wide range of organizations for a variety of purposes (Rajabifard et al. 2006).

The The Committee on Development Information (CODI), later renamed to the Committee on Development Information, Science and Technology (CODIST), hosted by the United Nations Economic Commission for Africa. CODIST aimed to "advise on the building, maintenance and dissemination of regional development databases, including textual and spatial databases,

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and assist in strengthening the capacity of member States to improve their national information systems". The subcommittee on geoinformation focus on this specifically. South Africa participated in several sessions and meetings (United Nations Economic Commission for Africa 2003, Cooper 2009).

A final international development of interest is the formation of the Global spatial data infrastructure (GSDI) Association in 2004 (GSDI 2015b). It had organizational members (academic and research institutions, government agencies, commercial companies, not-for-profit organizations, and national or regional associations) and individual members (professionals and students). The GSDI was involved in capacity building, e.g. by hosting workshops, seminars and training opportunities, and funding GSDI projects and the GSDI Small Grants Program. A few grants were awarded to projects related to the South African SDI (GSDI 2015a).

5.5.2   Vision and Objectives

SDI legislation was enacted early in this period, with the objective to 'establish the South African spatial data infrastructure, the Committee for Spatial Information and an electronic metadata catalogue; to provide for the determination of standards and prescriptions with regard to the facilitation the sharing of spatial information; to provide for the capture and publishing of metadata and the avoidance of duplication of such capture' (South African Government 2003a). This presented a shift from voluntary participation to a legislative approach to SDI implementation (Clarke 2011).

The predecessor of the statutory Committee for Spatial Information (CSI) had the same name but was an Inter-Governmental Committee with the aim to, amongst others, 'eliminate overlapping and duplication of the collection and capturing of geographical Information' (Committee for Spatial Information 2003). The objectives of the Act extended this aim to include standards and a metadata catalogue.

5.5.3   Legal Framework

Coetzee & Cooper (2008) noted that in the period from 1998 to 2004: "the national mapping organisation, a major supplier of geospatial information, obtained approval for a policy shift in the pricing model for geospatial information". Information products were provided at the cost of supplying such products. This led do significantly increased use of geospatial information and many private sector opportunities for providing value-added services.

The NSIF initiated the SDI Act (South African Government 2003a), however, by then the NSIF was in decline and lost most of its staff over an 18-month period (Harvey et al. 2012). Apart from passing the SDI Act into law in early 2004 and drafting regulations in support of the Act, the South African SDI effectively came to a standstill. The online metadata catalogue was still operational, but users were not contributing any metadata records to the catalogue (Smit et al. 2009).

5.5.4 Operations

The Inter-Governmental CSI had three subcommittees (Committee for Spatial Information, 2003):

- The Policies subcommittee developed policies for promoting access to and sharing of geospatial information, covering issues such as pricing, data custodianship and information sharing.

- The Liaison subcommittee was tasked with communicating CSI activities to all spheres of government.

- The Technical subcommittee focused on development and implementation of standards and tools, development of product specifications and undertaking national projects.

According to Clarke (2011), implementation of the SDI Act after its enactment was slow. For example, the CSI, tasked with facilitating SASDI implementation and advising the Minister accordingly, was not established. As a result, very little progress was made with SASDI, the metadata catalogue, standards, etc. A geoportal was developed but not maintained, metadata was scarce. One of the reasons for this was the NSIF losing most of its staff.

Even though officially little happened in this period, SDI-like activities could be observed and led to several outputs (Harvey et al. 2012). For example, the National Department of Agriculture, together with all nine provincial departments dealing with Agriculture and the Agricultural Research Council developed the Agricultural Geo-referenced Information System (AGIS) (AGIS 2011). The Earth Observation unit of the South African National Space Agency (SANSA) at Hartebeeshoek had been receiving, processing and archiving satellite imagery for many years, and the imagery was available through an online catalogue. In April 2007, the first multi-government license for SPOT 5 imagery was put into place, a first anywhere in the world. Through this, ortho-rectified and mosaicked images were accessible to anyone in government, universities and schools in South Africa (CSIR 2008).

By the end of the first decade of the 21st century, SDI activities in South Africa resembled different generations of SDIs. SANSA's top-down approach of providing satellite imagery to the whole country is typical of first-generation product-based SDIs in the 1990s. AGIS (2011) put the focus on users and problem-solving, as seen in second generation process-based SDIs. In contrast, Smit et al. (2009) states that the City of Cape Town Metropolitan Municipality (CoCT) within the Western Cape adopted a user-driven bottom-up approach to data sharing. However, the study defines 'users' to be the departments within the municipality, and not any other institutions or the general public. The CoCT and other municipalities appointed private sector companies to maintain national datasets for streets, cadastre and addresses, based on various types of bi-directional data sharing agreements with municipalities (Smit et al. 2009,

Sebake & Coetzee 2013).

5.5.5 Available Resources

There was not anything available to help institutions to implement SDI, e.g. catalogue, training, standards. The standards development process was facilitated by the South African Bureau of Standards (SABS), who also provided financial support for South African representatives to attend international ISO/TC 211 meetings. A research project by the National Research Foundation provided some financial support for the SANS 1883 project leader, but other than that, there was no financial support for the development of standards.

5.5.6 Outcomes

In 2001, Gavin (2001) reported that an 'operational metadatabase', the SDDF, contained nearly 3,000 metadata records about public and private sector datasets covering the SADC region. In July 2003, the proposed layout of a new metadata capturing tool was presented to the CSI Technical subcommittee who provided feedback. The tool was based on the newly published ISO 19115:2003 metadata standard (CSI Technical Subcommittee 2003), however there is no evidence that the new layout was implemented during this period.

SANS 1877:2004, A standard land-cover classification scheme for remote-sensing applications in South Africa, provides the three-level hierarchical classification used for the 1994/5 National Land Cover (NLC94) database (Thompson 1996), NLC2000 (Verhulp & Denner 2014) and other projects. The classification was designed to conform to that used for the AFRICOVER project of the Food and Agriculture Organisation citeThompson1996, which subsequently spawned ISO 19144-2:2012, Geographic information – Classification systems - Part 2: Land Cover Meta Language (LCML).

In 2003, SC71E initiated a project to develop a South African National Standard as a standard framework for South African addresses with the aim of facilitating interoperability of address data. Development of the standard commenced in 2006, attracting wide participation from private and public sector organizations (Coetzee & Cooper 2007), including several municipalities. In 2009, two parts of the addressing standard were published (SANS 1883-1:2009 and SANS 1883- 3:2009).

5.5.7 Role of Municipalities

Section 5 of the SDI Act establishes the CSI. Provision for municipal influence is provided for through the members representing the national department of Provincial and Local Government and two local municipalities (South Africa, 2003). Other stakeholders who may indirectly represent the interests of the local sphere are the South African Local Government Association

(SALGA) and the national Department of Cooperative Governance and Traditional Affairs (CoGTA). In principle, the legislation allowed municipalities to be represented on the CSI, but no CSI members were appointed until 2010.

5.6 SASDI AND THE ROLE OF MUNICIPALITIES SINCE 2010

5.6.1 International Context

Third generation SDIs, which emerged during this period introduced the concept of governance and more specifically, decentralised governance. Despite the growing importance of SDI governance, Coetzee & Wolff-Piggott (2015) note the paucity of literature on this topic. It may be that during the last decade, countries have still been navigating the transition from a data management to a data governance approach, which requires a significant paradigm shift. In the Netherlands and Flanders however, considerable research has been presented on SDI governance systems and coordination approaches (Crompvoets, Bouckaert, Vancauwenberghe, Orshoven, Janssen, Dumortier, Dessers, Hootegem, Geudens, Macharis & Plastria 2008, Geudens et al. 2009, Macharis & Crompvoets 2014, Sjoukema et al. 2017, 2020, 2021), motivating that SDI governance should align with the principles and concepts of public governance. Furthermore, some of these and others have argued that well-functioning SDIs can contribute to a system of 'good governance' (Jacoby et al. 2002, Craglia & Johnston 2004, Crompvoets, Bouckaert, Vancauwenberghe, Orshoven, Janssen, Dumortier, Dessers, Hootegem, Geudens, Macharis & Plastria 2008, Crompvoets et al. 2018), which is built on principles such as transparency, equity, and participation (Iftimoaei 2015) – principles that are common to third-generation SDIs.

Another trend with third-generation SDIs, is the integration of SDI into wider government programmes, such as eGovernance. This practice was adopted in the context of INSPIRE and has been included in NSDI strategies of member states such as the Czech Republic (Vandenbroucke 2011). NSDI has also been embedded into the eGovernance in Europe through registers (Rajabifard et al. 2010, Čada & Janečka 2016, Coetzee et al. 2019, Coetzee 2018). A register is a digital authoritative dataset that can be accessed by all, centrally.

Within the African continent an important initiative was established in 2014, the United Nations Initiative on Global Geospatial Information Management in Africa (UN-GGIM: Africa), following the decision taken by the Committee on Development Information, Science and Technology (CODIST-III) in March 2013. The aim is to identify relevant geospatial information management issues, initiate actions and discussions, and contribute to the direction of the UN-GGIM (UN-GGIM-Africa 2016). The regional Committee, which is one of five such regional committees reports to the global United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), established in 2011. Within the African initiative, several working groups and expert groups work on geospatial information management.

The UN-GGIM: Africa used to cooperate with the GSDI (McKee 1996, UN-GGIM-Africa 2016). This cooperative relationship was seen as vital, since the GSDI had put great effort toward SDI development in Africa. In 2018, the GSDI was dissolved and its remaining resources handed over to the UN-GGIM with the intention that the UN-GGIM would continue to carry out the vision and mission of the GSDI (GSDI 2018).

Further to the work by the UN-GGIM and the regional committees, a decision was taken in 2017 that the UN-GGIM and the World Bank would collaborate on the development of the Integrated Geospatial Information Framework (IGIF). The purpose of the Framework is to strengthen geospatial capacity and development within UN member countries (UN-GGIM 2018a). The Framework, which is to be implemented at the national level goes beyond the traditional concept of NSDI and is motivated by the lack of awareness of geospatial information management and its vital role in contributing to national development (UN-GGIM 2018a). However, not disregarding the role of existing, enabling information systems such as national SDIs, but rather enhancing its capabilities through integration with intergovernmental aspects that lead to more sustainable geospatial information management (UN-GGIM 2018a). The Framework has three parts, two of which are already available (UN-GGIM 2018b). Part one provides the overarching strategic framework and part two is the implementation guide – the aim is to provide practical guidelines that make implementation easier for UN member countries (UN-GGIM 2018a). During the process of developing the parts, all UN member countries were invited to comment on the documents. South Africa participated in this. Part three, which is still under development, will provide the country-level action plan.

5.6.2   Vision and Objectives

The CSI was legislated in 2003 when the SDI Act was passed, but 2010 marks the year when the first statutory CSI was inaugurated. At the CSI inauguration meeting, the Statistician-General highlighted that the newly elected CSI would have to focus on providing outcomes-based strategies for resource mobilisation where the end goal is improved service delivery - rather than supporting individual, competing organisational agendas (Lehohla 2010). Following the event, VanZwieten (2010) provided a strong narrative on the need for the CSI to provide a strategy to ensure successful SASDI implementation, essentially calling for coordination and collaboration amongst stakeholders.

The 2010 CSI presented its vision as: 'to provide an implementation framework to ensure availability, access to and utilization of accurate, relevant, authoritative and comprehensive sources of geospatial information on interventions, support, progress, or lack thereof in the achievement of government outcomes' (NSIF 2010). The same document outlines the three-part mission for the CSI, which comprises a partnership framework for the acquisition and provision of data, a policy implementation framework and a technology implementation framework. As per the evolutionary trend of SDI generations, this type of vision-mission encapsulates a first generation, product-based SDI approach (Rajabifard et al. 2006).

The SASDI vision, which is, 'appropriate choice is made by all stakeholders in the development process and everyday life through the effective use of meaningful geospatial information for the benefit of all humankind and the environment' (Clarke 2011), aligns with the product-based SDI approach. Stakeholders are categorized as end users of geospatial data; thus, the focus is on providing access to the data. In other words, the SASDI belongs to national government who hold the decision-making power regarding development and implementation, while end- users do not have an influence over the final products they require (i.e. hierarchical coordination).

The documentation around this start-up period for the CSI provides the goals and planned activities, but the purpose of the SASDI was not clearly understood by all stakeholders and it is apparent that much planning and strategic thinking was still required (NSIF 2010, Cooper et al. 2010). The vision contained in the CSI documents was product-based, but at the same time this and other CSI discussion documents emphasize a coordination and facilitation role for the SASDI, which leans more toward the process-based SDI (i.e. second-generation SDI), where the linkages between stakeholders and the data are important (Rajabifard et al. 2002, Hennig & Belgiu 2011).

5.6.3   Legal Framework

By the time the CSI had been appointed, the SDI Amendment Bill (i.e. the Bill to amend the existing SDI Act) was already on the CSI's agenda. Based on the archived CSI meeting documents, there is a general understanding that the SDI Act was lacking, but the details of this are not provided in the documentation. In 2012, however, the CSI was requested to remove the SDI Amendment Bill from the parliamentary review process, as a strategic plan for the SASDI had to be drafted first. A 2014 country report compiled by the DARD &LR (then the Department of Rural Development and Land Reform or DRD & LR) - presented at the 48th meeting of the Regional Centre for Mapping of Resources for Development (RCMRD) - states that the Spatial Data Infrastructure Amendment Bill had been approved by the Minister for submission to the Cabinet (Department of Rural Development and Land Reform 2014). The report mentions the main amendments, which include updated definitions and penalties for non-compliance. In 2019, stakeholders were invited to a workshop to review the proposed SDI Amendment Bill. During the workshop stakeholders highlighted many issues with the SDI Amendment Bill, which included the absence of a strategic plan. Also, the introduction of punitive measures for non-compliance of data custodians was not received well, especially since organisations had expressed their need for capacity building.

Though initial work for the SASDI strategy, the South African Geospatial Information Management Strategy (SAGIMS) had started in 2010, the 2014 parliamentary decision on the SDI Amendment Bill propelled the work on the strategy. Three commissions (capacity building, technology and data) were tasked by the CSI to undertake the necessary research for developing the strategy. The archived documentation shows that much time and effort was committed to the research.

However, in 2014, the work on the strategy came to an abrupt halt because the term of the CSI had ended, and a new CSI was only appointed in 2016. For a period of almost two years, SASDI was without a coordinating body. To date, no further work on the strategy has been undertaken, even though it is included in the CSI's programme of work.

Despite the 2014 recommendation to first establish a strategic plan, the Regulations (subordinate legislation) in terms of the SDI Act, the two policies (Base Data Set Custodianship Policy and the Policy on Pricing of Spatial Information Products and Services) and the Compliance Guidelines (first mentioned in 2013 CSI minutes) were developed. The two policies were passed in 2015. The 2017 CSI meeting minutes mentions the development of two other policies, but these policies were not published. Nationwide workshops were held in 2016, where stakeholders were invited to give their comments on the Regulations. However, these Regulations have not been passed and as a result the Compliance Guidelines have not been adopted, which means neither can be enforced.

5.6.4   Operations

In terms of the CSI composition, the respective organisational categories and affiliations are contained in the Act and the Minister responsible for Land Affairs (now DARD &LR) elects the final committee members. As per the SDI Act, the committee serves for a period of three years and is responsible for advising the Minister on all matters related to the SASDI (South African Government 2003a). The first committee appointment in 2010 had their term extended to 2014. The CSI terms of reference was compiled in 2011 and was not changed in subsequent terms. The next committee was appointed in 2016 and again the term was extended to the end of November 2020. At the time of writing, the process for appointing the committee is still underway.

In 2010, the statutory CSI introduced a new subcommittee structure, from three to six subcommittees, which is in place since then. Each subcommittee operates according to its terms of reference and programme of work, compiled by the subcommittee and approved by the CSI. Generally, the subcommittees advise the CSI on the development and implementation of the SASDI, which is based on research, member expertise and stakeholder engagement. All final decisions regarding the SASDI are made by the CSI. Around 2010, there was a CSI proposal to establish another subcommittee that would be solely responsible for monitoring the SASDI. The subcommittee would 'consist of external stakeholders and will conduct audits and speaks about data strategy in terms of data interoperability and integration' (Cooper et al. 2010). However, this subcommittee was never established, instead individual subcommittees are tasked with providing quarterly reports on their progress as per their programme of work. The six subcommittees are:

- Data;
- Technical systems;
- Policy and legislation;

- Education and training;
- Marketing;
- Standards

The SDI Act Regulations makes provision for a secretariat, responsible for administrative and secretarial support to the CSI. Since the Act was passed, NSIF has fulfilled this role and has provided a liaison person for each of the six subcommittees. According to the Act, other stakeholders, such as representatives of public entities and academia, should be represented on the CSI and may also form part of the subcommittees. In 2010, the CSI recommended that the private sector should have the opportunity to participate in the SASDI. This recommendation was supported by industry bodies (GISSA 2010, VanZwieten 2010). It was proposed that agreements with the private sector could be put in place to allow for such interaction (Cooper et al. 2010) or through forums (GISSA 2010). However, as it stands, the Act does not extend to the private sector and no formal mechanisms exist within the SASDI to allow the influence from the private sector.

In terms of participation in international SDI initiatives, the Minister of DARD &LR (then DRD & LR) advised the CSI in 2010, to 'form partnerships with regional and global bodies to eradicate poverty' (Gwanya 2010). Before the dissolution of the GSDI, South Africa was one of the participating countries. Since the UN-GGIM: Africa was established, South Africa has been participating on the working groups and expert groups, for example, as convener of the working group on Fundamental Datasets and Standards. Through this participation, the Data Subcommittee of the CSI has adopted the list of global fundamental geospatial data themes, which was developed by the Working Group on Global Fundamental Geospatial Data Themes (UN-GGIM 2019b). Prior to this, the subcommittee had provided a South African list of fundamental geospatial data themes, later fundamental geospatial datasets were identified for each. In 2020, the subcommittee undertook the process to align the South African data themes with the UN-GGIM adopted themes.

5.6.5 Available Resources

After the collapse of the SDDF in the late 2000's, the NSIF outsourced the metadata cataloguing service to the South African Environmental Observation Network (SAEON) in 2015. The Electronic Metadata Catalogue (EMC) was made publicly available that same year. It provided an online platform for organisations to submit their metadata in one of the three CSI approved metadata standards. According to the Act, all organs of state are obliged to submit their metadata to this system, but the EMC was open to all data providers (South African Government 2003a). The purpose of the EMC was to facilitate the findability of public geospatial data to all users from a central place. Though the online application for submitting metadata was simple, the metadata standards required for compliant metadata was new to most organisations. Through the Subcommittee for Education and Training, various training workshops on metadata capture and online publishing were offered to organisations responsible for certain geospatial datasets. The training mainly targeted national departments, only a few municipalities were

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invited to attend. All training material and guideline documents were made available through the SASDI portal, also hosted by SAEON. Despite the training workshops, very few organisations successfully submitted their metadata records. There were various reasons: technical problems (such as firewalls), organisations struggling to implement sustainable metadata business processes, difficulty in understanding geographic standards and a lack of support, following the workshops. In 2018, the contract with SAEON expired and no subsequent metadata system was developed or implemented.

Around 2014-15, the DARD & LR undertook to develop the SASDI website. The intention of the website was to create SDI awareness and make all related documentation available to the public (e.g. legislation, policies, CSI decisions etc.). The Data Capture Project Register (DCPR) was included in the SASDI website. As its name suggests, the DCPR was intended to be a register of public data capture projects, providing users with information on the data they can expect in future and creating transparency amongst data providers to avoid duplicate data capture. Due to lacking technical skills and inadequate hosting infrastructure, the website only became available in 2020 (Department of Agriculture Rural Development and Land Reform 2019).

During this period, SABS continued to provide financial support for South African representatives to attend ISO/TC 211 meetings.

5.6.6 Outcomes

The work on geographic information standards by the SABS/TC211 continued and a number of locally developed standards were published:

- SANS 1878-1:2011, South African spatial metadata standard Part 1: Core metadata profile;
- SANS 1880:2014, South African geospatial data dictionary (SAGDaD) and its application;
- SANS 1876:2018, Rules for unique feature identifiers in South African geospatial datasets; and
- SANS 1883-2:2018, Geographic information - Addresses Part 2: Addresses data exchange, based on ISO 19160-1:2015.

The Data Subcommittee published a list of fundamental geospatial data themes in 2016-17 and thereafter the fundamental geospatial datasets for each theme. Since publishing the list of datasets, the subcommittee has been appointing national departments as data custodians for each dataset, as required by the SDI Act and Base Data Set Custodianship Policy. The purpose of appointing custodians is firstly to ensure that the organisations capture, maintain and provide access to those datasets for which they are responsible and secondly, to let users know the authoritativeness of the datasets.

Lastly, members from the Education and Training Subcommittee collaborated with academia and industry bodies to publish papers on SASDI education related topics.

5.6.7   Role of Municipalities

When the first statutory CSI was appointed in 2010, one representative from the Ehlanzeni District Municipality (representing rural municipalities) and one representative from Mogalakwena Municipality (representing urban municipalities) were elected (Department of Rural Development and Land Reform 2010). While the Act allows the appointment of alternate members, none were appointed for municipal representation in the first term. By 2011 the representative for urban municipalities had withdrawn from the CSI (Department of Rural Development and Land Reform 2011). The representative from the Ehlanzeni Municipality was elected again in 2016 as a member of the CSI and a representative from the City of Johannesburg (CoJ) was elected to represent a data custodian under section 5(2)(j) of the SDI Act (Department of Rural Development and Land Reform 2016). Municipalities were also asked to participate on the subcommittees. Other than through the membership on the CSI and the subcommittees, there is no governance structure which outlines the role of the local sphere within SASDI, and no governance instruments (such as policies or frameworks) that allows for the bottom-up influence from the local sphere.

5.7   Summary and Discussion

5.7.1   Analysis of Municipal SASDI Participation

From our review, it is apparent that municipalities have had limited involvement in SASDI over the last four decades. In Siebritz et al. (2021) we provide a table summarising the SASDI activities for the last four decades. There have been at most, four municipal representatives on the CSI and several municipalities have participated in the subcommittees with the participation becoming wider in recent years. This is problematic since participating members are expected to represent the interests of and make decisions on behalf of the 278 municipalities in the country. From our experience, there is no diffusion to municipalities that are not participating in the SASDI. This adds to the existing inter-governmental relations issue in South Africa. However, simply increasing the representation will not be sufficient because there is a disjuncture between SASDI and the functioning of municipalities: municipalities are aligned with specific national objectives, realised through respective legislation, but SASDI has no strategic or implementation plan to address national objectives. As such, SASDI still resembles a first-generation SDI.

Though municipalities themselves have a responsibility to take up the legislative and policy requirements of SASDI, from what we have observed, municipalities believe that the principles of SASDI are necessary for effective data management and thus organisational functioning (Siebritz et al. 2021). Because SASDI awareness in the local sphere has remained low over the years, municipalities do not necessarily associate the principles of data sharing, avoiding

duplicate data capture and making data accessible with an SDI and therefore the mechanisms available through SASDI to enable those principles, are not well-known to them. For example, while some municipalities advocate for standardised metadata capture using their own internal standards, which may assist their internal record keeping and data distribution mechanisms, many other municipalities do not include standardised metadata capture in their data models. SASDI on the other hand, requires metadata that is captured according to national standards to allow for increased accessibility and widespread interoperability, but the implementation of national standards is not straightforward, and stakeholders require extensive capacity building in this regard. In this case, data custodians from national departments were prioritised for the SASDI metadata training workshops (Siebritz et al. 2021). The SASDI requirements for municipal compliance are stringent and it is done without the SASDI being able to articulate the benefits to municipalities. Without understanding the potential benefits, municipalities are not likely to take up the SASDI. On several occasions municipalities have emphasized that the support and drive from senior management is critical for improved data management whereby their internal departments all participate in a coordinated system.

However, the problem is greater than awareness, the problem lies in the SASDI governance. The very things that should define and shape the SASDI governance have been lacking. The SASDI vision has been unclear, does not respond to any specific national objectives and has not been reviewed since it was first established. There has been no strategic plan to map out the intended development trajectory and no implementation plan which distinguishes the various role players and how they are expected to interact. In the case of municipalities, there are no clearly defined roles for SASDI participation and no mechanism that allow for bottom-up influence, without which it becomes impossible for national government to adequately respond to the needs of the local sphere. This translates to poorly defined indicators, which do not support or measure the principles of SASDI i.e. access to data, sharing data, no duplicate data capture. Without these mechanisms to measure and monitor the usefulness of SASDI in responding to user needs, how will the SASDI, as a complex system be able to adapt to the changing environment (Siebritz et al. 2021)?

5.7.2 Framework for Municipal SDI Implementation

We used the results of our review together with the feedback from the stakeholder engagement undertaken for the Municipal Capacity Building Project (Siebritz et al. 2021), to address the SASDI governance challenges. To this end, we have proposed a SASDI governance structure based on the hierarchical SDI model introduced by Rajabifard et al. (2006), where SDIs are implemented at each government administrative level (in our case, for each government sphere), by leveraging existing resources. An important aspect of this hierarchical model is that the SDIs need to be inter-linked, i.e. horizontal relationships exist between organisations within the same sphere and vertical relationships exist between organisations from different spheres. These linkages between SDIs establish formal lines of communication and enable alignment between spheres and interorganisational collaboration, reducing opportunities for SDIs to operate as

silos and, thereby inculcating an SDI culture (Siebritz et al. 2021).

SDIs for the three different spheres will be different because the mandates for each sphere is different. In South Africa, municipalities are seen as the primary data producers, provincial government is required to coordinate and support municipal activities and national departments are required to be more strategic in their role to support provincial and local government. Even so, the foundations (or basic components) of the SDI model may be applied to all spheres, therefore it is possible to superimpose a generic SDI implementation framework for each sphere, while the responsibility to provide details on SDI implementation remains with the organisations. For our generic framework, as shown in Figure 5.1, we have proposed a tiered SDI implementation approach, which was adapted from the Ordnance Survey Maturity Assessment (van Loenen & Van Rij 2008, Ordnance Survey 2021) to suit the South African context (Siebritz et al. 2021). We coined our framework the Geospatial Empowerment Matrix or GEM (Siebritz et al. 2021). For each of the SDIs within the GEM (i.e. hierarchical of SDIs), tiers are defined, where each tier represents the level of SDI implementation (i.e. columns in Figure 5.1) and moving from one tier to the next means that the organisation has improved on their SDI implementation. On the left side of Figure 5.1 (i.e. the rows), we list the components that are required to implement an SDI model in an organisation.
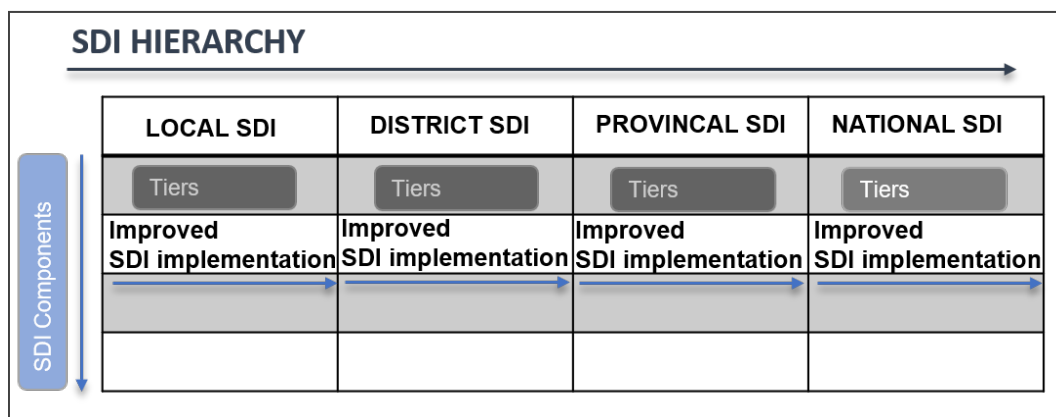
Figure 5.1: Overview of Geospatial Empowerment Matrix Figure

Figure 5.2 shows an extract of the framework for local SDI implementation for the 'policy' component. At the lowest level (Tier 1) we assume that there is no SDI awareness and implementation and therefore data management happens in and 'ad hoc' way. At the next level (Tier 2) the municipality has taken steps to implement systematic data management practices, for example they have aligned their day-to-day activities to the organisational objectives to some degree. At the third tier (Tier 3), the municipality has implemented an SDI model, an SDI strategy has been developed and has largely been implemented. Finally, at Tier 4, the municipality has put measures and indicators in place to monitor the effectiveness of their SDI in organisational functioning. We apply the tiers to each of the SDI components, which in the end provides a good idea of the overall status of SDI implementation within the organisation. This generic tiered approach takes the organisations' data challenges, resource availability and

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their context (e.g. geographic location and extent) into consideration. Furthermore, because all spheres are included in the GEM, it allows for clearly defined roles but the relationships between the spheres are dynamic because the organisations decide on the details of their interactions. Lastly, the GEM provides the practical steps to implement an SDI.

An example how this model may be applied, is in the context of the South African National Biodiversity Institute (SANBI), who has the mandate for a sustainable South African environment. The SANBI has developed an online Biodiversity GIS that provides free access to the relevant data (see: https://bgis.sanbi.org), for which they require municipal data. The current practice is to engage each of 278 municipalities directly regarding their biodiversity data (F Daniels, 2020, personal communication, 19 March 2020). The GEM can greatly assist them with effective inter-governmental structures for more sustainable methods of engagement, leading to reliable audits.

TIERED LOCAL SDI IMPLEMENTATION

Indicator	Tier 1: Ad Hoc	Tier 2: Systematic	Tier 3: Implement SDI	Tier 4: Monitor SDI
Common understanding of SDI?	No	Some understanding	Well accepted understanding of SDI value - operational level	SDI is supported at all levels of organisation
SDI policy or strategy?	None	In process of development	Operational/ Administrative policy	Council approved & supported policy
Policy monitoring	N/A	Operational/ Administrative level reporting	Council reporting	SDI identified & managed as a KPA of senior manager; scheduled periodic review of this policy
Policy been institutionalised by means of budget, governance structures etc.	N/A	In process of development	Some resources allocated to implement policy	Most departments or teams are aligned to this policy

Improved SDI implementation →

SDI Components / Component 2 / Policy

Figure 5.2: Extract of local SDI implementation framework

5.8 Conclusions

In this article we inspected the role of municipalities in SASDI over four periods. We undertook a longitudinal study, reviewing various aspects of the SASDI for each of the four periods and then analysed the municipal involvement in SASDI during the time. It was important for us to contextualise the trajectory of the SASDI in terms of international SDI trends. In doing so, we were able to characterise the coordination mechanisms used and identify the factors which have impeded its progress and more specifically municipal participation.

Since its inception, only a small number of municipalities were involved in SASDI, either as CSI members or through participation in the various subcommittees responsible for advising the CSI on SASDI development and implementation. However, for various reasons, such as the inadequate municipal representation on the CSI and the lack of SASDI mechanisms to allow for bottom-up influences, this has not offered much assistance to municipalities in their management of geospatial information and ultimately their service delivery. Unless there is a strategic change of direction, e.g., by SASDI focusing on facilitating the coordination mechanisms so that municipal data needs can be supported by the other vital stakeholders like the NMA, nothing is bound to change. At the crux of it, an efficient SDI is completely reliant on the designated people and organisations fulfilling their responsibilities, which requires integrity, transparency and accountability, etc. (i.e. good governance).

Using the results of our study and the stakeholder feedback from the Municipal Capacity Building Project, we have proposed a hierarchical governance framework for SDI capacity building and implementation for each sphere of government. The framework promotes and facilitates alignment of the SDIs between the various spheres and aids intergovernmental relations. The framework is generic, providing organisations with a practical guide to implement SDI in phases (i.e. a tired approach). In this way organisations can decide on the details of their SDI that is suitable for their context (e.g. drivers, resources, existing business process etc.).

The review presented in this article showed that to date municipalities had been involved only marginally in SASDI, and therefore SASDI could not impact the functioning of municipalities. If SASDI changed to focus on the needs of municipalities, it could greatly improve service delivery in the local sphere of government.

Chapter 6

EVALUATING STAKEHOLDER INFLUENCES ON THE LAND USE APPLICATION PROCESS IN SOUTH AFRICA - RESULTS FROM AN ANALYSIS OF THE LEGAL FRAMEWORK

This chapter was published as an article in the the journal, Land Use Policy (Siebritz & Coetzee 2022). It contributes to the third research objective:

> to understand and identify the shortcomings of the governance structure and business processes for the municipal land use application process in South Africa

In this chapter the first phase of the analysis, an explorative, statutory study was undertaken to determine the influence of the various stakeholders on the municipal land use application process. The roles and responsibilities of stakeholders were derived directly from the legislation that applies to spatial planning and land use management in the local sphere.

This part of the analysis provided: 1. the rules that govern the municipal land use application process, which was later compared to the interview responses during the analysis of the interviews (refer to Sections 3.4.1.1 and 7.9), 2. contributed to the interpretive validity the interview analysis (refer to Section 3.5.2.3) and 3. insight into the alignment of SPLUMA and the SDI Act (refer to Section 6.5). It therefore contributes to the third research objective to understand and identify the shortcomings of the governance structure and business processes for the municipal land use application process in South Africa.

Abstract

The fact that geospatial data is a vital international and national resource is gaining increased acceptance worldwide. However, proper management of fundamental geospatial datasets, like land use, determines how well this resource can serve the goals of sustainable development, e.g. achieving inclusive and sustainable urbanization through informed decisions based on up-to-date land use data. Land use data describes the rights to utilize land in accordance with the legal zoning thereof. Allocation of land use rights must align with and give effect to national, provincial and local spatial plans, which means multiple stakeholders are involved in land use regulation. The purpose of this study was to identify and classify the network of stakeholders involved in the land use application process, which results in allocated land use rights. This was done by analysing the South African legal framework for spatial planning and land use management, and to evaluate their a priori influence on this process and on land use data. The results of the stakeholder network analysis can guide the identification of (a) suitable custodian(s) for this fundamental geospatial dataset in the context of the South African Spatial Data Infrastructure (SASDI). Within the SASDI, custodianship is used to ensure availability of good quality geospatial data to empower governments in their planning and decision-making. The average influence of each stakeholder, and as a result their impact on the land use data, was determined based on a classification of roles and responsibilities in the land use application process. The average influence was computed for each sphere of government. The provincial sphere had the highest influence, even though the local sphere has the mandate to allocate land use rights. The national sphere is mainly responsible for strategic direction and implementation support and thus had a significantly lower influence. Based on the results, shared custodianship of land use data in South Africa is recommended among a legislative custodian, coordinating custodians and data custodians. Further research will involve stakeholder representatives to verify the results and to establish multi-stakeholder custodianship roles and responsibilities.

6.1   Introduction

Land is one the most important national assets, especially in countries like South Africa where land was previously used to give effect to discriminatory practices, such as racial segregation. That being the case, land reform is high on the agenda of the South African National Development Plan (National Planning Commission 2010). The fair allocation of land use rights is the implementation level of those policies on land reform. Municipalities regulate land use rights and municipal land use decisions have a direct impact on the environmental, social and economic development of a municipality's area of jurisdiction. Oppositely, how and where land use is allocated determines the resources a municipality requires to provide adequate services to the public.Land is one the most important national assets, especially in countries like South Africa where land was previously used to give effect to discriminatory practices, such as racial segregation. That being the case, land reform is high on the agenda of the South African National Development Plan (National Planning Commission 2010). The fair allocation of land use rights is the implementation level of those policies on land reform. Municipalities regulate

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land use rights and municipal land use decisions have a direct impact on the environmental, social and economic development of a municipality's area of jurisdiction. Oppositely, how and where land use is allocated determines the resources a municipality requires to provide adequate services to the public.

Land use allocation must also be purpose-driven, which means land use regulation must exist within a long-term strategic plan where the requirements for geospatial land use data are put into context and adequately planned for. The proposed National Spatial Development Framework (NSDF), as given in section 13 of the Spatial Planning and Land use Management (SPLUM) Act No. 16 of 2013, provides a long-term strategy for coordinating spatial planning, land development and land use management (Department of Rural Development and Land Reform & Department of Planning Monitoring and Evaluation 2018). In the NSDF, the need for geospatial land use data for future planning is implicit, but clear. On the topic of rapid urbanisation, for instance, it states that better and active planning of land use allocation is needed, as it has a direct impact on public service delivery. Such planning requires up-to-date land use data. As a result, there has been increased awareness over the years of how land use data and more importantly, the management thereof, directly affects the well-being of humans and the environment (UN-GGIM 2019a).

In 2017, the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) established the minimum list of global fundamental geospatial data themes and National spatial data infrastructures (NSDIs) were identified as the vehicle for implementing the UN-GGIM themes (UN-GGIM 2018a). As the name suggests, the fundamental geospatial themes specify the minimum data required to address national and international objectives for sustainable planning. NSDIs have been adopted by most countries as multifaceted structures for the effective and efficient management of its spatial data resources and support sustainable planning and development. Globally, land use was identified as one of the fundamental geospatial data themes and is defined as "the current and future planned management, and modification of the natural environment for different human purposes or economic activities" (UN-GGIM 2019a). Land use data is vital for sustainable development and the achievement of the United Nations Sustainable Development Goals (SDGs) (UN-GGIM 2018a), such as SDG 15, Life on Land, which aims to address the impacts of land degradation, drought and desertification (United Nations Development Programme 2018). There are other SDGs where the necessity for land use data is less obvious, but vital, such as SDG 13, Climate Action: geospatial land use data may inform how climate change has affected the usability of land, alternatively, land use planning must consider the current and future consequences of climate change on the environment.

In South Africa, those spatial data infrastructure (SDI) geospatial themes and datasets that have been identified as fundamental, are currently being aligned to the UN-GGIM global fundamental geospatial data themes to promote interoperability. Land use was also identified as a national theme for the South African SDI (SASDI). The SASDI must support all governmental strategies,

programmes and objectives that relate to or require geospatial data, such as the NSDF. Land use data, within the context of the SASDI, has always referred to (though not formally defined) the mapping of land use as it exists on the ground, through automated spatial analysis techniques such as photogrammetry and remote sensing (School of Social Work 2022), which is different from the geospatial datasets derived from the manual capturing of land use rights for a particular property. The latter is the subject for this paper. Though both are equally important, not enough emphasis is placed on the availability and accessibility of land use rights data, without abbreviations are available which municipalities in South Africa cannot function. Accurate information about what the land is legally designated to be used for is vital for municipal revenue regulation and generation.

The South African process for allocating land use rights forms part of a complex Spatial Planning and Land Use Management (SPLUM) system. Within the SPLUM system, the formal process of mapping land use rights is established (i.e. what the property is legally zoned for); however, since the system was only introduced in 2013, there are a few things that must be noted in the context of municipal land use management. Firstly, there is still a process of transition from previous land use systems. Secondly, municipalities may capture both the legal use of land and the de facto use of the land (i.e. what the land is being used for, irrespective of its legal zoning), since the two are not always the same. Thirdly, for the spatial planning aspect, municipalities are also required to map the intended use of land in their Spatial Development Frameworks (SDFs). According to the SPLUM system, the legal land use must align with the planned use of the land. This paper refers only to the legal process for capturing land use rights, in which multiple stakeholders participate. The geospatial land use data derived from this process is thus a product of multiple stakeholder contributions (Sustainable Planning Solutions 2013). The main objective of this paper is to determine how the various stakeholders influence the land use application process so that custodianship can be recommended for the land use rights data.

The SASDI is legislated by the Spatial Data Infrastructure Act No. 54 of 2003 and is established on the principles of data sharing, data accessibility and no duplication in the capturing of public geospatial information (South African Government 2003a). To ensure that public, fundamental geospatial data are of good quality, authoritative and continuously accessible to all users, the coordinating body of the SASDI appoints custodians for each fundamental dataset, guided by sector-specific legislation. In South Africa, a data custodian is "an organ of state; or an independent contractor or person engaged in the exercise of a public power or performance of a public function, which captures, maintains, manages, integrates, distributes or uses spatial information" (Committee for Spatial Information 2015). However, no custodian has been appointed for land use yet. The complexities around its multi-stakeholder nature make it difficult to identify a custodian based on legislation only. Additionally, a SASDI multi-stakeholder collaboration framework does not yet exist. The purpose of such a framework would be to provide legal, organisational and productive cooperation structures that link stakeholders who participate in a common goal (Dessers et al. 2010). Without such a framework, a chain of negative implications emerges, starting with an undefined inter-organisational goal and

adding to that, competing organisational goals of those participating in the collaboration (Pouloudi & Whitley 1997, Pouloudi 1999, Reed et al. 2009, Dania et al. 2019). An undefined inter-organisational goal leads to duplicated efforts due to unstructured information flow and communication paths; data interoperability problems because of the lack of geospatial data standards, leading to less authoritative data being available for decision-making and planning; and difficulty in monitoring and measuring the success of a collaboration. SDIs were introduced to tackle these types of problems that contribute, amongst others, to the mismanagement of national data resources (Rajabifard et al. 2002, 2004).

The work presented in this paper [chapter] is part of the first phase of a research project to identify appropriate instruments for establishing institutional arrangements needed for SASDI stakeholder collaboration. The process for allocating land use rights is the case study for this research. For the first phase, of which the results are reported here, the stakeholders in the land use application process were identified, classified and their relationships analysed as per the legal framework for SPLUM. Based on this, each stakeholder's influence on the process and on the land use data was evaluated. During the second phase, we will undertake semi-structured interviews with stakeholder representatives to establish criteria for allocating multi-stakeholder custodianship roles and responsibilities for fundamental geospatial data. Finally, a stakeholder collaboration framework, based on institutional arrangements between stakeholders, will be proposed based on the results of the first two phases.

This paper [chapter] is structured as follows: Section 6.2 gives the background and context to spatial planning in South Africa, a review of the SASDI and the role and purpose of SASDI custodians and it also presents a review of the literature on stakeholder theory from the management perspective. The methodology for the stakeholder analysis and the results are summarised in Section 6.3 with the discussion of the results in Section 6.4. Conclusions are presented in Section 6.5.

6.2   Background and Context

6.2.1   National spatial planning in South Africa

South Africa has a long and complex national spatial planning history. The negative impacts of this history on the landscape are vast and evident. In the previous political dispensation, spatial planning was the mechanism used to geographically segregate areas for the various racial groups. Many years later, unjust spatial patterns and the results thereof are still seen across the country, despite the numerous spatial planning reform strategies, plans and instruments that have been presented over the last two decades (Coleman 2018). Currently, the landscape comprises a variety of settlement types (such as rural, urban, informal, small town, villages and scattered) and thus, different land tenure systems, including informal or customary systems (South African Ministry for Provincial Affairs and Constitutional Development 1998). Various pieces of legislation were used to drive the Apartheid ideology of racial discrimination and the

spatial planning legislation played a significant role in this.

Prior to the era of land reform, during the years of Apartheid, spatial planning was driven by the regulatory function of land use zoning (Van Wyk & Oranje 2014). This control function gave the state the authority to maintain racially segregated areas as intended by the Apartheid ideology. Areas allocated to white people were purposely zoned to prioritise economic and social development (Denoon-Stevens 2016). Property prices in these areas remained high, forcing minority groups with low income to remain in areas of low or even no economic and social development (Nel 2016a). During this period, municipalities had little influence over land use allocation; the authority vested with the state (Van Wyk & Oranje 2014).

Post-Apartheid, the Constitution of the Republic of South Africa Act No.108 of 1996 was the first piece of legislation that aimed to address every area of injustice resulting from the past regime. The Constitution establishes the Government of the Republic as constituting three distinct spheres: National, Provincial and Local. Though distinct, the three spheres are interrelated and interdependent and thus have a direct mandate to operate under the banner of cooperative governance (South African Government 1996, Oranje & van Huyssteen 2007). Regarding the management and development of land, the Constitution defines the local sphere of government, i.e. municipalities, as covering the whole territory of the Republic (South African Government 1996). The entire country is demarcated by 278 contiguous municipal boundaries (Department of Local Government 2020) – requiring spatial development planning for every part of the country (Coleman 2018). Through the objects of local government in section 152 of the Constitution, municipalities are given executive authority over their functions. Municipal functions are further expounded in subsequent transformative legislation, e.g. the Local Government Municipal Structures Act No. 117 of 1998 (South African Government 1998b) and the Local Government: Municipal Systems Act No. 32 of 2000 (South African Government 1998b). Of specific interest to this research are the powers and functions of the local sphere regarding the allocation of land use rights, which up until the adoption of the SPLUM Act in 2013, were unclear. In the two decades leading up to the adoption of the SPLUM Act, that is post-Apartheid, various pieces of disparate legislation governed spatial planning and land use regulation (Laubscher et al. 2016).

The SPLUM Act provides a national framework of legislation for spatial planning and land use management for all three governmental spheres (Laubscher et al. 2016). As a result, some of the previous Acts pertaining to spatial planning were repealed, partly repealed or amended to align with the requirements set out in the Constitution and the SPLUM Act. The intention of the SPLUM Act was not only to bring uniformity and clarity, but also to give the local sphere the authority to allocate land use rights (Coleman 2018, De Visser & Poswa 2019). In the context of South Africa's political history, this decentralisation of authority is a significant shift because it allows those who are the most knowledgeable about community needs to respond appropriately. It allows municipalities to make land use decisions based on their planning needs and minimises the political influence on those decisions.

Another point worth noting is municipalities' need to strictly comply with their legislated responsibilities (Glasser & Wright 2020, User Needs Analysis Working Group 2021, Siebritz et al. 2021, 2022). This is mainly because their resources are limited and they cannot afford to undertake any other tasks that they are not strictly required to do (User Needs Analysis Working Group 2020b). Therefore, if we want to understand why a municipality operates in a certain way, a study of the pertinent legislation provides a good starting point, as we have done in this paper.

As may be interpreted from the SPLUM Act, spatial planning has two dimensions, (i) strategic or proactive planning, which provides development tools for future planning; and (ii) statutory or regulatory planning, which is the lawful control of land use types and development applications in terms of a land use scheme (Laubscher et al. 2016). The SPLUM Act aims to provide the relationship between the two dimensions (South African Government 2013). Municipal Spatial Development Plans (MSDFs), first introduced in the Municipal Systems Act, are the instruments used to carry forward the vision and strategy of spatial planning from the local perspective (De Visser & Poswa 2019). The SPLUM Act further prescribes that each sphere of government must provide SDFs for their jurisdiction and that the SDFs from different spheres must be aligned (South African Government 2013).

This research deals with one aspect of regulatory planning, the land use application process. Under (1) of chapter 1 of the Act, municipalities are given the role of controlling and regulating "the use of land within the municipal area where the nature, scale and intensity of the land use do not affect the provincial planning mandate of provincial government or the national interest" (South African Government 2013). The national and provincial spheres are empowered to play a strategic role and offer support to municipalities in terms of SPLUM (South African Government 2013).

Though land use allocation is a function of municipalities, the interrelated, interdependent nature of SPLUM requires cooperation between the spheres and sectors of government (South African Government 2013, Van Wyk & Oranje 2014). The need for a well-functioning public administration is provided for in the five normative principles, namely spatial justice, spatial sustainability, efficiency, spatial resilience and good administration, upon which the SPLUM Act is established (South African Government 2013, Van Wyk & Oranje 2014). The principles of 'efficiency' and 'good administration' relate more specifically to the public administrative system required for allocating land use rights and managing stakeholder influences and are therefore relevant to this study. The two principles may be summarised as: efficient, streamlined, timeous land use procedures for decision-making; and an integrated approach to land use and development application processes that are transparent and allow for sufficient public participation. A brief discussion of the principles follows.

6.2.1.1 Land use decision-making

Van Wyk & Oranje (2014) aim to determine whether the spatial planning system, as set out in the SPLUM Act and the Bill of Rights enshrined within the Constitution are mutually beneficial. They provide an in-depth discussion of the various aspects that both pieces of legislation address, including public administrative decision-making and participation of all stakeholders in the municipal spatial planning processes. The land use application process comprises a chain of stakeholder decisions and they conclude that both the Constitution and the SPLUM Act prescribe good administration to allow for effective decision-making. In terms of the spatial planning system though (i.e. through SDFs), a decision, as defined in the Constitution, is not legally binding (Van Wyk & Oranje 2014). However, land use application decisions are protected by the Constitution and are thus legally binding, meaning that the administrative processes can be enforced (De Visser & Poswa 2019). For this reason, municipalities are obliged to comply with their respective MSDFs and may only deviate from their MSDF if properly justified (South African Government 2013, Johnstone 2019). Compliance with provincial and national SDFs is less compelling for municipalities (De Visser & Poswa 2019). This disjuncture may present an opportunity for misalignment of spatial planning visions and political influencing, but further investigation is required to understand this dynamic.

Municipalities are required to establish by-laws to effect good administration (South African Government 1996, De Visser & Poswa 2019). Municipal by-laws are intended to provide the details of, in this case, administrative processes for land use allocation that must comply with the Constitution, as well as with national and provincial spatial planning laws (De Visser & Poswa 2019). As emphasized by De Visser & Poswa (2019), the SPLUM Act provides a legislative framework for municipal land use by-laws.

6.2.1.2 Integrated approach

Because the land use application process involves several stakeholders, the SPLUM Act calls for an integrated approach by those involved. The Act makes provision for decisions from other sectors of government that may be affected by a land use decision. In this regard, the Act allows for land use approval processes to be combined (South African Government 2013). However as De Visser & Poswa (2019) demonstrate through by-law case studies, municipalities have not been eager to integrate their processes with stakeholders from other spheres and sectors. The findings by Van Wyk & Oranje (2014) may provide some understanding – the authors state that the measures to enable cooperation and collaboration between the spheres of government are "sorely lacking" and may have a detrimental effect on the spatial planning system. Despite these realities, municipalities are still required to coordinate stakeholder approval processes for land use applications. This research aims to contribute to the above concern.

6.2.1.3   Public participation

A very important part of a democratic society is provision for public participation in state matters. In section 152 of the Constitution, public participation is enabled through engagement with municipal processes. Further to this, details on public participation in spatial planning and land use management (including land use application processes) are limited in the SPLUM Act. Section 7e of the Act simply states that the public are afforded the opportunity to give their inputs to such processes, leaving municipalities with the responsibility to create the mechanisms for transparent processes. Again, municipal by-laws are the appropriate mechanism for clarifying such processes.

In summary, the SPLUM Act principles are commendable in that they provide a holistic, normative guide for addressing the injustices resulting from the past regime (Johnstone 2019). However, implementation of the principles still presents a number of challenges. Pertaining to land use applications, the greatest challenge is probably the integration of stakeholder processes, or "stakeholder influences" as it is termed in this study. The question then arises: why and how does this research assist with managing stakeholder influences in the land use application process? The answer to the first part of the question is simple. The SASDI is defined as the: "national technical, institutional and policy framework to facilitate the capture, management, maintenance, integration, distribution and use of spatial information". In other words, the SASDI governs all public spatial data; meaning that it must also provide the mechanisms and instruments to support organisations with their data management that align with the data governance model. Thus, under the banner of the SASDI, the longer-term and overarching goal is to provide a framework that enables multi-stakeholder collaboration – answering the "how". The first part to providing such a framework is identifying suitable custodianship roles for the land use application process. This paper proposes such roles for land use rights data.

6.2.2   The SDI evolution

SDI has become a universally accepted concept. For at least the last three decades, countries have been working tirelessly to formulate governing structures for their geospatial data, realising that operating without such an infrastructure leads to wasted resources.

Since the concept was first introduced in the late 1990s, there have been three generations of SDIs (Masser 1999), emphasizing a different approach to geospatial data management. First generation SDIs focused on data production and the technical systems required to integrate geospatial data from various sources (Rajabifard et al. 2006). Second generation SDIs shifted from data management to data governance and allocated specific roles and responsibilities to sub-national government, and in many cases the private sector as well, that is, a decentralised SDI (Rajabifard et al. 2006). These two generations of SDIs gave national government full authority over the development and implementation of the SDI. Third generation SDIs have a user-needs focus (Masser 1999, Rajabifard et al. 2004). Users of the geospatial data have influence over the development and implementation of the SDI (Hennig & Belgiu 2011). The

intention of this approach is of course to ensure geospatial data meets user needs optimally.

Originally, the SASDI was initiated in the l980s with the plan of setting up a national central data repository for all public geospatial data. Since this was not possible at the time, what ensued was work on technical standards for integrating geospatial data, as was typical of first generation SDIs (Rajabifard et al. 2002, 2004). However, it was not until 2010 that the first SASDI coordinating body was established, the Committee for Spatial Information (CSI). Much of the SASDI, as it is known today, was established during that period. In the 2011 terms of reference, the CSI set out the strategic objectives of the SASDI, the CSI's role and responsibilities and lastly, it established the six subcommittees to carry out the work and give advice on the development and implementation of the SASDI (Committee for Spatial Information 2011). Fast forward to the present, the SASDI has seen slow institutionalisation, despite the efforts of many. This paper does not focus on the factors that have hampered the progress of the SASDI, but rather it will contribute to the SASDI implementation by proposing a way forward to achieving an enabling infrastructure for government programmes such as SPLUM.

The SASDI requires a vision and strategy. A number of SDI researchers have pointed out the necessity of an SDI vision and strategy and how it has translated into increased SDI institutionalisation (Chan & Whitworth 2003, Singh 2005, Masser 2005). Furthermore, Masser (2009) emphasizes the importance of updating an SDI strategy through continuous review processes. An SDI strategy specifies the governance approach. With the SASDI, even in the absence of a strategy, a hierarchical approach has generally been followed – the infrastructure is owned and driven by national government. The role of sub-national government, the private sector, as well as users, have not been defined or sufficiently engaged with. Part of this lack in strategic direction is the fact that the SDI legislation has not been integrated with other legislation related to geospatial information and public administration for the three spheres of government. The results of this research may be used to inform a strategy for the SASDI.

6.2.3 SASDI custodianship

The Department of Agriculture, Rural Development and Land Reform (DARD & LR) (previously the Department of Rural Development and Land Reform) is responsible for the implementation of the SASDI. Currently, the SDI Act only applies to organs of state (South African Government 2003a). Any organ of state that captures and distributes geospatial information to the Republic is referred to as a data custodian. However, an organ of state that is responsible for capturing a fundamental geospatial dataset must be appointed as a 'base data set custodian' through the CSI. A base dataset is defined as: "those themes of spatial information which have been captured or collected by a data custodian" (Committee for Spatial Information 2015). This definition lacks clarity and is currently under review by the responsible CSI Subcommittee. One of the SASDI policy documents also supports collaborative governance of a fundamental geospatial dataset (Committee for Spatial Information 2015). It states that custodianship may

be shared between custodians, as may be required. Shared custodianship must be coordinated by an organisation appointed as the 'base data set coordinator'. The information on shared custodianship and collaboration is limited within the policy. Though the structures are limited, SASDI uses custodianship as the main mechanism to implement geospatial data governance (Committee for Spatial Information 2015). The current practice within the SASDI is to identify custodians through their legislative mandates, which will always be the starting point in South Africa. However, the network of stakeholders involved with a specific dataset is not considered when a custodian is identified for the governance of that dataset. Without this, there is no clear picture of who has what kind of influence on the datasets. This may lead to poor coordination and duplication of efforts. Siebritz et al. (2021) (see Chapter 4) and Siebritz et al. (2022) (see Chapter 5) show that the lack of a governance structure has impeded the development and implementation of SASDI. This has led to limited stakeholder participation, specifically from the local sphere, which in turn has resulted in uncoordinated data activities, incompatible datasets and difficulty in accessing authoritative data, all of which affect government's ability to deliver services effectively to the public. To strengthen the governance of an SDI, the totality of stakeholder interactions (or network) must be considered; these stakeholder networks are vital for achieving inter-organisational coordination (Sjoukema et al. 2017), which leads to sustainable access to those fundamental geospatial datasets. Stakeholder analysis is a useful instrument to determine the influence of the various role players in a network to develop "effective and sustainable governance frameworks" (Coetzee 2018, Coetzee et al. 2019). Using this motivation, we build on the SASDI custodianship governance by demonstrating that the stakeholders within the network have varying influences on a specific dataset (in this case, the land use rights dataset) and therefore have to form part of the governance structure. Based on our results, we identify potential custodians.

As mentioned earlier, a list of SASDI fundamental dataset themes has been published and the associated geospatial datasets have been identified according to criteria proposed by the same CSI Subcommittee. From the authors' involvement with the implementation of the SASDI, one of the criteria that has been used to identify fundamental datasets is: complete coverage of the area of interest, preferably national coverage, which is important for planning and decision-making at a national level. The land use rights dataset meets the remaining criteria but does not meet the coverage requirement. Geospatial land use rights data is captured at the municipal level, not nationally and in many cases the coverage is not complete for the geographic extent of the municipality. The CSI has therefore not recognized the land use rights data as a fundamental dataset and has not appointed a data custodian, even though municipalities vitally rely on this information for the determination of property rates and taxes and to ensure compliance with their SDFs.

There are two main land tenure systems in South Africa, formal and customary, which are not integrated and thus result in different mapping practices, as well as unmapped land use in some areas (United Nations Economic Commission for Africa 2003, Dubazane & Nel 2016). Because of the inconsistencies in the geospatial land use data, the land use application process will

be analysed. Furthermore, customary land use processes are out of the scope of this research because they are not legislated and therefore not necessarily formally documented in geospatial data. The processes for allocating customary land use may also differ from one municipality to another.

6.2.4 Stakeholder theory

The term stakeholder was originally defined by Freeman (1984) as: "any group or individual that can affect or is affected by the achievement of an organisation's objectives". Pouloudi (1999), in a review of the stakeholder concept and its applicability in information systems development, argues that the original definition by Freeman (1984) places a single organisation at the centre and the stakeholder relationships are interpreted from that perspective. The author thus extends the original definition to accommodate interconnected stakeholders from more than one organisation as: "any individual, group, organization or institution who can affect or be affected by the interorganisational system under study". The adapted definition was used in this study for three reasons. Firstly, it considers the complexity of multidisciplinary stakeholders. Secondly, it supports collaborative stakeholder network theory. Thirdly, it is geared toward information system development, where traditional stakeholder typologies are redefined to empower stakeholders previously considered as less influential.

The significance of these three characteristics is that they are aligned with the characteristics of a 'bottom-up' SDI implementation – a vital consideration for the overarching research objective. Traditional 'top-down' SDIs are described as being hierarchical, bureaucratic and government-controlled (Crompvoets, Bouckaert, Vancauwenberghe, Orshoven, Janssen, Dumortier, Dessers, Hootegem, Geudens, Macharis & Plastria 2008, Coetzee & Wolff-Piggott 2015). 'Bottom-up' SDI implementation, on the other hand, allocates a greater level of importance to sub-national governments (provincial and local) and data users; and consequently they have more influence, i.e. decentralised SDI governance (Masser 2005, Masser & Crompvoets 2015). This governance model necessitates diverse stakeholders and maximisation of those stakeholder relationships (Rajabifard et al. 2006, Budhathoki & Nedovic-Budic 2007). In Belgium, a four-year long project, dedicated to the integration of stakeholders from multiple disciplines, was undertaken to ensure effective and efficient geospatial data management within the SDI context, demonstrating that it is a lengthy and complex process (Crompvoets, Bouckaert, Vancauwenberghe, Orshoven, Janssen, Dumortier, Dessers, Hootegem, Geudens, Macharis & Plastria 2008, Macharis & Crompvoets 2014).

Stakeholder management principles and techniques from the stakeholder theory were originally intended for the private sector but have proven useful in the public sector as well. Both Scholl (2001) and Flak et al. (2008) demonstrate how the theoretical stakeholder management approaches proposed by Donaldson & Preston (1995) can be used for driving complex multi-level government initiatives. Flak et al. (2008) combine the first of the three approaches, the descriptive stakeholder approach with dialectic process theory to identify potential conflicting

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stakeholder interest. Stated simply, the descriptive approach is used to reflect on and describe the relationships between the organisation and its stakeholders (Mclaughlin & Jawahar 2001). Further explanation of the organisation stakeholder relationships, whether past, present of future, may form part of this process (Donaldson & Preston 1995). The second approach, the instrumental approach looks at how the organisation-stakeholder relationship aligns with the vision and mission of the organisation in order to develop or improve methods or strategies used to achieve the organisational objectives (Donaldson & Preston 1995, Jones 1995, Pouloudi 1999). Thirdly, the normative approach considers a broader scope of stakeholders based on ethical reasoning (Jones 1995, Pouloudi 1999, Reed et al. 2009). Though the approaches each have distinct projected outcomes, they may be used in combination. As Reed et al. (2009) and Pouloudi (1999) state, the descriptive approach is generally used as a first step toward either an instrumental or normative goal. This paper presents the descriptive phase that will at a later stage contribute to the overarching normative objective, which is to propose a framework for SASDI stakeholder collaboration.

Stakeholder analyses comprise qualitative and quantitative techniques used in stakeholder management for determining stakeholder interest and influence. Typically, stakeholder influence is determined by the presence or absence of three attributes (Mitchell et al. 1997): (i) "power i.e. the degree to which stakeholder can impose its will in a relationship"; "legitimacy, i.e. degree to which stakeholder is socially accepted" and (iii) "urgency, i.e. degree to which stakeholder is prepared to go to any length to achieve the desired outcomes" (Mitchell et al. 1997). Similar to Coetzee et al. (2019), we did not consider the legitimacy attribute because all stakeholders are determined from legislation. The urgency attribute is difficult to determine without stakeholder engagement, and will therefore be assessed in the next phase of this research. Bourne & Walker (2005) who devised the Stakeholder Circle methodology for visualising stakeholder influence include another attribute, 'proximity', which refers to the level of direct involvement of the stakeholder. With this methodology, each of the three attributes are determined through an agreed upon rating system (i.e. the prioritisation process), where stakeholders are ranked according to their relative importance to the subject under study, at a particular time (Bourne & Walker 2005, Bourne 2009). Essentially, the rating system introduces a method for weighting the attributes (Yang 2014). The influence then may be calculated using the software developed by Bourne or through manual computations, which may be as simple as adding the respective ratings for each stakeholder (Bourne 2009). The methodology by Bourne & Walker (2005) (also see Bourne (2009)) was followed in this study and a manual calculation involving the weighted attributes was used to determine the influence of each stakeholder. It allowed us to present the qualitative analysis, quantitatively. An example is provided in Section 6.3.1.

6.3   Stakeholder Analysis

Prell et al. (2008) provide a three-phased approach for stakeholder analysis, that is, identifying stakeholders, classifying stakeholders and investigating the stakeholder relationships. This

section presents the methodology for identifying and classifying stakeholders in an interorganisational environment and determining their influence on the activities and outcome of the land use application process within land use management in South Africa.

The unit of analysis in this study is the municipal land use application process that results in geospatial land use data. Eventually, such municipal datasets could be aggregated and integrated into provincial datasets and/or a national dataset that meet the SASDI fundamental dataset requirements. Generally, the land use application process is defined as successive, interconnected activities, starting with the submission of a land use application and ending in the mapping of allocated land use rights (adapted from (Dessers et al. 2010)). By analysing how different stakeholders influence this process, it is possible to determine their influence on the land use data, which in turn makes it possible to identify the most suitable custodians. Thus far, the CSI has only appointed custodians as defined in the legislation, i.e. organs o state are responsible for making the geospatial data available. But as this study will show, for complex datasets like land use, more is required. Because the land use data is captured by individual municipalities (i.e. multiple data custodians for the same theme), coordination of those datasets is necessary – a function which does not fall within the municipalities' mandate. However, the coordination function must align with the functions and administrative systems of the spheres, as specified in the legislation. In addition, the DARD & LR is the owner of the SPLUM Act and thus carries the legislative responsibility.

6.3.1   Stakeholder identification and classification

The stakeholders for each of the land use application process activities were identified, primarily from the spatial planning legal framework and supplemented with other secondary sources, such as policy documents, reports, meeting minutes and government websites. The stakeholder level is defined at the formal group level (such as organisations, committees, councils and bodies), except for the applicant, which may be an individual or a group, who submits their application to the municipality. According to the SPLUM Act, municipalities are responsible for processing land use applications and allocating land use rights. This information was used as the starting point for identifying the stakeholders. The land use process activities within municipalities may differ according to their Municipal Category (i.e. category A, B or C) (South African Government, 1996), SPLUM by-laws (South African Government 2013, Coleman 2018), context (e.g. presence of land under customary systems) and resource availability. Nonetheless, the SPLUM Act together with the Local Government Municipal Structures Act No. 117 of 1998 and the Local Government: Municipal Systems Act No. 32 of 2000 establishes the essential stakeholder roles and their associated responsibilities for land use management and the land use application process.

Figure 6.1 depicts the land use application process and the stakeholders associated with each process activity. The three phases shown in Figure 6.1 – the (i) administrative phase, (ii) consideration phase and (iii) decision phase – were taken from the Regulations made in terms of

the SPLUM Act (Department of Rural Development and Land Reform 2015). Included in the process map is the resulting geospatial land use data that is mapped by the municipality. The connections between the stakeholders and process activities were derived from the legislation. As illustrated in the legend, there are three types of connections that are depicted in the process map: (i) stakeholder to stakeholder (black, solid line connections), (ii) stakeholder to land use process activity/ data (black, broken line) and (iii) process activity to process activity/data (bold grey, broken line). The figure shows that the Municipal Planning Tribunal (MPT) and/or a municipal official is appointed by the legislative municipal executive, the Municipal Council, and is responsible for assessing all land use applications and providing the final decisions. The MPT is made up of members from the Municipal Administration and members from the public. Land use applications may be submitted by the public or by the state in the case of state development initiatives.
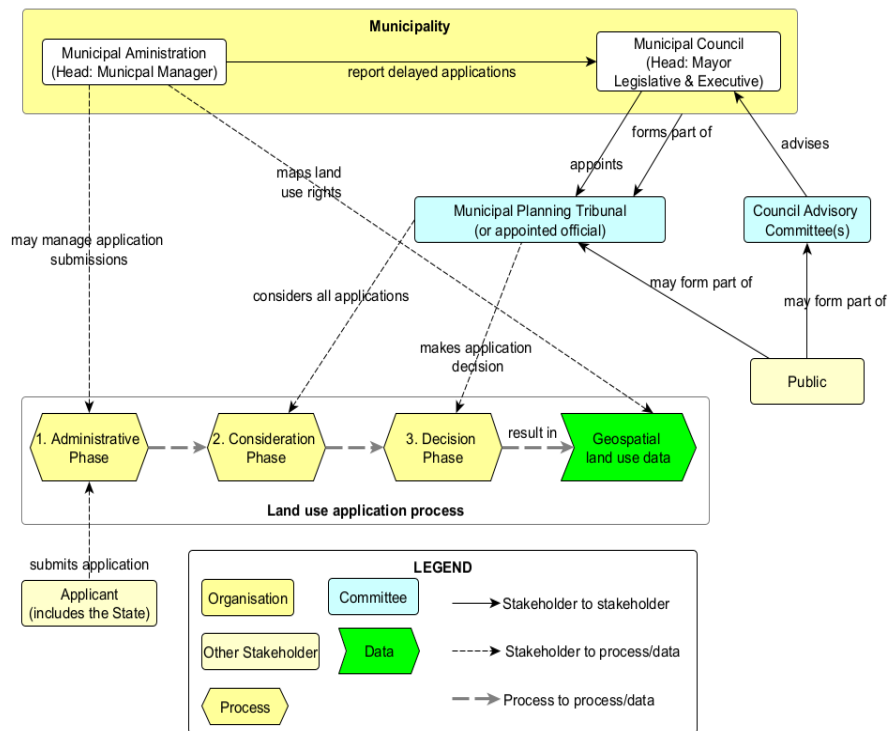
Figure 6.1: Municipal land use application process mapped from SPLUMA regulations

In South Africa, the land use application process is not isolated – the regulation function belongs to the local sphere, but the provincial and national spheres are required to provide strategic direction, monitoring of and support to the local sphere. As is common with the descriptive stakeholder approach, a stakeholder network map was compiled for the land use application process (Flak et al. 2008), illustrated in Figure 6.2. The stakeholders for all three spheres were included in the network map. Other stakeholders included in the network are the applicant, the public and the SASDI CSI so that their influence on the land use application process could also be determined. As with Figure 6.1, stakeholders were connected based on the description of the stakeholder role and responsibilities in relation to the land use application process, as specified

in the legislation. It should be noted that only those stakeholders that are associated with the land use application process are shown in the stakeholder map and not the entire structure of government.
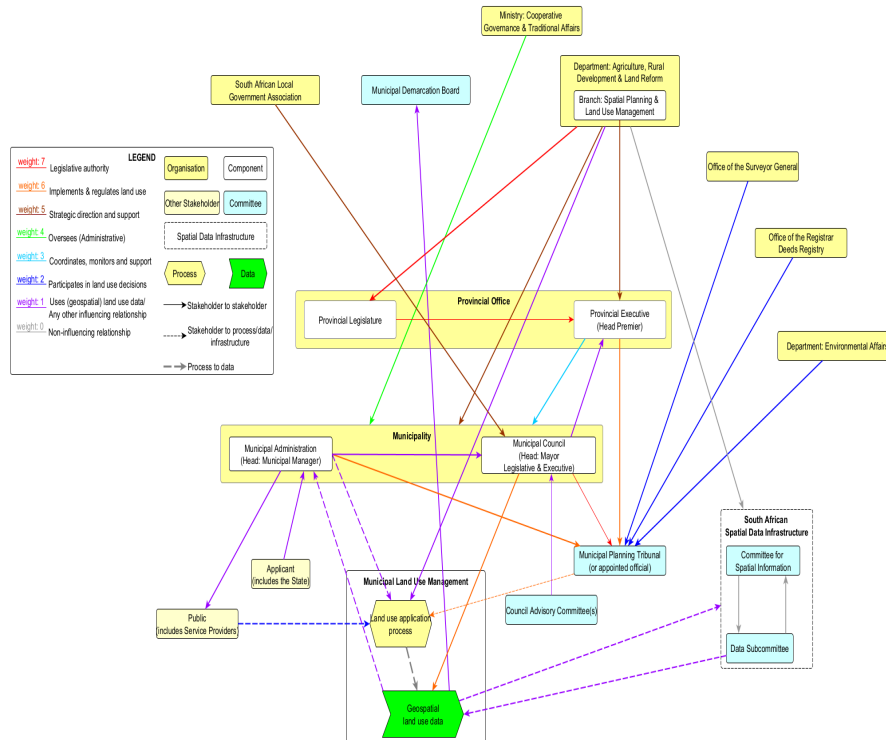
Figure 6.2: Municipal land use application process mapped from SPLUMA regulations

At first, all stakeholder connections were mapped in the same colour; as an example, the connection between the Municipal Demarcation Board (MDB) (committee at national level) and the geospatial land use rights data as captured by the Municipal Administration, is described by section 25 (h) in the Local Government: Municipal Demarcation Act 27 of 1998 (South African Government 1998a) as: "...the Board must, when determining a municipal boundary, take into account- existing and expected land use, social, economic and transport planning;". A summary of that legal description was originally used as the label for the connection between the stakeholder and the data and the direction of the connection (denoted by the arrow head) is from the stakeholder who has the power to influence, as shown in Figure 6.2. In this case, the MDB must comply with the existing and planned land use as given in the land use data, therefore the direction of the connection is from the data to the MDB. In another example from Figure 6.2, the relationship between the Branch: SPLUM (within the DARD & LR) and the Provincial Executive is described as, "may prescribe norms and standards for land use management and land development", which is taken from section 8 (1) of the SPLUM Act. According to these legal descriptions, the Branch: SPLUM has a much greater power to influence the land use application process than the MDB. Therefore, the various stakeholder relationships were assigned weights accordingly, which is described in the next section.

No	Stakeholder Category	Power Level	Proximity Weight
1.	Legislative authority		
2.	Strategic direction and support	7	1
3.	Coordinates, monitors and support	5	3
4.	Oversees (Administrative)	3	5
5.	Implements and regulates land use	4	4
6.	Participates in land use decisions	6	2
7.	Uses (geospatial) land use data	2	6
8.	Any other influence relationship	1	7
9.	Non-influencing relationship	0	15

Table 6.1: Stakeholder classification for the land use application process

The stakeholder responsibilities in the network map were used to create the stakeholder classification shown in Table 6.1. Each category in Table 6.1 was allocated a power level based on the degree to which that category can impose its will on the land use application process (i.e. allocation of stakeholder weights), and therefore any potential changes to the land use data. Definitions for the power levels are presented in Appendix B. All definitions were taken directly from the SPLUM legislation and similar stakeholder responsibilities grouped into the nine categories corresponding. For each category a weight was assigned by the authors, ranking the stakeholders according to their relative importance, resulting in seven power levels (Bourne 2009, Coetzee et al. 2019). The colours were used to distinguish between different power levels. Thus, in the two afore-mentioned examples, the Branch: SPLUM-Provincial Executive relationship, was assigned a greater weight (brown connection with power level 5), compared to the MDB-data relationship (purple connection with power level 1), which has very little power over the land use application process. This process was followed for all stakeholder connections.

The categories, "gives strategic direction and support", "coordinates, monitors and supports", and "oversees (administrative)", were difficult to distinguish, because the terminology between sources was not aligned and the legislative descriptions were vague. To avoid loss of information, three separate categories were created for each of the associated responsibilities. Though there are three categories, it is possible that there is overlap in the stakeholder responsibilities. For each stakeholder connection shown in Figure 6.2, a power level (ranging from 0 to 7, where 0 represents a non-influencing relationship and 7 represents the highest level of influence) was assigned based on the stakeholder classification in Table 6.1, which is represented by the corresponding colours. Because some stakeholders were assigned more than one role, they had more than one connection to other stakeholders and consequently more than one power level was allocated. For readability sake, the labels containing the legal descriptions were removed from Figure 6.2 and only weighted connections shown. The details of the stakeholder relationships are provided in Appendix B.2. It shows the connection direction (i.e. "from" and "to" columns), a summary of the stakeholder's responsibilities for each connection, the level of interest as it pertains to the responsibility (i.e. national, provincial or local) and lastly, the power level. Some stakeholders have more than one connection, indicated by the arrow in the "from" column.

The power per stakeholder was determined by summing the weighted connections from the influencing stakeholder to other stakeholders. Next, a power percentage was computed by normalising the totalled power per stakeholder, following the same method as Coetzee et al. (2018) and Coetzee et al. (2019) in their stakeholder analyses. The normalisation was required because the power and proximity attributes had different ranges and the normalisation enables us to combine the attribute values to obtain an influence percentage. In addition to the power, each stakeholder category was assigned a weighted proximity based on how closely associated the stakeholder category is to the land use application process (see column 4 in Table 6.1). Stakeholders who are closer to the land use application process have a lower proximity than those further away. For each stakeholder, the proximity was determined by summing the shortest connecting path from the stakeholder to the land application process, which results in a change or update to the land use data (Coetzee et al. 2018, 2019). As with the power, a proximity percentage was computed through a normalisation process. As an example, the influence of the Office of the Chief Surveyor General (SGO) was computed as follows. In Figure 6.2 the connecting path from the SGO to the municipal land use application process is: the connection from the SGO to the MPT shown by the dark blue connection and from the MPT to the land use application process, shown by the orange connection. According to the stakeholder categories in Table 6.1, the blue connection has a proximity weight of 6 and the orange connection has a proximity weight of 2, which results in a total weighted proximity of 8 (i.e.: $6 + 2 = 8$) for the SGO, and after normalisation results in 53 % (i.e. the relative proximity, which is: $(8 \div 15) \times 100 = 53\%$). For the power, the dark blue connection is the only connection from the SGO, which according to Table 1 has a power weight of 2 resulting in a normalised power of 14 % (i.e. relative power, which is: $(2 \div 14) \times 100 = 14\%$). Finally, the influence per stakeholder was calculated by averaging the power and the inverse (i.e. $100\% - 53\% = 47\%$) of the proximity. The inverse proximity was used so that higher percentages represent stakeholders that are closer to the process and would thus contribute to a higher influence (Coetzee et al., 2020). In the SGO example, the stakeholder influence would be: $(47\% - 14\%) \div 2 = 30\%$.

6.3.2 Stakeholder influence

Figure 6.3 shows the power percentage (in orange) and inverse proximity percentage (in grey) for each stakeholder of the land use application process. As described above, the power percentage per stakeholder was obtained by summing all the weighted connections from the influencing stakeholder to other stakeholders and the totalled power was normalised. The inverse proximity percentage was obtained by summing the shortest connecting path from the influencing stakeholder to the land use application process, normalising the totalled proximity and then calculating the inverse. The Municipal Council displays the most significant result with the highest power and the second lowest proximity (and thus second highest inverse proximity percentage), resulting in the highest influence (i.e. 90 %). The DARD & LR has the second highest power and a high inverse proximity resulting in the second highest influence (i.e. 76 %). The Cooperative Governance and Traditional Affairs Ministry (CoGTA), the DARD & LR and the Department of Planning, Monitoring and Evaluation (DPME) are collectively responsible

for the implementation of the SPLUM Act, with the DARD & LR being the owner of the Act (Department of Rural Development and Land Reform 2017). Yet, the CoGTA has a low average influence of 14 %. The DPME was excluded from this analysis because no explicit mention of its role in regulatory planning was mentioned in the legislation, only its responsibility toward spatial planning generally. Another interesting result is the relatively high influence level of the Provincial Executive with an influence of 64 % Collectively, the provincial sphere had the highest influence of 64 %. Comparatively, the national sphere had a significantly lower influence of 29 %, while the local sphere had an influence of 53 %. Included in the local sphere's influence is the public, since their engagement is directly with the municipality where they reside. Individually, the influence of the public was 37 %.
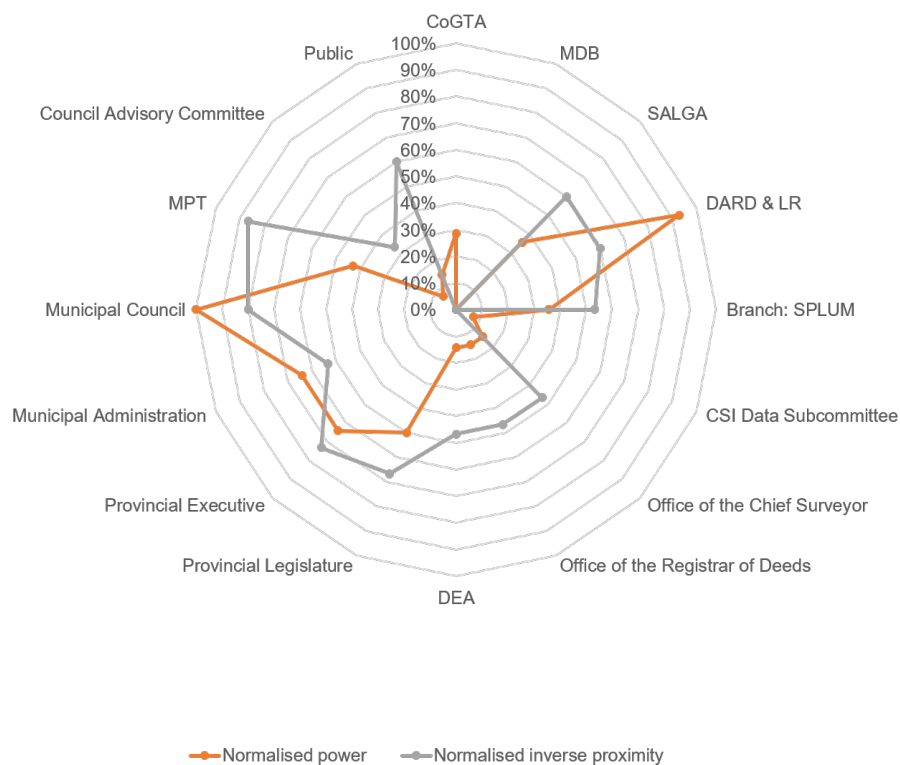
Figure 6.3: Normalized power and normalized inverse proximity of stakeholders in land use application process

6.4   Discussion

The South African spatial planning and land use management legal framework calls for uniformity, intergovernmental cooperation and coordination, and therefore balancing of stakeholder influences. The low level of influence of the national sphere on the land use application process is not a surprising result, since no implementation or land use regulation occurs at this level of

government. What should be of concern at this level is the differences in influence between the DARD & LR, CoGTA and DPME. Though the CoGTA and DPME roles are concerned with the alignment of authorities and monitoring of spatial planning rather than land use allocation, the SPLUM Act emphatically promotes integration of the strategic and regulatory dimensions, which requires a holistic strategic role for the national sphere. From the legislation, it is difficult to distinguish with certainty the roles of national departments and how those roles translate into functions. There were also no connections (horizontal relationships) between the two national departments in the network map (refer to Figure 6.2), and as mentioned before, DPME was not included in the stakeholder analysis because it is not explicitly mentioned in the legislation. The effect of this is echoed in the 2019 report by the Panel on Land Reform and Agriculture, which states that there is misalignment between the aforementioned national departments regarding land and land management decision-making (Mahlati et al. 2019). It also shows the shortcoming of the SASDI practice to appoint custodians based only on explicit mention of mandates in legislation.

To some degree, the vertical relationships between the national and provincial spheres are more distinct. The DARD & LR has the responsibility to provide national legislation, policies, norms and standards and the province must implement these and articulate the requirements to the local sphere. The provincial sphere must also provide province-specific legislation that is compliant with the SPLUM Act and this must also be articulated to the local sphere. The high level of influence of the provincial sphere may be attributed to the legislative power that it possesses. Municipal SPLUM by-laws must align with provincial SPLUM legislation. Adding to that, the provincial sphere has the right to appoint the members of the MPT that allocates all land use rights in instances where the municipality fails to do so. The South African Local Government Association (SALGA) within the CoGTA Ministry has a similar responsibility to articulate national legislation to the local sphere but interacts directly with municipalities. It is difficult to determine from the legislation whether these two legislative functions are aligned. Future research, which will include direct engagement with municipalities, may provide clarity on the roles of these stakeholders.

It is less complex to interpret the roles and responsibilities within a municipality from the legislation. With municipalities having almost complete power over the outcome of a land use application, it was expected that they would have the highest influence, but this was not the case. The connections from the municipality to the remaining spheres were not as obvious to interpret form the legislation. The stakeholder map in Figure 6.2 shows that the connections are mainly from other stakeholders to the municipality, with only a reporting responsibility to the Provincial Executive. This provides evidence that the type of relationships between the local and the provincial and national spheres are still instruction-driven from the top down – possibly accounting for a lower influence at the local sphere than expected. The SPLUM legal framework has introduced the incorporation of a 'bottom-up' influence from the local sphere. A 'bottom-up' influence is not limited to the mandate to allocate land use rights, but the local sphere should be able to influence provincial and national legislation and policies

on land use. Both the provincial and national spheres should have a good understanding of the local sphere (e.g. What are their needs? What business processes are in place? Do they understand the legislative implications of the SPLUM Act?) because legislation and policies are developed and implemented hierarchically. Intentionally, systematic interaction between the three spheres is required and formal mechanisms must be in place to balance legislative authority against implementation authority for a multi-stakeholder system like the case presented in this paper. Furthermore, the local sphere provides a voice for the public through public participation processes. The influence, as shown in this investigation, was low but it may be attributed to the limited detail included in the SPLUM Act. Thus, it is difficult to determine the extent of public participation in the land use application process without studying a municipality's by-laws. This requires further investigation, which will be done through the stakeholder engagement phase of the research.

The 'bottom-up' nature of SPLUM aligns with the 'bottom-up' SDI implementation approach, which means it would be possible to satisfy the end goals of both SPLUM and SASDI with an integrated approach. An integrated approach may also be useful in determining how and when geospatial land use data can be consolidated to cover larger geographic extents. The stakeholder analysis has however shown that the relationship between SPLUM stakeholders and the SASDI is limited and that SASDI does not add any value to the land use application process. This outcome is significant because the success of an SDI relies on its ability to improve the functioning of organisations and their business processes (Dessers et al. 2010). The SASDI commands compliance and standardised, good quality, integrated geospatial land use data from municipalities but does not provide any support to the multiple stakeholders involved in the creation and management of this data. Because there is no support from the SASDI, municipalities that are already under-resourced struggle to provide authoritative geospatial land use data – without which SPLUM cannot function.

6.5 Conclusion

The aim of this research was to evaluate how stakeholders influence the land use application process and the resulting land use data. The results can be used to inform identification and assignment of custodianship of SASDI datasets toward a more inclusive and sustainable SDI governance. The study highlighted the importance of understanding in detail how powers and functions of organs of state in terms of geospatial data provision are assigned in the legislation. It also pointed out the shortcoming of relying only on explicit mandates assigned in legislation. Based on the results of this study, shared custodianship is recommended for the land use application process. A different approach is taken here to what is documented in the SASDI policy documents; instead of simply proposing custodianship for the data only, responsibility is allocated for the entire process that results in geospatial land use data. The DARD & LR is recommended as the legislative custodian, meaning that it is responsible for implementation of and compliance with the SPLUM Act. The respective provincial offices are recommended

to be the coordinating custodians, ensuring that municipal datasets are captured according to the land use schemes, that data capture is not duplicated amongst municipalities and that provision is made for aggregated municipal datasets, as may be needed in future. Thirdly, the respective municipalities are recommended as data custodians, responsible for the production and maintenance of the land use data for their areas of jurisdiction. The legislation provided a good starting point for identifying the stakeholders, but to gain a clearer understanding of the stakeholder relationships in order to verify their actual influence (such as the public's influence) and to verify the custodian roles we recommend that apart from the criteria for custodianship, direct engagement with the stakeholders is required. This will help us to understand how municipalities have implemented the SPLUM Act land use application process and the various internal and external factors that affect this process and its outcomes. Engagement will also make it possible to determine the stakeholder urgency with respect to the process and the data, and to identify de facto stakeholders that are not explicitly mentioned in the legislation.

This paper is part of a larger research project, which aims to propose a way in which multiple stakeholders can collaborate on the maintenance of geospatial datasets like land use. Cooper et al. (2014) emphasized the need for an integrated approach to the implementation of SASDI and SPLUM. Six years later, there is no observable progress in this regard, despite the fact that the DARD & LR is the owner of both pieces of legislation. Cooper et al. (2014) state that inclusion of the broader scope of stakeholders for the implementation of the SASDI is vitally important for the implementation of the SPLUM Act. This research presented an approach that includes a wide range of stakeholders and may even be expanded following a stakeholder engagement process. Secondly, this method has revealed that much work still needs to be done in terms of inter-Departmental and intra-Departmental initiatives, such as the SASDI and SPLUM, if these are to serve the purposes of national and international sustainable planning and development as proposed in the SDI work undertaken by the UN-GGIM (UN-GGIM 2018a). A good starting point for SASDI support is the integration of the SDI Act and the SPLUM Act. The SDI Act has also not been integrated with any other legislation that deals with public administration, information management, information access or information and communications technology (ICT), like e-governance. Future work should consider customary land use processes because these are an important part of SPLUM in South Africa.

Finally, a note on the internal and external validity of this study. The method used in this paper clearly demonstrates how stakeholders with varying levels of influence affect the land use application process. Changing the role and responsibilities of a stakeholder automatically changes the influence they have, demonstrating the internal validity. Several stakeholder classifications have been introduced by other researchers, but the classification used in this study was more suitable for the analysis of stakeholders from the legal perspective. It should also be noted that this classification was purely based on the stakeholder roles described in the legislation, rather than using a predetermined classification, which has a potential for bias toward certain stakeholders. It would be interesting to see if similar results are obtained if a different classification were to be used but also based on the concepts of "power" and "proximity".

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Though all stakeholders of the SPLUM legal framework were included, there are other stakeholders, such as State-owned Enterprises (e.g. the electricity provider, Eskom), who have an indirect influence over the land use application process but are not mentioned in the legislation. This is a limitation of the study, which will be addressed in the stakeholder engagement phase of the study, during which the legal framework will be compared to what happens in practice. Another limitation of this phase of the study is that we cannot determine how the land use application process is affected by internal factors such as organisational structure and culture, resource availability (e.g. data availability, skills, technological systems and budget), organisational policies etc., as well as external factors such as provincial SPLUM legislation, natural disasters, geographic location and extent etc. This information can only be gained through meaningful engagement with a number of stakeholders.

In terms of external validity, the geospatial land use data as described in this paper is unique to South Africa (i.e. mapped land use versus property use rights); however, zoning and land development approval processes that involve multiple stakeholders are not unique to South Africa (Brody 2003, Nel 2016b). This method could also be applied in other countries to reveal the power dynamics of interdependent stakeholders and how the respective legislation either empowers or dis-empowers certain stakeholders, whether in the context of SDI or other areas, such as resource management (Prell et al. 2009).

Chapter 7

RESULTS FROM STAKEHOLDER INTERVIEWS

7.1   Introduction

This chapter presents the findings of the case study, which is the municipal land use application process. It contributes to the third and fourth research objectives:

> to understand and identify the shortcomings of the governance structure and business processes for the municipal land use application process in South Africa; and

> based on the above, propose a collaboration framework for SASDI stakeholders to improve governance of and access to fundamental geospatial datasets.

This was achieved by observing various aspects related to the municipal land use application process, especially the stakeholder interactions and the role of geospatial information in supporting the process. The findings are presented qualitatively first, under themes, referencing both applicable theory and interview quotes to support the researcher's interpretations, and secondly as an indicator assessment (DeCarlo 2018).

The purpose of the assessment framework was to provide a framework (or standard): 1. against which the status of individual municipalities could be assessed and 2. for comparing the municipalities in terms of their implementation of the land use application process and the geospatial data management that supports that process, and the municipality on the whole. Though not presented as the main results, the indicator assessment was valuable in providing a framework to inform the theme discussions. Furthermore, it guided the researcher in determining which indicators should be included in the discussions and which ones to remove, because there were insufficient responses from the participants.

This chapter is structured as follows: firstly, a brief overview on the intergovernmental nature of SPLUMA is provided in Section 7.2. Because the provinces are structured and administered differently, the municipal processes are discussed separately for the Western Cape (see Sections 7.3) and Gauteng (see Sections 7.4). This applies both to the land use application process and the

geospatial data management processes. The land use application process is described for each municipality, based purely on the interviews. What follows, in Section 7.5 is an interpretation of the influence of organisational culture on the land use application process. The municipal geospatial data management is presented similarly: firstly, the descriptions of their processes in Section 7.6 and then an interpretation of their SDI implementation in section 7.7. Thereafter, a comparison of the statutory study (phase one) and the empirical study (phase two) is presented in section 7.9. The full indicator assessment results are available in Appendix L.12.

7.2 The Intergovernmental Nature of SPLUMA

The Constitution as a starting point, establishes the spheres of government and defines the functions and powers of each sphere at a high level, to be further expounded in other pieces of legislation, policies etc. Though distinct, the three spheres are interrelated and interdependent and thus have a direct mandate to operate under the banner of co-operative governance (South African Government 1996, Oranje & van Huyssteen 2007) (also see Section 6.2). Generally speaking, national and provincial government are responsible for monitoring and supporting the local sphere "...by legislative or other measures..." (South African Government 1996) [section 155(6)(a)] in order to "...see to the effective performance by municipalities of their functions..." (South African Government 1996)[section 155(7)]. The most recent report (i.e. 2022 report for the 2019-2020 financial year) by the Auditor-General of South Africa (AGSA) on the financial state of municipalities, emphasises the need for government to operate within an integrated system: "...a municipality does not function in isolation – it is part of a bigger system of government. The Constitution requires national and provincial government to support and strengthen the capacity of local government" (Maluleke 2020, p. 6).

SPLUMA, which provides a national framework legislation for spatial planning and land use management for the three governmental spheres (Laubscher et al. 2016), further enforces this intergovernmental arrangement through the five development principles: 1. spatial justice, 2. spatial sustainability, 3. efficiency, 4. spatial resilience and 5. good administration. In terms of SPLUMA, national and provincial government undertake the strategic role of monitoring and supporting municipalities with meeting the requirements of the Act. Provinces may enact provincial legislation pertaining to spatial planning and land use management, as may be required (South African Government 2013) [Schedule 1]. Municipalities are empowered by SPLUMA to draft by-laws in accordance with the national and the provincial legislation, in which they detail their spatial planning and land use management procedures (South African Government 1996) [section 32]. This refers to local and metropolitan municipalities only. District municipalities play a supportive role to local municipalities and they act as a commenting stakeholder to land use applications.

7.3 Western Cape Government Implementation of SPLUMA

At the time of writing only the Western Cape Government (WCG) out of the nine provinces had passed provincial spatial planning and land use management legislation, the Western Cape Land Use Planning Act, No.3 of 2014 (LUPA). The Act is administered by the provincial DEA & DP. An extract of the 2022 DEA & DP organogram is shown in Figure 7.1 (full version available at: https://www.westerncape.gov.za/eadp/about-us/organogram). Development planning, which is one of the five chief directorates in the department has two functional areas (spatial planning and development management), each of which comprise three directorates. As seen in Figure 7.1, within development planning, each directorate is split into three regions. Each region performs the same function, thus each one has a sub-directorate for Land Use Regulatory Support Services, which provides support to municipalities with the implementation of their land use management systems.
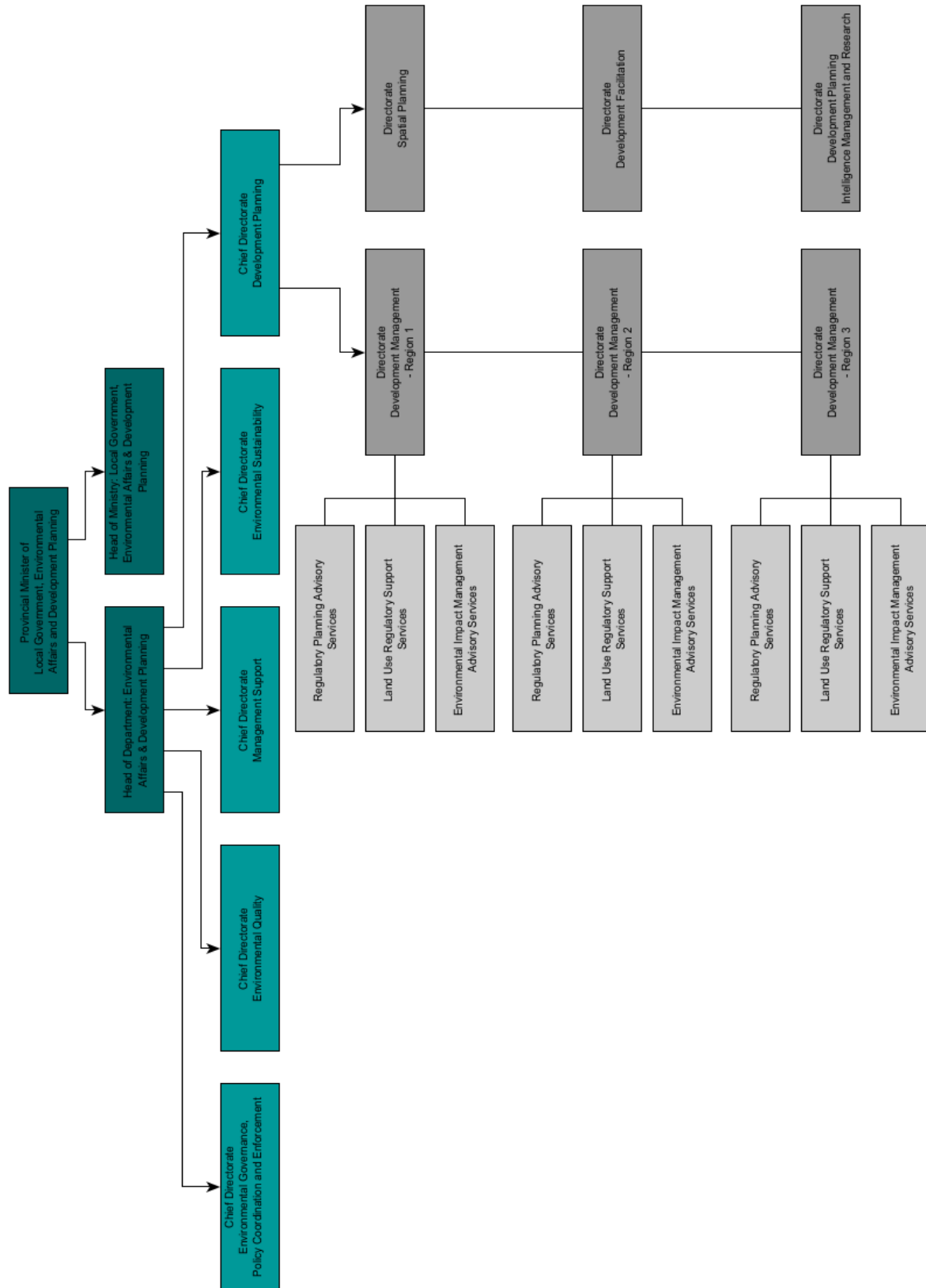
Figure 7.1: Extract of WCG Department of Environmental Affairs and Development Planning organogram

During the semi-formal discussion with representatives from DEA & DP, the representative from one of the directorates for Land Use Regulatory Support Services expressed that their support for municipal land use management has become more systematic as a result of their on-going monitoring of municipalities (Siebritz 2020). No other details were discussed in terms of their support function, however all of the municipal interview participants in the Western Cape expressed the significant support they have received from DEA & DP. Mainly, they mentioned assistance with the adoption of their by-laws. One participant also mentioned the province's Municipal Outreach Program, where they interact with DEA & DP on environmental land use applications to reach final decisions more efficiently (Municipality 5: Participant 1 2021).

7.3.1 Municipalities in the Western Cape

This section provides a brief overview of the categories and the performance of municipalities in the Western Cape province. The province comprises five district municipalities, one metropolitan municipality and 24 local municipalities. The Land Use Regulatory Support Services sub-directorates within the DEA & DP generate periodic reports on the status of municipal land use management, however this information is deemed sensitive and was therefore not made available to the researcher upon request. It may be that they want to protect those municipalities that are struggling or failing at their land use management. This type of information may not be received well by the public, especially those who are not receiving the necessary services from their municipality. The WC: Department of Local Government also prepares periodic reports on the status of various municipal aspects. However, access to these reports were also denied upon request for similar reasons.

The 2022 report by the AGSA was thus reviewed to provide an external perspective on the performance of municipalities. The AGSA reports on the financial activities (such as procurement, financial reporting, control mechanisms etc.), financial status and service delivery (planning and reporting, infrastructure etc.) of the municipalities. It also provides an overview at the provincial level, which includes high-level recommendations to address the problems identified in the report. Of the municipalities interviewed in the Western Cape, all four local municipalities obtained a clean audit report (James-Brent, Styan 2021, Maluleke 2020). The fifth municipality (metropolitan) received a financially unqualified opinion with reference to legislative compliance. The municipality did however receive commendation for having no material misstatements (refers to "errors or omissions that are so significant that they affect the credibility and reliability of the financial statements" (Maluleke 2020, p. 8)) and for their governance processes that have resulted in a good control environment.

There is a definite connection between the financial status and the administration of the municipality. Without the reports on service delivery however, it becomes difficult to pin point what that connection means. In the Western Cape, it may be assumed that good municipal administration has resulted in good financial practices (refer to results for Western Cape municipalities in Section 7.3.2). In Section 6.2, the SPLUMA principles of 'good administration'

and 'efficiency' was summarised as: efficient, streamlined, timeous land use procedures for decision-making; and an integrated approach to land use and development application processes that are transparent and allow for sufficient public participation.

7.3.2   WC: The Municipal Land Use Application Process

The following sections provide the descriptions of the municipal land use application process for each of the Western Cape municipalities that were interviewed. The descriptions are purely based on the interviews (that is, no interpretations by the researcher). In Chapter 6, distinction was made between land use data, which spatially describes what the land us being used for, irrespective of the land administrative system and the land use rights, which results from the legal, municipal land use application process. A further distinction is made here between the zoning and land use rights data. The zoning data spatially describes the general category for which a property may legally be used as per the adopted municipal land use scheme. The land use rights refer to the specific and detailed allowances allocated to an applicant, that correspond with the allocated zoning. An example is provided in Figure 7.2, which shows the zoning (Residential 5) and the allocated land use rights (dwelling unit and residential building). It also provides further details on what rights may be exercised by the owner as shown in row 3. This is only an extract; the complete table provides a number of specifications to the owner on the type of developments allowed (e.g. parking size, building heights etc.). For the discussions that follow, generally the participants refer to the zoning datasets in their responses, because the land use rights data is dealt with by a different department or unit (typically the department or unit that deals with building plans).

Municipality 1 - Category A

In comparison to all the other municipalities that were included in the interview process, both in the Western Cape and Gauteng, Municipality 1 has implemented an advanced electronic land use application system. This system allows the applicant to submit their application electronically via the Internet, and the municipality processes the application in an automated way from start to end, i.e. it provides more capabilities than just an application tracking system. The application system integrates with the municipality's GIS, allowing for amendments to the land use scheme and allocated land use rights to be captured spatially and with ease. At the time of the interview (March 2021) the municipality was planning to upgrade and improve the existing application system.

Municipal departments within Municipality 1 that have a direct interest in a land use application are automatically notified through the application system to assess the application and provide their comments within the specified time-frames. Because the application system utilises the personal system as its base platform, the persons responsible within the respective municipal departments are directly notified of the application, and those persons are held accountable through the performance management system, which is also built into the application system.

Figure 7.2: Extract of example showing zoning and associated land use rights
(City of Tshwane 2021)

Performance criteria is not necessarily managed at the individual level, instead the department responsible for processing land use applications, is monitored according to the procedures set out in the municipal planning by-law (e.g. timeliness).

It is unclear how land use applications are circulated to stakeholders external to the municipality. However, according to the municipal planning by-law of Municipality 1, organs of state who are invited to provide comments on an application should be notified via email. Therefore, it may be assumed that a manual process is undertaken with external stakeholders. The summary of the indicator assessment for Municipality 1 is given in Table 7.1. Similarly, tabular summaries are provided for all municipalities in Appendix L.12.

Municipality 2 - Category B

Applications are processed manually in Municipality 2, whereby the municipal departments that are directly affected by an application are notified via a memorandum and external stakeholders are notified via letters. The municipality has a dedicated unit for the development and implementation of the local SDF. The unit scrutinizes every land use application to ensure compliance with future spatial planning for the municipality. The participant emphasized the alignment of their land use decision-making processes with the prescriptions set out in SPLUMA, LUPA and their municipal by-law:

"From a land use perspective, it is so regulated that one person cannot deviate from or influence a decision, yes it will be your assessment but there's specific criteria that you need to

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SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 1

		Component	Attribute Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	High: fully implemented
	3	Land Use Unit Structure	Category A - high functional task division
	4	Geospatial Data Management	High - medium
Throughput	1	SPLUMA Legislative framework	High
	2	SPLUMA Policy Framework	High
	3	Land Use Unit Structure	High coordination with automated application system
	4	Geospatial Data Management	Hybrid GIS, low outsourcing, internal data standards
	5	Stakeholder Engagement	Unknown coordination, high-medium public participation
Output	1	SPLUMA Legislative Framework	High applicant compliance
	2	Data Distribution Policy	Enabling distribution policy
	3	Geospatial Data Management	High data accessibility, high data usability
	4	Stakeholder Engagement	High: Stakeholder notifications within prescribed time
	5	Financial Systems	Unknown
Internal Influences	1	Organisational Structure & Operations	Medium process-focused, medium support for land use, high performance monitoring
	2	Organisational Culture	High SDI Culture, high municipal urgency for SPLUM
	3	Geospatial Data Governance & Management	High: fully implemented
	4	Budgetary Allocations (for SPLUM implementation)	High: fully implemented
External Influences	1	Intergovernmental relationships	Enabling national, enabling provincial relationship
	2	Geospatial Data Governance & Management	Low access to external data, low external standards available, unknown provincial coordination (data)
	3	Stakeholder Relationships	Unknown stakeholder adherence, unknown public interest
	4	External support (for municipalities)	High external support, medium-low inter-organisational collaboration

Table 7.1: Summary of indicator assessment for Municipality 1

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follow when you do an assessment. There's very little leeway to actually influence." (Municipality 2: Participant 1 2021)[1]

At the time of the interview (March 2021), the municipality had recently acquired an electronic application system, which is managed by a service provider. The system allows all land use decisions to be captured electronically in the land use register. However, the application system is not interoperable with the municipality's GIS, which has resulted in an outdated zoning map. At the time of the interview, the map reflected zoning information up to 2018 and there was no dedicated person to undertake the manual process of updating the zoning map or to maintain the currency of the map.

Municipality 3 - Category B

In Municipality 3 applicants are required to submit their applications in person at the municipality, where an administrative person will capture the application details electronically. As with Municipality 2, the circulation processes, both internally and externally are manual. All recommendations and decisions regarding an application are captured in the land use register that is part of the electronic system. The final decision is also captured spatially on the municipality's GIS through a manual process, once the valuation process has been completed. Although the zoning map is updated daily in the GIS, the process of updating is not simple because the systems are not integrated, as stated by the participant:

"We got a professional to assist them with the register, NeoLMS is our program. It talks to Esri's GIS and updates the zoning maps but it's a process." (Municipality 3: Participant 1 2021)[1]

Municipality 5 - Category B

Municipality 5 was actively involved in the development of LUPA and was considered to be SPLUMA and LUPA compliant by August 2015, two years after SPLUMA was passed. Long before SPLUMA was passed, the municipality had already implemented an electronic application system. The system allows for easy circulation of land use applications to the internal municipal departments that are directly affected; their comments and recommendations are captured on the system. Furthermore, circulation to external stakeholders are done manually, via letters. For some applications, there is significant public participation, however in other instances (i.e. other towns) the public participation is limited, which the participant attributed to the lack of awareness and communication mediums (e.g. people do not own cellphones).

A dedicated person captures the zoning information spatially in the GIS together with other location information, such as coordinates and street names. The participant provided an indication on the efficiency of their land use application process, which is based on their adherence to the SPLUMA time-frames and their achievement of performance targets. Although the participant did not indicate how many applications are typically completed within one

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month, the participant's tone, emphasis and non-verbal cues were interpreted as an achievement. The following quotes are highlighted:

"In January and February, we have almost finalised 40 new land use applications." (Municipality 5: Participant 1 2021)[1]

"We in the municipality understand our role from a planning and building control side, that we must speed up decision making so that it can contribute to the economy on the outside. We create the environment for the economy to grow, if we delay it then everything on the outside is delayed. The other departments must understand their role in facilitating land use planning." (Municipality 5: Participant 1 2021)[2]

Municipality 6 - Category B

The land use application process in Municipality 6 is similar to that of Municipalities 2 and 3, in which the applications are circulated manually to the internal departments and to the external stakeholders that are directly affected. Though manual, there is "massive collaboration between the various departments to ultimately reach a decision" (Municipality 5: Participant 1 2021) on land use applications. The process for capturing the zoning information in the GIS is a manual, undertaken by a dedicated person on a quarterly basis. Updating of other related information, such as the cadastral information is undertaken by a service provider.

Summary and Discussion

Based the participants' feedback, all five Western Cape municipalities are deemed to be SPLUMA compliant as far as the land use application process is concerned. These municipalities have all adopted their planning by-laws which includes the land use scheme, appointed their Municipal Planning Tribunals (MPT), delegated officials and appeals authority. They have also implemented their land use registers and systems for mapping the allocated zoning and/or land use rights information digitally. Lastly, they have implemented a schedule of tariffs for the various application types. Only Municipality 1 has implemented an automated land use application process. The other municipalities all use a similar electronic application system provided by the same service provider that requires manual processing by the operator. This includes manual circulation to external stakeholders that are directly affected by a land use application. Nonetheless, they are able to adhere to the legislated time-frames for processing a land use application and reaching a final decision. However, because their manual systems are not integrated with the municipalities' GISs, their land use maps are only updated periodically or may even be outdated, as is the case with Municipality 2.

For the Western Cape municipalities, the interviews worked well - the participants were very descriptive in their responses and were very willing to share information. To the researcher, the participants appeared to be comfortable and often their responses were informal. This

may point to three things, firstly, their pride in undertaking their responsibilities which was evident to the researcher, secondly, the land use application process was well defined and thus well understood by them, and thirdly, they had the necessary skills and experience to fulfil their responsibilities. This allowed the researcher to connect the actions of individuals (i.e. the participants) to the macro level (i.e. the land use unit and the municipality) (refer to Section 3.1)

As discussed in the previous chapter, for Municipality 3, five people participated in the interview. Because their feedback was coherent and still provided the thick descriptions required, their interview could easily be included in the analysis. The same municipality provided written responses to the follow-up interview questions on their geospatial data management. Though the responses were less descriptive, it was still useful to have a high-level understanding of the geospatial environment. Furthermore, it also assisted with the analytical generalisations - if more participants share similar views, it increases the applicability and validity of the generalisations (refer to Section 3.5.2).

There were instances where participants from the first and follow-up interviews gave contrasting views, i.e. different perceptions of reality (refer to Section 3.2.1.3). It was important for the researcher to not look for a single truth in these instances, but rather to understand that the participants have different contexts - they operate in different environments (or units) within the municipality performing different functions and not forgetting that their views are influenced by their own knowledge, beliefs, perceptions etc. (refer to Section 3.4.1.1) This is discussed further in the sections that follow.

7.4   Gauteng Government Implementation of SPLUMA

As stated in the previous chapter, an interview was also conducted with the Director: Land Use Management from the Gauteng: Office of the Premier, the office responsible for monitoring and supporting municipal land use management. The participant explained their experience and involvement in both provincial and municipal land use management, which dates to pre-SPLUMA, when the provincial ordinances were still governing land use decision-making. In those years preceding SPLUMA, "...the old order was basically whereby there were certain sections of those planning ordinances that were dealt with and undertaken by municipalities and there were other sections of the same piece of provincial legislation which was the responsibility of the respective provinces" (Hay 2021). Since the introduction of SPLUMA however, the provincial office no longer performed this function, but is now responsible for "the monitoring and support of municipalities on spatial planning and land use management" (Hay 2021). Following this shift in responsibilities, the Gauteng City Region (GCR) Implementation Plan for SPLUMA was developed in 2016 by the Gauteng Planning Division (GPD) within the Office of the Premier, together with the CoGTA, DRD & LR, the Gauteng Office of the SALGA and, the municipalities of Gauteng (Gauteng Planning Division 2016). The participant described the purpose of the plan as follows:

That document gives a background to SPLUMA, it sets the status quo of what is happening at the province, what is happening in municipalities at the time and it set about key interventions and programs, or projects and activities at a provincial level and then at a municipal level. It identified key things that we needed to do by province to close up shop on the bit that we were doing and handover, devolve that to municipalities and then take over the function towards municipal support and monitoring. (Hay 2021)[1]

The GPD undertook a formal engagement process with the municipalities in Gauteng to determine their progress on SPLUMA implementation. Through this process, the GPD was able to identify the specific needs of each municipality and based on that, devise interventions to be implemented systematically. The plan of action is discussed extensively in chapter 5 of the GCR Implementation Plan. Based on the participant's feedback the Gauteng provincial government is still being guided by the Plan and the interventions are still being pursued:

...but what I can tell you is that when a policy document whether it's GIS or land use etc., like we did the GCR plan, that is taken to the provincial ExCo. That's taken as an agreement because the provincial ExCo are a bunch of mayors from the municipalities that sits there and provincial executives. (Hay 2021)[2]

From the quote above, the Plan is regarded as policy. Unlike the Western Cape, the Gauteng provincial government did not adopt provincial legislation. This decision was taken after they had "extensive engagement" with their state legal advisers who concluded that there was no significant gap to address "from SPLUMA to municipalities", especially since municipalities are empowered to adopt by-laws in this regard (Hay 2021). If provincial legislation does become necessary in the future however, this will have to be addressed.

7.4.1 Municipalities in Gauteng

The Gauteng province is made up of three metropolitan municipalities, two district municipalities and seven local municipalities. The municipalities in Gauteng depend heavily on specialised municipal entities for their service delivery. This model is unique to the province (Municipality 8: Participant 1 2021, Maluleke 2020). In previous audits by the AGSA, municipalities in the Gauteng performed better than most - it was the only province that did not have any negative financial findings. Also, in the 2016 GCR review on municipal implementation of SPLUMA, it was found that two of the three municipalities interviewed for this research had managed to implement the requirements of the Act and did not require assistance from provincial government. The third municipality was "on par", but required some assistance (Gauteng Planning Division 2016). Since the 2016-17 AGSA audit, the financial status of the province regressed. According to the AGSA 2022 report, only one municipality received a clean audit and the two municipalities that had not required SPLUMA support in 2016 incurred irregular expenditure that remained high. As the report further states: "irregular expenditure increased the risk of funds meant for service delivery being misused" (Maluleke 2020, p. 66).

Again, it is difficult to explain the impact of the municipalities' administration on their financial statuses. The regression of municipalities in Gauteng may be as a result of a number of factors; elections and change in leadership may be a big contributor. In South Africa, previous municipal elections have taken place in 2016 and 2021 - around the time when these municipalities have shown poor financial practices. The impact on the land use application process however, is unclear. As summarised in Section 7.4.2, these municipalities all appear to be compliant with the requirements of SPLUMA, despite the poor financial results.

7.4.2 GP: The Municipal Land Use Application Process

As with the Western Cape, the following sections provide the descriptions of the municipal land use application process for each of the Gauteng municipalities that were interviewed. Again, the descriptions are purely based on the interviews.

Municipality 7 - Category A

Municipality 7 has set up 9 customer care centres, at various locations within the municipality's jurisdiction, where land use applications may be lodged in person. Applications from the customer centres are sent to the corporate office to be captured electronically and then processed. Applications may also be submitted via email. The municipality is however in the process of implementing a system that will allow the process of submission to be automated. As noted by the participant, some of the customer care centres are already making use of such a system. Circulation of applications follow a manual process, via email both to internal departments and external stakeholders. After the final decision is promulgated in the provincial gazette, the zoning is captured spatially by a dedicated person in the GIS unit, into a corporate GIS. The same person performs quality checks on every incoming decision before it is captured in the GIS.

Municipality 8 - Category A

At the time of the interview (April 2021), Municipality 8 was in the process of acquiring an automated system that would allow for electronic submissions via the Internet. Until that system is implemented, the municipality utilises a manual system whereby applications are submitted in person. Since the COVID-19 pandemic, the municipality has made provision for application submissions via email. Once the application is captured electronically, there are "workflow triggers" within the system that notify internal departments that are directly affected (Municipality 8: Participant 1 2021). The interviewee however noted a challenge with the electronic system, that it is almost impossible to engage with the persons providing comments or recommendations on the applications from the respective departments. Unlike the application system of Municipality 1, the personnel database is not linked to or integrated with

the application system.

In the municipality, the town planners within the land use unit are responsible for processing the land use applications to reach a final decision. This includes checking for compliance with the municipal SDF. Updating of the GIS with the zoning information is however captured by the GIS unit, which is also responsible for the accessibility of the data via the corporate GIS.

Municipality 9 - Category A

Municipality 9 has an Application Processing System (APS) that was developed in the 1990's already. Though the system is enabled for electronic circulation to the internal departments, the application system is not integrated with the GIS, as stated by the participant:

"It has been a very manual process, the reason being that our Application Processing System/Platform was developed in the 1990's. At that time, no one had the foresight and possibly the capability to link that to the GIS to georeference all the information coming in." (Municipality 9: Participant 2 2021)[1]

At the time of the interview (May 2021), six town planners were collectively responsible for managing the land use data spatially, providing daily updates on zoning amendments within the GIS. The data in the GIS is submitted to the municipality's web-based data portal manually, so that users may access the zoning data.

Summary and Discussion

Based on the participants' feedback, the three municipalities discussed in this section may be considered SPLUMA compliant. All three have adopted their planning by-laws, appointed their Municipal Planning Tribunals (MPT) and delegated officials, and they have implemented a schedule of tariffs. Municipalities 8 and 9 have adopted their appeals authority. The participants of Municipality 7 did not mention whether their appeals authority had been established, but provision is made in the municipality's by-law. All three municipalities, at the time of the interviews, had manual electronic application systems. Although, Municipalities 7 and 9 are working toward systems that allow on-line application submissions and Municipality 8 is working toward an automated application system, comparable to that of Municipality 1 in the Western Cape. Lastly, they have also implemented their land use registers and systems for mapping the allocated zoning and/or land use rights information digitally.

Similarly, to the WC, the semi-structured interviews provided the researcher with thick responses to the questions, except for Municipality 9 that provided a written response to the follow-up questionnaire. As stated before, though the written responses provided less detailed information, it still gave an overview on the state of geospatial data governance and/or management, SASDI

awareness and it assisted with the generalisations.

7.5 The Role of Organisational Culture in Municipal Land Use Management

This section provides the researcher's interpretation of the influence of organisational culture on the land use application process.

7.5.1 Municipal Urgency of Land Use Management

In the first phase of this thesis, the stakeholder influences for the municipal land use application process were determined, based on the roles and responsibilities as defined in the spatial planning and land use management legal framework (refer to Chapter 6). Stakeholder influence is determined by the presence or absence of certain attributes, these are: (1) power - "the degree to which stakeholder can impose its will in a relationship", (2) legitimacy - "the degree to which stakeholder is socially accepted", (3) proximity - "the level of direct involvement of the stakeholder" and (4) urgency - "the degree to which a stakeholder is prepared to go to any length to achieve the desired outcomes" (Mitchell et al. 1997). Mitchell et al. (1997) state that urgency allows the researcher to capture the dynamics of stakeholder interactions. It was therefore decided that the urgency attribute would be excluded from the phase one explorative study, to be observed through direct stakeholder engagement during the semi-structured interviews undertaken in phase two.

7.5.2 Determining municipal urgency through stakeholder interviews

The level of stakeholder urgency was deduced from the participant responses to various questions; they were not asked to give their own rating. There were a number of responses from the participants in both provinces indicating that municipal land use management is undertaken with a high level of urgency. The following interview extracts demonstrate how the time constraints on land use applications as set out in the legislation, creates the pressure that leads to stakeholder urgency. As Mitchell et al. (1997) state, time-sensitivity is the first condition for urgency.

The previous legislations set no timelines but with the current legislation in terms of SPLUMA, LUPA and our by-laws, it means that when we receive an application, every party must meet the deadlines. I cannot delay an application unreasonably and I need to get to certain steps in the overall land use application process otherwise someone will hold me accountable, both in terms of the municipality or the applicant. In that sense we have a certain amount of days to assess and circulate." (Municipality 6: Participant 1 2021)[1]

With the advent of SPLUMA, things have changed a bit where one of the critical considerations is the turn-around time for applications...to try and make it as predictable as possible for the residents and the public at large. (Municipality 7: Participant 1 2021)[1]

Furthermore, two participants from Municipalities 5 and 8 respectively, stated that their ability to comply with the time constraints is monitored through their performance management systems (Municipality 5: Participant 1 2021, Municipality 8: Participant 2 2021). Another participant from Municipality 1 emphasized that performance of the land use unit is monitored, rather than the individuals involved (Municipality 1: Participant 1 2021).

7.5.3 Urgency and the Theory of Planned Behaviour

There are other factors that can influence the urgency, such as the individual's intention. One participant stated:

...we must speed up decision making so that it can contribute to the economy on the outside. We create the environment for the economy to grow, if we delay it then everything on the outside is delayed. (Municipality 5: Participant 1 2021)[1]

According to the Theory of Planned Behaviour, an individual's behaviour can be predicted by their intention. The intention comprises three determinants: 1. attitude toward the behaviour i.e. how favourable or unfavourable the behaviour is, 2. subjective norm i.e. the perceived social pressure to perform or not perform the behaviour and 3. perceived behavioural control i.e. how easy or difficult the behaviour is perceived to be (Ajzen 1991). Wehn de Montalvo (2017) used the theory to interpret why organisations in South Africa share geospatial data. In the model, the author constructs a number of domains for each of the three determinants and beliefs for each domain. Figure 7.3 depicts the model developed by Wehn de Montalvo (2017).

Though not applied strictly in this research, this model was useful to frame the urgency and deduce the level of urgency of that municipalities allocate to the land use application process referred to as 'high', 'medium' or 'low' in the indicator framework. In this case, the behaviour is processing land use applications for the purpose of allocating land use rights and the intention is the urgency to process land use applications for the purpose of allocating land use rights. The following three extracts from the interview with Municipality 5 will be used as an example to demonstrate how the model by Wehn de Montalvo (2017) was used to interpret the level of urgency:

"*In January and February, we have almost finalised 40 new land use applications.*" (Municipality 5: Participant 1 2021)[1]

...we must speed up decision making so that it can contribute to the economy on the outside. We create the environment for the economy to grow, if we delay it then everything on the outside
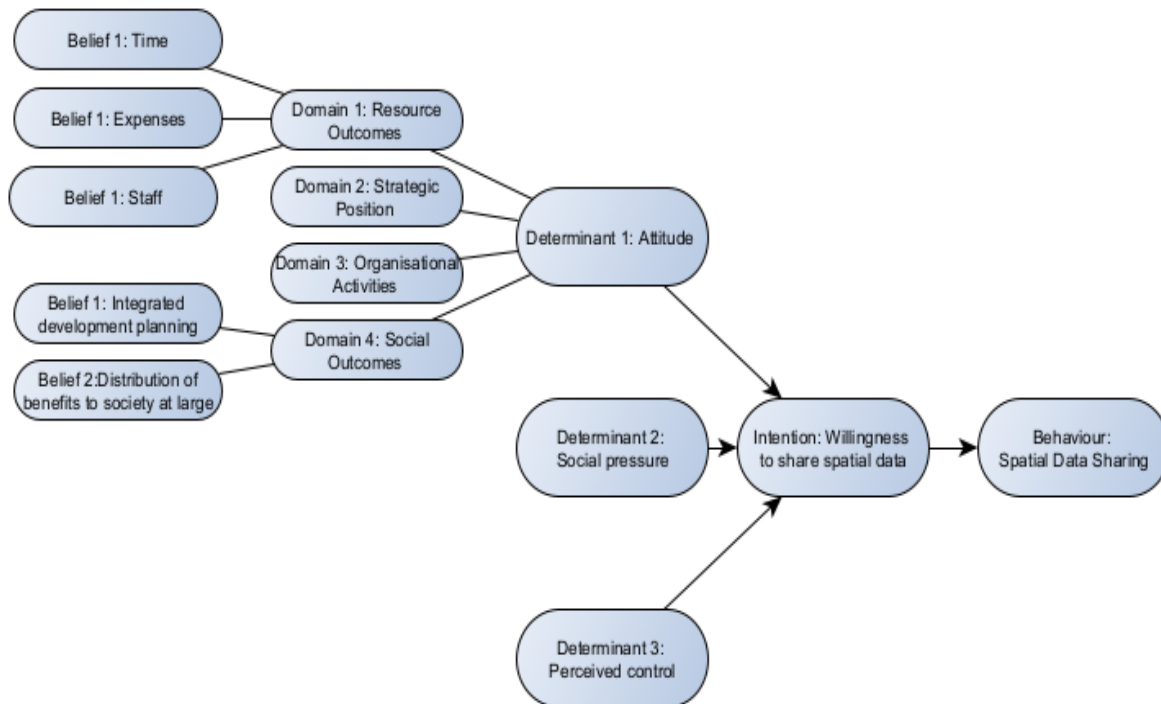
Figure 7.3: Extract of determinants of attitude towards spatial data sharing. Adapted from Ajzen (1991) and Wehn de Montalvo (2017)

is delayed. (Municipality 5: Participant 1 2021)[2]

We've just completed our audit and we've just obtained another clean audit result. We are happy with the work we are doing in Municipality 5 (municipality name removed). (Municipality 5: Participant 1 2021)[3]

In the first instance, the attitude domain 'social outcomes' with the belief 'distribution of benefits to society at large' is applicable - economic growth is regarded as a societal benefit, which is expressed by the participant as an aspiration. In the second instance, the attitude domain 'resource outcomes' is applicable. The domain comprises a number of beliefs (such as time, expenses, staff etc.) and is interpreted as the intention (in this case, the urgency to process land use applications) either enhancing for reducing the resource. It goes without saying that processing land use applications utilises a number of resources. However, the participant expresses a positive outcome as a result of the urgency applied to the process: 1. applications are processed successfully in a short period of time, 2. the municipality receives a clean audit result and 3. the municipality is able to contribute to the country's economic growth. The enhancement of resources as a result of the urgency outweighs the reduction of resources. In this example, the participant's view of the urgency required is also referred to as criticality, which according to Mitchell et al. (1997), is the second dimension of urgency. Unlike time-sensitivity dimension, which is guided by the legislation and performance standards in this case, participant criticality is subjective and may thus differ significantly from one

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participant to the next. Therefore, it was important to consider other aspects as well when deducing the level of urgency. To further explain, for Municipality 5, the assessment indicators 'capture land use rights spatially' and 'land use application system' were also considered when deciding on an appropriate level of urgency. Though both indicators were scored 'low', the municipality has a dedicated resource to capture the spatial land use information periodically, and an electronic application system, which according to the participant, allows them to operate with ease. Therefore, the urgency for this municipality is high.

7.5.4 Municipal urgency results

Overall, municipalities were allocated with a 'high' level of urgency toward the land use application process (see Table 7.2), with the exception of two municipalities who were scored a 'medium', one in the Western Cape and one Gauteng. In South Africa, SPLUMA had a significant impact on the powers that municipalities gained - municipalities make the final decisions on land use applications. One participant made emphatic statements in this regard (Municipality 1: Participant 1 2021). From the district perspective, the participant explained how the clarity of municipal roles and functions of the land use application process resolved the "infighting and unhappiness", and they "don't overstep" their boundaries and they have "a fairly good space to interact" (Municipality 4: Participant 1 2021). According to Mitchell et al. (1997) "power gains authority through legitimacy, and it gains exercise through urgency". Therefore, it is possible that this change in power has also increased the level of urgency in municipalities for land use management.

MUNICIPAL URGENCY		
Municipal Alias	**Western Cape**	**Gauteng**
Municipality 1	high	
Municipality 2	medium	
Municipality 3	high	
Municipality 4	high	
Municipality 5	high	
Municipality 6		high
Municipality 7		high
Municipality 8		medium

Table 7.2: Allocated urgency for interviewed municipalities

7.5.5 Inter-organisational Collaboration

Stakeholder engagement, as a legislative requirement may be referred to as institutional collaboration (Bree et al. 2008). However, Lawrence et al. (2002) distinguish inter-organisational cooperation from collaboration according to their respective drivers. Cooperation is either as a result of a purchase or due to legitimacy (e.g. legislated). Collaborations, which may be viewed as a type of network (Harvey 2001, Bree et al. 2008, Lance et al. 2009), are not reliant on the control of

markets or hierarchical structures. Furthermore, other behaviours that typically characterise collaborations are, a common goal (Dania et al. 2019), trust (Box & Rajabifard 2009, Sjoukema et al. 2020), reciprocity and a high degree of autonomy (Budhathoki & Nedovic-Budic 2007).

7.5.6 Municipal Land Use Stakeholder Engagement

The land use application process was a good case for gaining understanding on the type and extent of intra-organisational (that is between municipal departments and) and inter-organisational interactions, from the municipal perspective. As was previously discussed in Sections 7.3.2 and 7.4.2, municipalities are required to engage all stakeholders that are directly affected by any land use application. Those stakeholders are required to assess the applications and provide their expert recommendations to the municipality for consideration in taking the final decision. This engagement is a legislative requirement.

When speaking on the stakeholder engagement that is a requirement for processing a land use application, both internally and externally, participants typically referred to this as 'getting' or 'receiving comments'. Only one participant referred to this process as a 'collaboration' (Municipality 6: Participant 1 2021). When asked about the mechanisms that enable this 'collaboration', the participant explained how the timelines set out in SPLUMA, provincial legislation and their by-laws hold the stakeholders accountable. Although not in the context of a collaboration, most of the participants emphasized the important role that the legislated timelines play in processing the applications. The SPLUMA development principle 'efficiency', which states that development application procedures have to be "...efficient and streamlined and timeframes are adhered to by all parties", applies here (South African Government 2013)[section 7c(iii)]. Further to this, SPLUMA (and LUPA in the case of Western Cape) does not include the term 'collaboration'. Therefore, municipalities may decide on the level of stakeholder engagement with reference to the land use applications, provided the "decision-making procedures are designed to minimise negative financial, social, economic or environmental impacts" (South African Government 2013)[section 7c(ii)]. This responsibility lies with all spheres; they have to "...ensure an integrated approach to land use and land development that is guided by the spatial planning and land use management systems as embodied in" the Act (South African Government 2013)[section 7c(ii)]. This is the SPLUMA development principle of 'good administration'. Based on the above argument, it can therefore be concluded that the stakeholder engagement associated with the land use application process is 'cooperation' rather than 'collaboration' as per Lawrence et al. (2002). Beyond this process, the participants did not mention collaboration with external stakeholders and that is why the second interview protocol was never used (see Section 3.3.2).

7.5.7 Geospatial Data Collaborations

In the follow-up interviews, participants were asked specifically about any collaborations they are involved with or aware of regarding the provision, access and maintenance of geospatial data.

This included collaborations between municipal departments and between the municipality and other organisations. Municipality 1 and Municipality 9 have formal agreements in place with other organisations for the provision of external datasets, such as the provincial Office of the Surveyor General (SGO) that provides cadastral information, the regional Deeds Office that provides property ownership information and the Statistics South Africa (Stats SA) that provides statistical information related to the economy, society and the environment (Municipality 1: Participant 2 2022a). Most of the participants from other municipalities mentioned their reliance on the respective SGOs and the Deeds Offices. With the exception of Municipalities 1 and 9, the other participants did not mention formal agreements with these or other custodians. Municipalities do not however use the SGO geospatial data because it contains inaccuracies. Instead, once they receive the legal property boundary information, they re-capture the data internally to a more suitable accuracy (Municipality 1: Participant 2 2022a, Municipality 3: Participant 2 2022, Municipality 5: Participant 1 2021, Municipality 6: Participant 1 2021, Municipality 7: Participant 2 2021, Municipality 9: Participant 3 2022).

Based on the characteristics of a collaboration (refer to Section 7.5.5), there were no signs of any other collaborations between the municipalities and external stakeholders. As Municipality 1 stated, "...most of the information is captured internally". However, within the municipality the various departments do collaborate on the capturing, accessibility and maintenance of geospatial data. As an example, the corporate geoinformatics department in Municipality 8 initiated a collaborative project whereby the departments and entities that are responsible for and utilise water property information, are working toward a standardised database. In another example, Municipality 2 has identified similar problems regarding duplicate, disparate datasets and is thus in the process of developing mechanisms in collaboration with the affected departments, so that the can "try to synchronise these issues" (Municipality 2: Participant 2 2021). Also, as stated by the participant from in Municipality 1:

Internally, there's a lot of these things happening where the departments collaborate. The Property Value Chain is such a collaboration. There are a lot of these kinds of projects afoot in the municipality for the: proper source of information, need of the information, how to disseminate it – how to get a steady pipeline for the information and also how to share that information within Council. (Municipality 1: Participant 2 2022a)[1]

7.6 Municipal Geospatial Data Governance & Management

This section describes the geospatial data governance and geospatial data management in the municipalities. As with Sections 7.3.2 and 7.4.2, these descriptions are purely based on the participants' responses and any related documentation (e.g. strategy document) they may have provided.

7.6.1 Western Cape Municipalities

Municipality 1 - Category A

Both participants from Municipality 1 emphasized that the municipality is striving to make good quality geospatial data accessible to all users. The second participant explained how the municipality's GIS strategy was established, what the drivers were and the principles that underpin the strategy. In the late 2000s the municipality acknowledged their need for an integrated data management system and channels for data dissemination. It was also around the time that the SDI Act was promulgated, and the municipality became aware that they needed to comply with the Act. The first geospatial data management strategy was therefore developed and approved by the council in 2008. Since then, the municipality has updated their strategy, the most recent one was approved in 2018. Based on their strategic approach, the municipality has also developed a policy for making their geospatial data 'open' (Municipality 1: Participant 2 2022a). 'Open' in terms of the policy means that more and high-quality data is accessible to all users via the Internet, unless it is considered sensitive or restricted to public (City of Cape Town 2016). The municipality has had an online portal for a number of years, which allows users to download the data via the Internet.

In terms of the implementation of the strategy, departments capture the geospatial data for which they are responsible in their respective production environments, and if they require their data to be published to the reporting environment (i.e. make it accessible via the portal), it has to comply with the necessary data and metadata standards. The IT department is responsible for syncing the data between the production and reporting environments. The Corporate GIS unit has the mandate to implement the SDI Act and therefore ensures that all published data complies with the municipality's data policies and standards. In compliance with the SASDI principle of reducing duplicate data capture, a 'super user group' was established to monitor data capture in the municipality. Furthermore, as part of the strategy requirements, they are in the process of defining a data inventory of available datasets (Municipality 1: Participant 2 2022a).

Municipality 2 - Category B

Both participants from Municipality 2 mentioned a number of issues related to the geospatial systems in the municipality. Already mentioned in a previous section, the municipality's land use map is outdated because the service provider failed to integrate the land use application and spatial systems. The other challenges include: duplicate data capture i.e. similar datasets are captured within different units for different purposes, the lack of data and metadata standards, disparate data systems ("mix" of applications) and lastly, municipal departments do not understand the importance of GIS and having a strategic plan for GIS implementation (Municipality 2: Participant 2 2021).

In response to the existing data management challenges, the GIS unit with the support of the

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City Manager has embarked on a mission to address those challenges. The support from the City Manager has created a big drive toward GIS implementation, which culminated in a GIS strategy. The approach of the strategy is to assess how GIS can support all departments, then, review and amend the existing business processes accordingly within the next three years. At the time of the interview (November 2021), one of the business processes had already been reviewed and amended. With the strategy, the intention is to implement a completely new approach to better manage the municipality's geospatial data, that is, a new data model, data and metadata standards, streamlined data maintenance processes etc. Building GIS capacity within the departments is also a big consideration of the strategy (Municipality 2: Participant 2 2021).

Municipality 3 - Category B

Municipality 3 does not have a GIS unit or department instead, the IT department performs some of the GIS-related activities, but mainly the municipality utilises a service provider. They have "...an ArcGIS Enterprise platform with a central database displaying data on Internal GIS viewers as well as a public GIS Viewer" (Municipality 3: Participant 2 2022). The same service provider had also been awarded a 10-year contract to develop a corporate GIS for the municipality. The municipality also employs consultants to capture their technical datasets. Despite their current set-up, the participant stated that "...the executive management and politicians view the GIS as an integral tool within the different corporate systems", and that GIS interest from the departments is "very good" (Municipality 3: Participant 2 2022). According to the second participant, the municipality does have a GIS strategy in place, however no further information was provided on it (written interview responses). The last aspect to mention, is the awareness and effort toward data standardisation - the participant mentioned the Technical Schema that enforces a data standard for their infrastructure and the Schema attributes are referenced for their metadata.

Municipality 4 - Category C

Municipality 4 is a district municipality and therefore does not capture any land use data. The following interview quote summarises the current situation in this district with respect to geospatial data management:

But there is in general not much support being provided from a district perspective in terms of geospatial information, because we're struggling ourselves. We first need to sort out our own before we can assist others. (Municipality 4: Participant 1 2021)[1]

The participant explained in detail the challenges that the municipality faces with the management of their geospatial data. To summarise, because the municipality does not have the required spatial data expertise or the necessary support, in previous years they spent their budget on a system that does not serve their needs. As a result, the system is currently (at the time of the

interview, March 2021) unusable by the municipality, and the departments are running their own separate systems. Added to this, the municipality does not have access to the geospatial data they require; they acquire their data through service providers who limit how they can use the data, and they also access data via other open platforms (e.g. Cape Farm Mapper).

7.6.2   Gauteng Municipalities

Municipality 7 - Category A

In Municipality 7, the land use data is captured spatially by a separate unit. This unit is responsible for quality checking land use decisions and capturing those decisions spatially, they do not interact with other geospatial data. This unit and the other departments that capture spatial data, all contribute their datasets to the corporate GIS, which may be accessed by internal users. The base datasets are generally freely available to the departments. For certain dataset however, the departments are required to pay, for example, raster and LiDAR data. The participant explained that it serves as a means to secure funds for subsequent financial years. External users are required to pay for all data, unless they request it for a small geographic extent only. The municipality has a data viewer for external users, but no data portal whereby users can directly access the data (Municipality 7: Participant 2 2021).

The second participant highlighted the difficulty in accessing reliable cadastral data. They have attempted to address this challenge by proposing a collaboration between the Gauteng metropolitan municipalities and the provincial SGO, but the SGO was unwilling. As a result, as stated by the participant, there is duplicate data capture on the part of the municipality - a situation that is not unique to this municipality.

Municipality 8 - Category A

As with Municipality 8, the land use data is captured spatially by another unit, because the "...town planners that assess application do not have the skill sets to deal with the actual GIS" (Municipality 7: Participant 1 2021). In this case, the participant was referring to the zoning data, the land use rights data is captured through a different process by a different directorate. At the time of the interview (April 2021), the municipality was in the process of acquiring a new electronic submission system for building plans, which was intended to integrate with the GIS, but that had not been achieved yet. The municipality has a corporate GIS environment, to which the departments contribute their geospatial datasets.

In the follow-up interview, the representative from the Corporate Geo-informatics department discussed how the municipality had implemented an SDI or data governance approach for their geospatial data (discussed further in Section 7.7). A number of mechanisms had been developed and implemented in this regard, such as integration and standardisation of datasets, standardised metadata capture, GIS support to the departments (e.g. GIS representatives

assigned to departmental projects), a GIS spatial information steering committee, GIS user group and appointment of custodians who are required to adhere to Service Level Agreements (SLAs). Data accessibility is however still a limitation; the municipality has a data viewer that does not allow external users to access the municipality's data via the Internet. At the time of the interview (June 2021), the municipality was publishing their data on the provincial data portal hosted by the Gauteng Office of the Premier. The municipality does aim to develop their own portal in the future.

Municipality 9 - Category A

Similarly to Municipalities 7 and 8, Municipality 9 has a hybrid GIS system, in which the departments capture the datasets for which they are responsible and then, contribute it to the corporate GIS. Through the implementation of their Geospatial Data Governance Framework, the municipality captures their data according to their internal data standards. Together with this, the municipality produces "...metadata in accordance with the SDI Act, with no national guidelines on how, what or content", but it is "...based on ISO 19115 (also endorsed by the FGDC)" (Municipality 9: Participant 3 2022). As for data accessibility, the participant had the following response:

...city departments are provided access to geospatial data on the GIS Data Warehouse and information options are shared on the intranet (includes Web GIS, web map services, maps, etc.). External users have access to information options and ordering of data guided by ISO 9001 procedures on the internet. (Municipality 9: Participant 3 2022)[1]

On the topic of internal access to the geospatial information, the second participant from the spatial planning research unit acknowledged a few issues. Extracting information on land use rights data is problematic; the Geomatics unit is able to manually generate statistics on the type of applications, but not on the land use rights. As expressed by the participant, this information is crucial for spatial planning research. Other issues mentioned were, the limited resources, such as hardware, software, staffing and internet capabilities to access the geospatial data they require (Municipality 9: Participant 2 2021). This view may be considered as contrasting to that of participant 3 from the municipality, who wrote that senior management provides sufficient support for geospatial data management and that "...GIS integrates with a number of business processes, applications and systems city- wide impacting on service delivery and revenue income of the city" (Municipality 9: Participant 3 2022). The constructivists paradigm, which underpinned the semi-structured interviews allows for such contrasting views, which are different expressions of the participants' reality or versions of the truth.

7.7 SDI Implementation in Municipalities

Out of the nine municipalities that were interviewed, only Municipality 1, Municipality 8 and Municipality 9 had actively pursued compliance with the SDI Act. The participant from Municipality 8 mentioned that the SDI Act and the policies are reflected in their GIS strategy. The participant also stated that the municipality implements data and metadata standards. No further information was offered on the implementation of SDI (written interview responses). Municipalities 1 and 8 however, provided detailed information on their SDI implementation, which is further discussed in the next sections.

7.7.1 SASDI Implementation in Municipality 8

The participant from Municipality 8 went as far to say that their vision is to implement a local SDI model for their municipality that aligns with the national SDI, the SASDI (Municipality 8: Participant 2 2021). This vision of inter-connected SDIs aligns with the hierarchical SDI model proposed by Rajabifard et al. (2002) (refer to Section 2.4.6). Municipality 8 has participated in the SASDI since the first CSI was elected in 2010 (Siebritz et al. 2021). Between 2015 and 2017, representatives from the municipality were active participants in the implementation of the SASDI Electronic Metadata Catalogue (EMC) through both the Steering Committee and the Technical Liaison Committee (NSIF 2015, 2017). As stated by the participant, their vision for a local SDI may be attributed to their involvement in the national SDI for over a decade (Municipality 8: Participant 2 2021). The following interview extract provides insight into the municipality's strategy for implementing the SDI model:

Right at the beginning it was very difficult to get the buy in from people to participate across departments... we established this weekly data champions meeting, and it was quite good because at that stage we were looking at implementing a new billing system, so it was sort of under the topic that we are establishing a new system. But what we were actually doing, was cleaning the data and we were migrating it to one database. If we hadn't had that data champions meeting to establish working together and the principles it would have really been very difficult. Up to today, this morning still, we had our data champions meeting, so we are still working together. It involves quite a lot of change management to get that going, but we overcame it – we had a purpose, we had to clean the data and we had to put it into one database because we had different databases.. (Municipality 8: Participant 2 2021)[1]

Key elements to the municipality's SDI implementation are: 1. there has to be a legal instruction from management, 2. a person in a senior management position that has a good understanding of SDIs and the requirements thereof, needs to motivate and drive the implementation from the top, down and 3. a team that champions the implementation and provide support to stakeholders who are less experienced in SDI.

7.7.2   SASDI Implementation in Municipality 1

This topic was already introduced in Section 7.6.1). To summarise, the SDI implementation efforts of Municipality 1: developing the geospatial data management strategy that aligns with the the SDI Act, establishing an open data policy to increase the accessibility of geospatial information to all users, data governance structures (such as user groups) to synchronise and standardised geospatial datasets through data standards, creating standardised metadata and appointing custodians to ensure the data is available and maintained. The participant from Municipality 1 emphasized the municipality's efforts to implement and comply with the SASDI principles and legal requirements. Two other crucial aspects must be mentioned, firstly, in recent years Municipality 1 has also been participating in the SASDI through the various subcommittees. Secondly, as with Municipality 8, the starting point for SDI implementation in Municipality 1 was the legal instruction:

> *A big thing is, mandates that are derived from delegated authority – in the municipality it works like that. Everything that a municipality must do or any legislation that the municipality must implement, first originally vests with the City Council. The City Council can then delegate these authorities to the City Manager and the City Manager can delegate it further down explicitly. If it is a delegated function, it is something that has been taken seriously.* (Municipality 1: Participant 2 2022b)

7.7.3   SDI-like Efforts in Municipalities

Other than the afore-mentioned municipalities, the participants from other municipalities revealed little to no awareness of the SASDI or the SDI concept in general. Despite this, the participants knowingly and even unknowingly expressed their willingness and efforts to align with the principles of the SASDI (i.e. access to data, sharing of data and no duplication). Therefore, a distinction is made here between SASDI compliance and SDI implementation - municipalities are not necessarily concerned with compliance but they do have to operate effectively and efficiently (Siebritz et al. 2022). A few interview extracts are provided below as evidence of this:

> *In my opinion, I agree whole-heartedly with the principles of SDI and in our organisation, we are trying to implement all the principles of the SDI, not duplicating and sharing of data. We have our GIS steering committee which looks at the sharing of data to a certain extent.* (Municipality 2: Participant 1 2021)[1]

> *I will add this also, there's a concern of sharing of data between spheres government, that is our biggest concern. We have been asking province for data. They have a big project and we are trying to get access to that data because there are inconsistencies with regards to what they have and what we have, which could lead to big problems.* (Municipality 2: Participant 1 2021)[2]

> *There's not only a planning need for data, information, datasets, but for municipalities it's not, specifically legislated or a core function to gather and to house spatial information as a day*

to day function that could actually further assist in each municipality as a whole. Because I think there's a lot of other functions that can also benefit municipal health, for example monitoring water, sewage outflow, food source - all of that information needs to be readily available because at this stage it's been gathered and it's sitting somewhere in a file in a cupboard of some manager then it needs to be sourced and scanned again. If that can be captured on a centralized system where you can access municipal health information environmental management information, waste data, Fire and Rescue data, social development information etc., there's a lot of information. (Municipality 4: Participant 1 2021)[1]

As an example, our valuation contract also has a GIS component and they capture things slightly differently. Within the same municipality there are sub-consultants to the valuer. I have spoken to Esri a few times because there needs to some level of standard protocol and I'm not sure if it's there. Municipalities have a certain level of information required, a certain resolution and accuracies; there needs to be coordination in the geospatial industry, that there is certain level of overlap. We don't set the standards. With our neighbouring municipality, we do things almost identically, based on what Esri has advised. Esri does grant us a certain level of flexibility. (Municipality 6: Participant 1 2021)[1]

GIS. Everybody is on this digital path with trying to keep the data current and us as well. We share outwardly, but we also import as many layers and information as we can [for example the various layers from SANBI]. This information helps the applicant incredibly. In the past, the applicant would have to appoint a specialist to do a flood line cross-section of the river and that is incredibly expensive. Just by virtue, that department making that information available, saves everyone a lot of time and effort. (Municipality 6: Participant 1 2021)[2]

...we are corporate geoinformatics. We have our Oracle database. Other departments are supposed to have their spatial data in our Oracle database. Here and there you might find somebody who has the data on his PC. But in theory everybody should work from our database. We have a database administrator maintaining the database and he has a read-write list so there is no duplication in that regard. Every department is reliant on our cadastre as a base. (Municipality 7: Participant 1 2021)[1]

Only a few extracts are given above (due to space limitations), but a number of important generalised statements can be interpreted in terms of the existing efforts of municipalities, that may be built upon toward SDI implementation, and with reference to this study, to inform the recommendations for the collaboration framework for SASDI stakeholders.

7.7.4 SDI-like Efforts to Build Upon

1. Municipalities are confident about the usefulness and usability (i.e. of good quality and relevant data) of at least the fundamental data they create.

2. Municipal geospatial data is being re-used at least by their departments. The ease with which this happens depends on centralised access to data and whether there are costs

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involved in acquiring the data.

3. Municipalities want to remain relevant in terms of GIS and geo-informatics and have actioned various mechanisms in this regard.

7.7.5   *SDI support required by municipalities*

The support that municipalities still require to implement an SDI model for their environment are as follows:

1. Municipalities are reliant on external geospatial data but face three main challenges: 1. external custodians limit access to their data, 2. municipalities do not always understand their legislative right to access external public data and 3. external data is often not useful and/or usable - the data is not standardised and/or no metadata is provided.

2. Municipalities require greater intergovernmental support with their geospatial data governance and management. More specifically, they require provincial government to coordinate applicable geospatial data standards for municipalities. This will facilitate data interoperability and will assist municipalities with the type of systems and applications they implement. The second aspect relates to capacity building. Municipalities are heavily reliant on service providers for their data processing systems, data maintenance and data dissemination platforms. The balance of power between the municipalities and service providers needs to be improved, so that municipalities are building capacity through the outsourcing process.

The conclusions listed above follow an inductive approach with mainly nomothetic explanations, meaning that the researcher looked for similarities and/or consensus between the individual participant responses to make general statements that are applicable to as many as possible (refer to Section 3.4.1.2). Where applicable, the responses were compared with the existing knowledge (i.e. theoretical framework, formal models, mental models and legislation) for objectivity and validity (refer to Figure 3.3 in Chapter 3). To a certain degree, it is impossible to exclude uniqueness (i.e. deductive approach and idiographic explanations), when the participants' statements correspond with existing information. For example, only one participant spoke about the vision for a local SDI that aligns with the national SDI, which embodies the concept of a hierarchical SDI originally proposed by Rajabifard et al. (2002) and adopted by Siebritz et al. (2021).

7.7.6   Discussion on SDI Implementation in Municipalities

Although SDI implementation is legislated, municipalities require more than the national legislation for institutionalising the requirements. As observed with SPLUMA, municipal powers and functions are explicitly provided for in the Act. Secondly, SPLUMA encourages municipal by-laws to clarify the implementation processes. As expressed by the participants, municipalities require a clear legal mandate for any undertaking. This legislative base for the governance structure is lacking in the SDI Act and policies, and as a result many municipalities are still

unclear about what the SDI Act requires from them. With the municipalities that have shown progress with SASDI implementation, there had been a great deal of effort from individuals, including participation on the SASDI, and gaining support from senior managers in the municipality.

For SDI implementation, municipalities require the external resources to support their SDI implementation. Again, as observed with the municipal implementation of SPLUMA, each province has a dedicated provincial office that must monitor and provide support to municipalities, and national government must provide support to the provincial offices. There is also a supportive role that district municipalities undertake for the development of spatial development plans. Although it is beyond the scope of this study, the interview with the district municipality (Municipality 4) revealed how interconnected the SDF review process. With the SASDI, no such intergovernmental support system is in place. National government is solely responsible for the implementation and as Siebritz et al. (2021) state this has resulted in a disjuncture between the spheres with the governance of geospatial data.

The available SASDI resources have not supported municipalities sufficiently. The technical systems like the EMC, have been unavailable for some time. Even when the systems were available, municipalities received minimal capacity building to enable them to utilise these systems (Siebritz et al. 2021). Considering all of this, municipalities have to be commended for their efforts in practising the SASDI principles, even if it is unknowingly. Municipalities 1 and 8 even more so, because they have displayed a proactive approach to SASDI implementation. Although 'open' SDI is not a new concept and has been taken up in other countries already (Vancauwenberghe & van Loenen 2017, van Loenen 2020), the Open Data Policy developed by Municipality 1, which utilises the principles of the Open Data Charter (Open Data Charter 2015), may be considered ahead of its time in the South African context. The same goes for the Property Value Chain Data Governance Policy developed by Municipality 8, which was designed to ensure high quality, reliable property information. The policy includes across organisational workflows that addresses the challenges they experience with the SGO and Deeds Office data (Municipality 8: Participant 2 2021, Hattingh, Marcelle 2021). Both municipalities also continue to raise SDI awareness throughout their municipalities.

7.8   Summary of The Indicator Assessment

A total of 62 indicators were assessed. Appendix L.12 provides a summary of the assessment. For each component, there were a number of indicators, in the summary an overall score is provided for each of the components. Summaries are provided due to space limitations, however the full list of indicators with their attributes is available in Appendix K.11.

7.9 Comparison of Statutory Study Results with Empirical Results

The comparison of the statutory and empirical results is summarised in this section. As stated in Section 3.2.1.3, the comparison makes specific reference to certain aspects, which are presented in the following subsections.

7.9.1 The Municipal Land Use Application Process

The municipal land use application process was depicted in Figure 6.1. The figure included the three main phases of the process: the (i) administrative phase, (ii) consideration phase and (iii) decision phase, as described in the SPLUMA legislative framework. The geospatial land use (rights) data is depicted as an output of the process. Generally, the participants' descriptions of their land use application process corresponded with the legislation.

In Figure 6.1, the Municipal Administration is shown at the high level, in practice though, this component constitutes a number of service departments that participate in the application process, including the department responsible for land use management. The interviews revealed that the participation of the departments is heavily reliant on the land use application system (whether manual or automated). The interviews also revealed that the data capturing is most often undertaken by a dedicated geospatial person, unit or even by the IT department, separately from the land use application unit, and thus the land use application phases, as depicted in the figure.

7.9.2 De facto Stakeholders of the Land Use Application Process

Figure 6.2 depicted the stakeholder network map for the land use application process. According to the interviews, the most salient stakeholders were those that were included in the stakeholder map, such as the SGO, the Deeds Office and the Department of Environmental Affairs - these were mentioned in SPLUMA. However, two things became apparent from the interviews, firstly, provincial sector departments are consulted more often on applications than the national departments - this relationship should have been depicted in the stakeholder network map. Secondly, there are a number of stakeholders that were not included in the network map who may be consulted depending on the type of application, the characteristics of the municipality (i.e. the municipal category, geographic location and extent etc.) and the available resources.

7.9.3 De facto Stakeholder Influences

The stakeholder influences were not recomputed based on the interviews, as it would not account for the degree to which stakeholders actually fulfil their legislated roles. The following sections provide some insight into the accuracy of the influences computed in the statutory study by comparing it with the participants' descriptions.

Relationship: DARD&LR - Municipality

The DARD & LR must "provide strategic support with land use management" to municipalities, as per the requirements of SPLUMA (refer to Appendix B.2). During the interviews, other than being the custodian of the SPLUMA, and providing comments to certain land use applications, the role of the DARD & LR in terms of strategic support was not really mentioned.

Relationship: CoGTA - Municipality

In the statutory study CoGTA was allocated the 'oversees' role, defined as "...more interaction which may include direct instructions" (refer to Appendix E.5). None of the participants mentioned CoGTA, neither the national nor provincial departments. The participants did however, indicate that the 'oversees' responsibility as defined above, is taken up by the provincial DEA & DP in the Western Cape and the provincial Office of the Premier in Gauteng.

Relationship: SASDI - Geospatial Land Use Data

There was no significant relationship of support from the SASDI to the municipalities. Two participants explained how their participation in the SASDI had provided them with a better understanding of SDI implement in their municipalities, but it was without the assistance of the SASDI. In fact, another participant explicitly stated that their municipality had managed to implement metadata standards "...with no national guidelines on how, what or content". With reference to the geospatial land use rights data produced by municipalities, this dataset is not recognised as a fundamental dataset by SASDI. Thus, there is no support for this dataset.

Relationship: Provincial Executive - Municipality

In the legislation, the respective provincial offices are responsible for "...coordinating and monitoring municipal land use performance" (refer to Appendix B.2). Of the participants stated that the municipality has to submit periodic reports to the provincial office on their land use. However, not much detail is required in the reports; one participant stated that they only need to provide a status on the number and type of applications that had been processed for that period. In terms of the coordination function, in the Western Cape, the DEA & DP is still in the process of formulating a coordinated approach to supporting municipalities. The Gauteng office established the GCR Implementation Plan for SPLUMA, which may have enabled a more coordinated approach. It should also be noted that the support from the province refers specifically to the land use process. When asked about standards for, or the coordination of the geospatial land use rights data, participants in both provinces indicated that no such support has been made available.

Relationship: Public - Land Use Application Process

By law, municipalities must enable public participation on land use applications. The spatial planning and land use management by-laws of the respective municipalities contain the details of these public processes. For many municipalities, the interview results could not verify the extent of the actual participation; i.e. not enough information was provided. One participant did mention that there was reasonable public participation from their more established towns, but they struggled with the lower-income towns because people in these areas do not have access to municipal information via digital communication platforms.

7.9.4 Stakeholder Urgency

The urgency of municipalities was determined in the empirical study and was already discussed in Section 7.5.1. The interviews emphasized that the urgency is best determined by direct engagement with the stakeholders. Originally, the idea was to gain insight into the urgency of the other stakeholders as well, based on the municipal participants' feedback. Though their feedback gave some idea on the urgency of the external stakeholders, a reliable determination cannot be made without engaging those stakeholders directly.

Since the DEA & DP in the Western Cape and Office of the Premier in Gauteng were directly engaged, some conclusions can be drawn regarding their urgency, respectively. Theoretically, both of these provincial offices have a medium to high urgency toward the municipal land use application process. They do not participate directly in the process (unless an application requires it), but they have to ensure that municipalities are equipped to process the applications. In Gauteng, there is no significant engagement between the province and the metropolitan municipalities because, these municipalities have been able to implement their land use management without the support of the province. For other smaller municipalities, they have provided significant support. In the Western Cape, the provincial office provided significant assistance to municipalities with their spatial planning and land use by-laws. One municipality also mentioned that the provincial office had been assisting them with speeding up the finalisation of applications. In this instance, it can be said that the DEA & DP urgency is high, but overall the urgency of the provincial offices for the municipal land use application process is medium.

7.9.5 Average Stakeholder Influences

The statutory study analysed the land use application process in its entirety, that is, the focus was not only on the decision taken on an application. If it was focused on the decision, the stakeholder powers would have been allocated very differently, and the MPT or the delegated authority would have had the highest influence, i.e. decentralisation decision-making by municipalities. However, as discussed earlier in this chapter, the land use application process is intergovernmental, with the national legislation as a starting point, which cascades down to the provincial sphere and then to the local sphere, i.e. top-down. Everything that happens within the municipal land

use processes must comply with both provincial and national legislative requirements. Thus, the legislative authority has to carry the highest power. Based on the participants' interview descriptions, this is what happens in practice as well. Even beyond the land use application process, a few participants expressed that the municipality does not take on any responsibility unless delegated via legislative instruction from the Municipal Council. Hence, the high influence results for the Municipal Council in the statutory study. It can thus be said that the stakeholder classification in the statutory study supports with empirical results.

The influence over the geospatial land use rights data presents a different case. SPLUMA requires municipalities to develop and adopt a land use scheme and the legislation provides guidelines for setting up such a land use scheme. But ultimately, the municipality may decide on the structure of its land use scheme and as a result, the structure of the geospatial land use rights data resulting from the application process. There are no geospatial data capture standards provided by the provincial offices, the DARD & LR or SASDI. Only municipalities are eligible to capture this type of data, and currently the data is limited to the municipalities' jurisdiction. The data is not aggregated at any of the administrative levels because each municipality captures their data differently - there is no interoperability. Had the municipal data been interoperable and aggregated, the result would have been a truly bottom-up dataset as envisaged by Siebritz & Fourie (2015).

7.9.6 Recommended Custodianship

The statutory study concluded with a recommendation for shared custodianship allocated to the land use application process, rather than simply appointing a data custodian, as is the current practice of SASDI. The DARD & LR was recommended as the legislative custodian, the respective provincial offices as the coordinating custodians and the respective municipalities as the data custodians. Based on the results presented in this chapter, it can be said with a fair amount of certainty that the recommend custodianship roles are suitable and necessary for multi-stakeholder datasets. However, the governance for these three roles must be defined to ensure that they work together effectively and efficiently.

7.10 Chapter Summary

This chapter presented the findings of the interviews into the municipal land use application process for municipalities in the Western Cape and Gauteng provinces. The analysis approach enabled the researcher to observe the stakeholder interactions and role of geospatial information in supporting this process. Qualitative results were presented under themes and also using an indicator assessment. The main findings are summarised in this section.

The municipalities interviewed from both provinces are deemed SPLUMA compliant. Although some municipalities appeared to be more efficient than others, all of them have been able to

implement their land use systems. Metropolitan municipalities are seemingly better resourced; comparatively they are allocated a bigger budget, which gives them an advantage. Evidence is seen in their ability to implement SPLUMA without much support from provincial government, their sophisticated technical platforms and their pro-active approach to SDI implementation.

The land use application process demonstrated how legitimacy gained through legislation influences the power of the municipality. The provisions of the legislation that facilitate municipal implementation and compliance, and thus increase their power are: 1. clear stakeholder roles, 2. a land use application process that is defined at the high-level, 3. allocated time-frames for each phase of the process and 4. the obligatory consultation with affected stakeholders prior to taking a final land use decision. These provisions also influence the municipal culture through increased urgency - a desired state because it improves efficiency. The municipal culture is also driven by the individuals' attitudes, such as their willingness to be effective and efficient and their belief in societal benefits.

In both provinces, the provincial government continues to assist and support smaller municipalities with their land use management. The Gauteng provincial office revealed an impressive support and intervention plan for municipal spatial planning and land use management. In the Western Cape, there is a slow shift away from ad-hoc support to municipalities, although many of the municipalities expressed their appreciation for the assistance they have received from the province.

As far as collaboration goes, municipalities generally did not have any formal collaborations with external stakeholders, despite the fact that access to external data is still a challenge and metadata is still scarce. Municipalities either collaborate internally or find other sources for the data they require. Several participants mentioned their reliance on the SGOs cadastral data, which does not meet the municipalities' accuracy requirements. The inadequacy of the NMA data was also mentioned.

Finally, with regards to SASDI implementation in municipalities, the results are emphatic: 1. municipalities are not included as vital SASDI stakeholder; 2. municipalities require support and capacity building (e.g. awareness raising, training, organisational instruments, technical platforms etc.) to institutionalise SDI and 3. municipalities need easy access to good quality geospatial data, which may be achieved through intergovernmental structures and collaborations - all of which the CSI has the mandate for.

The stakeholder interviews provided valuable insight into the functioning of municipalities, and not only with respect to the land use application process. The participants were surprisingly willing to offer as much information as they were able to. Their responses were rich, which allowed the researcher to gain a deeper understanding of their respective contexts. This method of data collection and analysis proved extremely useful for informing the recommendations for the collaboration framework, as will be presented in the next chapter.

The study was limited by the non-response to interview invites and by written responses instead of interviews. Thirdly, it was not possible to interview all municipalities due to the time constraints of the study.

CHECK The stakeholder interviews provided valuable insight into the functioning of municipalities, and not only with respect to the land use application process. The participants were surprisingly willing to offer as much information as they were able to. Their responses were rich, which allowed the researcher to gain a deeper understanding of their respective contexts. With this method of data collection, there is always the difficulty of bias and subjectivity, but as discussed in the this chapter, the researcher took a number of precautions to minimise this effect. Another limitation of this method of data collection, is the fact that two municipalities in the Western Cape did not respond to the invite for a follow-up interview and therefore, not much is known about their geospatial data management. Further to this, two municipalities in Gauteng preferred to give written responses. As a result, the feedback was not as rich and their was no opportunity to clarify certain responses. Lastly, it was not possible to interview all municipalities or even include more provinces due to the time constraints of the study. Even with these limitations, this method of data collection proved to be effective for the intended purpose.

Chapter 8

PROPOSAL FOR A SASDI STAKEHOLDER COLLABORATION FRAMEWORK

8.1 Introduction

This chapter addresses the fourth objective of this thesis:

> based on the first three objectives, propose a collaboration framework for SASDI stakeholders to improve governance of and access to fundamental geospatial datasets.

The proposed framework for the SASDI stakeholder collaboration is presented as a conceptual model first. Thereafter, the details of the framework (hereafter referred to as the 'collaboration framework') are discussed. The collaboration framework comprises various interrelated, interacting parts that are coordinated by the SASDI, holistically. This strongly relies on SDI governance that is dynamic and inclusive (Grus et al. 2010, Sjoukema et al. 2017). For this reason, the collaboration framework highlights the SASDI governance aspects that enable such collaboration and cooperation amongst stakeholders.

The collaboration framework was designed to promote adaptability and easy implementation. Adaptability was achieved by recommending generic abiding principles. Implementability was achieved by providing context-specific guidelines for South Africa.

The chapter is structured as follows: the scope and domain of the framework are explained in Section 8.2. Thereafter, the fundamental principles of the collaboration framework are introduced in Section 8.3. Section 8.4 explains how the mechanisms approach was applied to construct the framework. The chapter summary is presented in Section 8.5.

8.2   Domain and Scope of Collaboration Framework

The conceptual model for the SASDI stakeholder collaboration framework is shown in Figure 8.1. The three principles of the SASDI are, access to data, sharing of data and no duplicate data capture (South African Government 2003*a*). As shown in the figure, the collaboration framework is centred around the principle, access to data, which responds to the first generalised statement made in Section 7.7.3:

Municipalities are reliant on external geospatial data, but face three main challenges, 1. external custodians limit access to the data, 2. municipalities do not always understand their legislative right to access external public data and 3. external data is often not useful and/or usable - the data is not standardised, and/or no metadata is provided.

Thus, the domain of the framework, (or the goal) is improved access to useful, usable geospatial data. Though the collaboration framework is designed for improved access to geospatial data to all users, it is geared to promote the bottom-up influence from the local sphere and increase municipal access to data. The scope of the framework is defined in four parts: 1. the legal mandate of the SASDI, 2. the public administration implementation approach, 3. the characteristics of formal collaboration and 4. the level of the stakeholder network. The scope is further explained in the next sections.
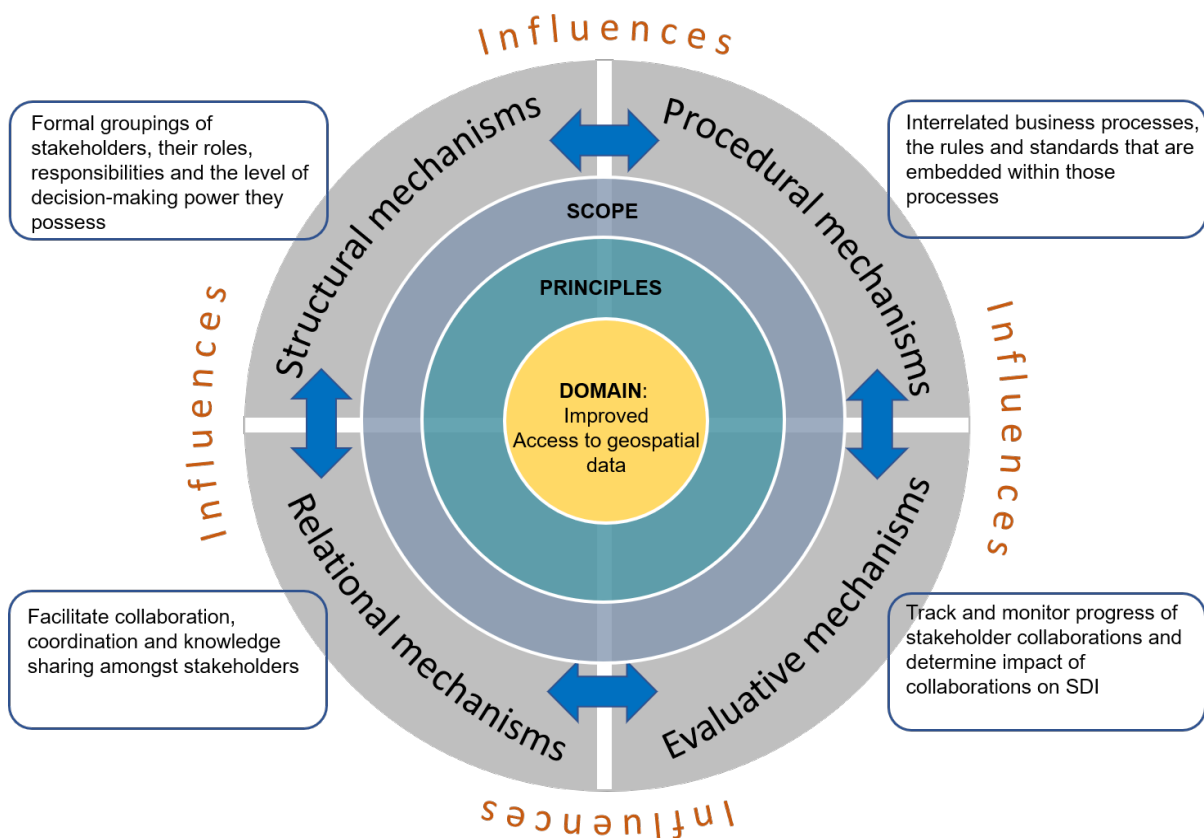
Figure 8.1: Conceptual model for SASDI stakeholder collaboration framework

8.2.1 SASDI Mandate

The scope is firstly bound by the SASDI mandate as, given in the following sections of the SDI Act: 2(a): "...to facilitate the capture of spatial information through co-operation among organs of state", and 2(d) " ...to create an environment which facilitates co-ordination and co-operation among all stakeholders regarding access to spatial information". The afore-mentioned provisions of the Act are stated broadly and therefore, it is not clear to what extent the SASDI must give support to organisations regarding coordinated access to spatial information. This collaboration framework provides SASDI stakeholders with a practical guide for cooperation through collaboration that is coordinated by the CSI.

8.2.2 Public Administration Implementation Approach

In Section 2.4.3, the implementation approaches to public administration were discussed, namely hierarchy, network and market. Collaborations are typically described as networks, as such, the collaboration framework employs a network implementation approach. In the network, the stakeholders are seen as equal - there is no one stakeholder that holds the power to dictate the network (Warnest 2005). In other words, the framework enables influences from various stakeholders. More specifically, it creates an environment for the local sphere to participate. An element of hierarchical coordination is still required to strengthen the SDI governance and enable uniformity and interoperability of the geospatial data, as motivated by Lance et al. (2009), Sjoukema et al. (2017) and Vancauwenberghe & van Loenen (2017) (also refer to Section 2.4.7). This role is taken up by the CSI.

8.2.3 Characteristics of Formal Collaboration

The third part of the scope is defined by the characteristics of formal collaboration (refer to Section 7.5.5). Formal collaboration requires trust and reciprocity amongst the participants, and the pursuit of a commonly defined goal. Peterson (2004) emphasizes the voluntary nature of relational mechanisms (discussed later), like collaborations. Though true, organisational instruments such as collaborative agreements may be required to maintain the integrity of the collaboration. Also, collaborations generally exhibit a high degree of autonomy and do not typically rely on hierarchical structures. The collaboration framework proposed here does however rely on national coordination from the CSI.

8.2.4 Stakeholder Network Level

Typically, fundamental geospatial data is created by the mandated data custodian without consulting external stakeholders. As a result, duplicate datasets exist. SDIs were specifically intended to encourage and enable stakeholder collaboration to avoid duplicate data capture. However, as concluded in the previous chapter for the South African case, and as shown by Warnest (2005), organisations require guiding instruments for SDI institutionalisation, more so

when those organisations need to engage external organisations collaboratively (also refer to (Siebritz et al. 2021) and (Siebritz et al. 2022)). The collaboration framework therefore utilises principles and mechanisms that extend to the interorganisational level (refer to Section 6.2.4).

8.3 Principles that underpin the Collaboration Framework

8.3.1 Principles of the UN-GGIM IGIF

The collaboration framework is underpinned by the overarching IGIF principles. The IGIF published by the UN-GGIM provides an integrated approach to the management of geospatial resources from a national perspective (also refer to Section 2.3). It positions NSDIs as one of the enabling platforms to achieve national objectives (UN-GGIM 2019a). As a participating member of the UN-GGIM: Africa, South Africa, through the CSI supports the IGIF implementation from the SDI perspective. The collaboration framework presented here, aims to contribute to that goal. The IGIF was designed at the country level, while the collaboration framework is centred around the provision of specific geospatial datasets, which dictates the level of stakeholder participation.

The seven IGIF principles, which the collaboration framework intends to pursue, are: 1. strategic enablement, 2. transparent and accountable, 3. reliable, accessible and easily used geospatial, 4. collaboration and cooperation, 5. integrative solution, 6. sustainable and 7. valued and leadership and commitment (UN-GGIM 2018a). Principles 2, 3 and 4 relate more directly to the collaboration framework. Each of these high-level principles are expanded upon in the IGIF Implementation Guide, specifically Strategic Pathways 4: Data (SP4) and 7: Partnerships (SP7). SP4 is a geospatial data framework to assist, especially data custodians with the management of their data. The guiding principles thus relate directly to those data activities and processes that result in good quality, useful, accessible geospatial data. The guiding principles are shown in Figure 8.2, which is an extract of the overall SP4 structure. The SP4 principles are listed as: governance, consistent identification, quality management, metadata, standards, accessibility, reusable formats, authoritative, timeliness, provenance, integrity, demand driven, efficiency, security and respected rights.

Strategic Pathway 7 "...establishes cross-sector and interdisciplinary collaboration, cooperation and coordination with all levels of government, geospatial industry, private sector, academia, and the international community" (UN-GGIM 2022). The purpose of such collaboration and cooperation is to maximise the available resources, rather than waste it by duplicating efforts and investment (UN-GGIM 2022). The guiding principles for SP7 are shown in Figure 8.3, which is an extract of the SP7 structure. The SP4 principles are listed as: mutual respect, trust and understanding, leadership, commitment and empowerment, shared visions and goals, learning and development, transparency and communication, clarity and realism of purpose and scope, performance management and accountability.

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Figure 8.2: Extract of IGIF Implementation Guide, Strategic Pathway 4: Partnerships overall structure. Source: (UN-GGIM 2022)

Figure 8.3: Extract of IGIF Implementation Guide, Strategic Pathway 7: Partnerships overall structure. Source: (UN-GGIM 2022)

8.3.2 Principles for Achieving 'Open' SDIs

From the SDI perspective, the guiding principles of SP4 and SP7 may be realised through 'open' SDIs (Vancauwenberghe & van Loenen 2017, van Loenen 2020). To summarise Section 2.2.2, 'open' SDIs are characterised by: 1. SDIs that apply the open data principles, as defined in the Open Data Charter (Open Data Charter n.d.), 2. open SDI governance and not only open data, which means that 3. non-governmental actors are seen as important stakeholders and 4. data is made available without restrictions to users on its use or reuse.

The open data principles for access to data are:

1. Open by default
2. Timely and comprehensive
3. Accessible and usable
4. Comparable and interoperable
5. For improved governance and citizen engagement
6. For inclusive development and innovation

The open data principles align with the SP4 and SP7 guiding principles, although different terminologies are used in some instances. For example, the open data principle 'comparable

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and interoperable' may be cross referenced with the SP4 guiding principle 'standards', which should be implemented to "enhance integration and interoperability of individual and disparate data sets" (UN-GGIM 2022).

8.4 Framework Mechanisms

The mechanisms approach to enterprise data governance as proposed by Peterson (2004) (refer to Section 2.4.5), was extended to the interorganisational level and used to construct the recommendations for a collaboration framework. This approach is ideal because the collaboration is centred around governance for improved access to data. Furthermore, the interrelated mechanisms include the elements that are required for a collaboration framework. The original approach by Peterson (2004) comprises three mechanisms, structural, procedural and relational. A forth mechanism was introduced for the collaboration framework, evaluative mechanisms, as shown in Figure 8.1. This mechanism was introduced to accommodate the coordination, monitoring and evaluation role proposed for the CSI. In the original model this function is performed within the enterprise (or organisation).

The four mechanisms are discussed next; each mechanism contains three parts, the structures which refers to the elements of the mechanism, the instruments utilised to implement the elements - these may be strategic, technical or administrative in nature (Verhoest et al. 2007, Vancauwenberghe & van Loenen 2017, Crompvoets et al. 2018) and thirdly, the influences which may be likened to the 'antecedents', as proposed by Abraham et al. (2019) in their stakeholder collaboration framework.

8.4.1 Structural Mechanisms

As per Section 2.4.5, structural mechanisms are the formal groupings of stakeholders, their roles, responsibilities and the level of decision-making power they possess.

Table 8.1 presents a summary of the structural, procedural, relational and evaluative mechanisms for the collaboration framework. In the table, the structures grouping is given in the first column, the structures are listed in the second column, the proposed instruments in the third column and the intervention proposed for CSI's undertaking is listed in the fourth column.

MECHANISMS FOR COLLABORATION FRAMEWORK

Group	Structures	Proposed Instruments	Proposed CSI Intervention
STRUCTURAL MECHANISMS — SDI Structures	SDI coordination body Policy-maker Secretariat Subcommittees Working groups Steering groups Advisory boards	1. SDI strategic plan 2. SDI implementation plan 3. Terms of reference (ToR) for coordinating body 4. Program of work for coordinating body	1. Develop SASDI strategic plan that includes stakeholder roles and responsibilities (Crompvoets et al. 2018); review & establish clear SASDI vision (Siebritz et al. 2021) 2. Develop SASDI implementation plan 3. Revise CSI ToR to align with reviewed SASDI vision & include all stakeholder roles 4. Revise CSI program of work to align with ToR 5. Establish advisory board to enable bottom-up influences
	Data standardisation body	1. Agreements between SDI coordinating body and standardisation bodies 2. Standards for geospatial information	1. Establish formal agreement between CSI and SABS/TC211 for the provision of standards; facilitate strategic alignment 2. Develop/revise program of work for Standards Subcommittee as per SDI strategy and user needs

Custodian /Producer			
	Intergovernmental structures	1. Interactive forums or provincial coordination for SDI implementation (e.g. provincial forums as proposed by Siebritz et al. (2021)) 2. Standard operating procedures (SOP) for intergovernmental engagement	1. Establish/facilitate/support forums toward SASDI implementation 2. Develop guidelines for SOP for intergovernmental engagement
	Municipal council and administration	1. SDI awareness and capacity building initiatives 2. Municipal strategic plans for geospatial data governance	1. Raise awareness at municipal forums (e.g. Municipal Managers Forum and ICT Managers Forum) 2. Provide SDI guidelines to municipalities for their strategic plans
	Legislative custodian Coordinating custodian Data custodian Producer	1. Legal mandate 2. ToR for coordinating custodian 3. Custodian appointment letter 4. Service level agreements, bid specifications, data licensing framework	1. Implement shared custodianship roles 2. Provide assistance to coordinating & data custodians with ToR 3. Appoint custodians, not only national data custodians 4. Develop data licensing framework for municipal service providers
	National Mapping Agency (NMA)	1. NMA strategic and operational plans 2. Stakeholder agreements coordinated by NMA	1. Provide coordination guidelines & support to NMA 2. Appoint NMA as coordinating custodian, with clear responsibilities

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Mechanism	Structure		
PROCEDURAL MECHANISMS	Organisational Structures	Organisation Data coordination committee Data quality person/unit	1. Organisational strategic plan 2. Data governance plan with defined domain 3. Business plans and SOP 4. Data architecture (models & standards)	1. Provide guidelines for organisational data governance plans Provide assistance with for data architecture
RELATIONAL MECHANISMS	Network Structures	Academia Parastatals Users Network relationships & messages	1. Collaboration agreement 2. Collaboration plan 3. Collaboration project plan 4. Communication plan	Provide guidelines for collaboration agreements Develop guidelines for SOP for intergovernmental engagement (see Intergovernmental structures)
		Broker	1. Guidelines for the EMC/metadata capture 2. Metadata standards metadata provision plan 3. SLAs	1. Negotiate service level agreements 2. Develop and maintain EMC 3. Provide training and guidelines for metadata standards implementation
EVALUATIVE MECHANISMS		Data Subcommittee	1. SDI Implementation plan 2. Indicator framework SDI impact analysis	1. Develop/review SDI implementation plan 2. Develop indicator framework & system for continuous monitoring 3. Undertake SASDI impact analysis
		SDI users	1. User needs analysis 2. Stakeholder engagement plan	1. Undertake user needs analysis 2. Develop stakeholder engagement plan

Table 8.1: Summary of the structural, procedural, relational an evaluative mechanisms for the collaboration framework

8.4.1.1 SDI Structures

There are already a number of studies related to SDI stakeholder roles (Hjelmager et al. 2008, Cooper et al. 2011, Béjar et al. 2011, Cooper et al. 2013, 2014). Since the framework addresses stakeholder collaboration, only those SDI roles that are essential for collaboration are discussed. Firstly, an SDI coordinating body is responsible for the development and implementation of the SDI. According to Cooper et al. (2011), this stakeholder may also be referred to as the 'decision-maker'. Typically, this body would appoint various subcommittees or working groups to undertake work in specific areas of the SDI (Coetzee et al. 2018, 2019). It may also appoint steering groups, who focus on specific areas of the SDI, but they are more strategic in nature and the SDI coordinating body may grant them decision-making power.

The role of the policy-maker is also important, as they decide on the policies that the SDI will pursue (Cooper et al. 2011). Administrative support may be provided by a dedicated secretariat, meaning that it would have allocated funding for the SDI (Cooper et al. 2011). It may also be referred to as an operational body (Béjar et al. 2011). To enable collective decision-making, an advisory body may be established to represent the interest of those stakeholders other than central or national government, such as the local sphere, private sector and civil society (Vancauwenberghe & van Loenen 2017, Crompvoets et al. 2018).

In South Africa, the CSI is the coordinating body responsible for the development and implementation of the SASDI. Their role also includes defining stakeholder roles and responsibilities. Furthermore, they must advise the responsible departmental Minister (currently the Minster of the DARD & LR) on SDI-related matters and report on the progress of the SASDI, annually (South African Government 2003a)[section 6]. The CSI thus holds the decision-making power over the SASDI and the policies that it pursues. Therefore, it is also the policy-maker.

Since its inception, the CSI has established subcommittees "for the effective performance of its functions", (South African Government 2003a)[section 10(a)]. For at least the last three CSI terms, six subcommittees were established that undertake work on behalf of the CSI. In previous years, the CSI also established working groups that were tasked with research for a South African Geospatial Information Management Strategy (SAGIMS) (Siebritz et al. 2021). However, the working groups were eventually dissolved due to financial constraints and the strategy was never developed. Lastly, the National Spatial Information Framework (NSIF), which is a directorate within the DARD & LR, is the secretariat to the CSI, undertaking the administrative duties.

8.4.1.2 Data Standardisation Body

There are two international standardisation bodies for geospatial information, the Technical Committee of the International Organization for Standardization, ISO/TC 211, Geographic information/Geomatics, and the Open Geospatial Consortium (OGC). The SABS/TC 211, Geographic information, the local mirror committee for the ISO/TC 211 was established in

South Africa in 1999 (then called the SC71E) (Siebritz et al. 2021). The SABS/TC 211 operates through the South African Bureau of Standards (SABS) as the body that develops and adopts national standards for geographical information. The SABS and thus, the SABS/TC211, acts independently from the SASDI, although a number of the SABS/TC 211 participants have over the years, also participated in the SASDI in their capacity as experts in geographic information standardisation. As a result, the CSI has adopted a number of standards that they recommend to data custodians (Siebritz et al. 2021).

8.4.1.3 Intergovernmental Structures

Since the collaboration framework is intended to facilitate interorganisational relationships, the intergovernmental structures must also be considered as a contributing structural mechanism. This aims to address the second generalised statement made in Section 7.7.3:

Municipalities require greater intergovernmental support with their geospatial data governance and management. More specifically, they require provincial government to coordinate applicable geospatial data standards for municipalities.

Intergovernmental relations are directly related to the political and administrative system of a country. Thus, the way intergovernmental relations are described here, is particular to the South African democratic republic. In South Africa, the Intergovernmental Relations Framework (IGRF) Act, No. 13 of 2005 applies to national, provincial and local government for a cooperative government, as outlined in the Constitution (South African Government 1996), and section 4 of the IGRF Act (South African Government 2005). The purpose of the Act is: "(a) coherent government, (b) effective provision of services, (c) monitoring implementation of policy and legislation and (d) realisation of national priorities", by facilitating coordination amongst the spheres of government (South African Government 2005)[section 4]. The section of the Act that support the collaboration framework are, section 5 (b) and (d). Firstly, organs of state who are affected by any decision or action by another organ of state, should be consulted formally as per existing legislative procedures (such as the land use application process provided for in SPLUMA), conventions or agreements. Direct engagement or "any relevant intergovernmental structures may be used for consultation" (section 5 (b)). Secondly, the Act condemns duplicate efforts or jurisdictional contests (section 5 (d)).

Because provincial governments are required to directly engage municipalities, it is ideally suited to coordinate SASDI implementation amongst municipalities. As stated by Siebritz et al. (2021) though, there is no specific mandate for provincial government to coordinate SASDI implementation in the local sphere. Provincial forums that relate to geospatial-related information and technologies were established in two provinces, but these do not deal directly with SDI implementation or the practical aspects thereof, like standards implementation.

8.4.1.4 Municipal Council and Administration

The administration of municipalities is prescribed by the political and administrative system of the country. In South African each municipality is governed by a council, which holds the political decision-making power. The administration implements those decisions. The council delegations are derived from national, provincial and municipal legislation (refer to Section 6.3.1). As emphasized by the participants of the municipal interviews, without this delegation, the municipal administration cannot act. The council's role in SASDI implementation is thus vital for municipalities. However, as the results of this study has shown, generally the awareness of SASDI is low in municipalities. The municipalities where their councils have taken up their responsibilities in terms of the SDI Act, have shown significant progress toward SDI implementation (refer to Section 7.7).

8.4.1.5 Custodians and Producers

The term 'custodian' is common in SDI and generally, within organisations. It typically refers to an organ of state that has a legal mandate to capture, maintain and disseminate a particular dataset. Cooper et al. (2011), in their formal model for SDI stakeholders, proposed a 'producer' role, which they define as "a stakeholder who produces SDI data or services". 'Custodian' and 'producer' may be seen as synonymous, but for the collaboration framework a distinction is made - the stakeholder must have the legal mandate to produce a certain dataset. The term 'data custodian' is therefore adopted. The purpose of the legal mandate is for accountability and to avoid duplicate data capture. In addition, as discussed above, municipalities operate strictly through delegated instructions derived from legislation.

In Chapter 6, three shared custodianship roles were proposed for the geospatial land use rights datasets that are produced by South African municipalities, a legislative, coordinating and data custodian. These custodianship roles have been integrated into the collaboration framework and can be applied to other datasets, using the same definitions that were proposed. It may be obvious, but the three custodians must have continuous engagement, which should be defined in the SDI governance. The recommendations in this chapter provide a good starting point and may be expanded upon by the CSI.

The legislative custodian is straight-forward, it refers to the organisation, department or departmental Minister that is responsible for the implementation of and compliance with a specific piece of legislation. This custodian would have drafted the legislation and may be mentioned in the legislation. The existing SASDI policies do not make provision for a legislative custodian in its governance.

The coordinating custodian coordinates data capture for specific datasets. This role is particularly useful when datasets that are governed by different jurisdictions need to be aggregated, such as municipal or provincial datasets. Currently, the SASDI policy on dataset governance describes a 'base data set coordinator' who is responsible for overseeing the 'base spatial data custodian' and

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the 'base attribute data custodian' that are involved with a particular dataset. The coordinating custodian proposed in this research is more generic, in that it may coordinate various aspects of and stakeholders involved with the data.

8.4.1.6   National Mapping Agency

Most countries have a National Mapping Agency, although their functions vary significantly. Common to all is the vast amount of geospatial data they produce, maintain and distribute. Consequently, a wide variety of users rely on the availability of this data, including other organs of state. Because of this, NMAs have assumed the role of the coordinator for data that is produced by other organs of state (Coetzee et al. 2018, 2019).

Siebritz et al. (2021) placed great emphasis on the need for the South African NMA to "provide coordination, guidance and support to municipalities with respect to the availability and access to relevant geospatial information". This sentiment was echoed during the municipal interviews.

8.4.2   Influences on the Structural Mechanisms

For the structural mechanisms, the influences at the national level are applicable, these include, the legislative environment, the financial environment and the country's national strategic objectives. Janssen (2008) proposed a legal approach for assessing SDIs (refer to Section 2.5.3). Their framework has three levels of assessment, the compliance, coherence and quality of the legislation. Compliance assesses whether the behaviour and implementation of the SDI elements comply with legislation and proposes that changes be made if non-compliance is found. Secondly, coherence assesses the SDI legal framework as a whole, with aim of determining whether the applicable rules are complementing or contradicting. Thirdly, the quality assesses whether the SDI legal framework enables the SDI to obtain its goals. This approach may be very useful in determining the influence that the legislative environment has on the SDI. Siebritz et al. (2021) also recommended this type of assessment for the SASDI legal framework.

The financial environment has a more obvious impact on the SDI; if financial resources are limited, the SDI achieves less. However, such limitations may be a motivation for initiating collaborations, as a way to maximise the available resources. Even in the absence of limitations, innovative methods to better manage resources should be pursued nonetheless.

SDIs derive their strategic objectives from national strategic objectives. Fortunately, national strategic objectives are set out for the medium- to long-term, thus the SDI does not need to derive a new strategy annually. However, annual review is still required.

8.4.3 Procedural Mechanisms

Procedural mechanisms encompass all the interrelated business processes within an organisation and the rules and standards that are embedded within those processes.

8.4.3.1 Organisational Structures

For the collaboration framework, the procedural mechanisms refer to the organisational level. The first structure is the therefore the organisation, which represents public organisations that have a mandate to produce geospatial information, whether directly or indirectly. Formal collaborations are established between organisations.

In South Africa, not all organisations have an explicit mandate to make geospatial information available to users, like the NMA for example, whose vision is to be "South Africa's foremost organisation supplying fundamental geospatial information" (Chief Directorate: National Geospatial Information 2020). Municipalities carry the mandate to provide services to the public. They rely heavily on the availability of geospatial information to fulfil this mandate. Most of the geospatial information they require, is produced internally; otherwise they source from external data sources.

The results from the municipal interviews highlighted two other important roles within the organisation; these have been included in the collaboration framework. At least two municipalities mentioned that they had established an internal committee to coordinate data capture amongst the municipal departments. The committee serves two purposes, firstly, to ensure that departments do not capture duplicate datasets and secondly, to represent user needs - this may be from the departments or external users. The second role identified from the interviews, is the person responsible for ensuring data quality, although there may also be a dedicated team or unit that carries the responsibility.

The last structure within the procedural mechanism is the service provider. As discussed in Chapter 7, municipalities often procure the services of private companies to capture, maintain and/or disseminate the data for which they have a mandate to provide (refer to Section 7.7.5). The role of the service provider is thus an important consideration in the collaboration framework. The 'producer' role was adopted to denote service providers (Cooper et al. 2011) (previously discussed as a structural mechanism).

8.4.3.2 Influences on the Procedural Mechanisms

Four main influences can be identified at the organisational level, resource availability, the technological environment, organisational culture and organisational data needs. Similarly to the earlier discussion regarding the financial environment, a lack in resources creates an opportunity for the organisation to seek out new and creative ways to meet their objectives.

Participants from the municipal interviews revealed some of the ways in which they have sought to overcome their challenges. One participant explained that they had developed a GIS strategy with a simplified approach, which is more appealing to those internal departments that under-utilise GIS and geospatial information i.e. they intend to raise awareness and build capacity internally (Municipality 2: Participant 2 2021).

The state of technology within an organisation is dependent on the available budget, but the organisation's mission and long-term objectives are also important determinants. One such example that was seen with the municipal interviews, is Municipality 1. Because they prioritised access to data, they became one of few municipalities to develop an online data portal, where any user may access their unrestricted data (Municipality 1: Participant 2 2022a,b). Resource availability is another aspect that influences the state of an organisation's technology. One interview participant explained how they had acquired what was meant to be a state-of-that-art geospatial data system and had spent significant budget on it, but in the end the system failed to deliver what was intended. The participant attributed this debacle to the fact that the municipality did not have the right skilled person to advise on such matters (Municipality 4: Participant 1 2021).

The above discussion is closely related to the organisational culture. Understanding and managing the organisational culture can be complex, because it constitutes all the individuals' attitudes, perceptions, beliefs etc. (Ajzen 1991). The role of organisational culture on the municipal land use application process was discussed in Section 7.5. Organisations may implement cultural and diversity plans to address the barriers that exist.

Organisational data needs are less subjective than the afore-mentioned influences. Because organisations are bound by their legislative mandates, their data needs should align with the organisational objectives.

8.4.4   Relational Mechanisms

Relational mechanisms facilitate collaboration, coordination and knowledge-sharing amongst stakeholders.

8.4.4.1   Network Structures

The relational mechanisms refer to the collaboration itself, in other words the interorganisational level. The collaboration network comprises stakeholders, their relationships, the messages and/or geospatial data that is relayed via the network relationships. Many of the stakeholders that are part of the collaboration framework, have already been introduced in the previous sections. In addition, and in line with the principles of an 'open' SDI, the network promotes the participation of non-governmental stakeholders. Further to those stakeholders already mentioned, academics may also provide a valuable contribution. They could provide expert

advice or make resources available, such high-performance computing power or research undertakings that serve the collaboration goal. The SDI Act, in section 5(2)(h) calls for "one person involved in the teaching or research of Geographic Information Science" to serve on the CSI (South African Government 2003b). Over the years, representatives from the University of Cape Town, University of Pretoria and the CSIR have been appointed in this role. These relationships may be leveraged for future collaborations.

South Africa, like many other countries also has state-owned enterprises or parastatals, which are organisations owned and controlled by the state, to provide services to the state. In the past, at least one such parastatal, who at the time produced a national geospatial building count dataset, was involved in the SASDI. The dataset was used by many organisations.

User groups may also be included as a network stakeholder. Cooper et al. (2011) define the role of a 'broker', which is "a stakeholder who brings users and providers [or custodians][1] together and assists in the negotiation of contracts between them. They are specialised publishers and can maintain metadata records on behalf of an owner of a product. Their functions include harvesting metadata from producers and providers, creating catalogues and providing services based on these catalogues". Based on section 4(d) of the SDI Act, this responsibility should be taken up by the CSI. Between 2015 and 2018, the CSI made the EMC available to data custodians for the submission of their metadata records (Siebritz et al. 2021). The unavailability of the EMC since 2018 is because the CSI relied on a service provider to maintain the platform but did not renew the service contract in time.

Stakeholders are connected by their relationships (refer to Section 6.3.1). Any stakeholder may have any number of relationships that serve the collaboration goal. At the very least, relationships require an exchange of messages between stakeholders. This may be referred to as the communication flow of the network. Although, technically, collaborations do not require that messages be two-way. Peterson (2004) also includes knowledge-sharing, for the purpose of building capacity as a relational mechanism. This form of communication requires planning and structure. Other than messages, stakeholders may also exchange geospatial data, for example, one stakeholder may be responsible for capturing a base dataset, while another may enrich the same dataset by contributing attribute information. This type of relationship is also encouraged in the SASDI policy documents (Committee for Spatial Information 2015).

8.4.4.2 Influences on the Relational Mechanisms

The influence of organisational data needs and organisational culture were discussed earlier - these also apply to the relational mechanisms, but in the interorganisational context. The need for reliable data remains one of the biggest drivers for stakeholder collaborations in the geospatial information context. Organisations may resolve to enter into a collaboration as a means to acquire the data they need. To ensure that the data needs from different participating

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[1]Inserted by researcher

organisations are met, due diligence is required.

Organisational culture may have an impact on the success of the collaboration. This may be controlled to certain degree through the relational instruments proposed in Table 8.1. These instruments contain the goal and scope of the collaboration, the stakeholder roles and responsibilities, and it may also prescribe the expected behaviour of participants, such as cultivating trust by delivering on project milestones.

The third aspect that influences the collaboration, is the specialised resources that are made available from participating organisations. Peterson (2004) states that "the essence of relational capability is the integration of domain-specific expertise and tacit knowledge". Again, the process of due diligence should be undertaken to maximise the skills and expertise that will benefit the collaboration.

8.4.5   Evaluative Mechanisms

The evaluative mechanisms are specifically designed for the SDI coordinating body to track and monitor the progress of stakeholder collaborations, and to determine the impact of such collaborations on the strategic objectives of the SDI.

8.4.5.1   Evaluative Structures

The structural mechanisms focused on the strategic SDI structures and instruments to facilitate stakeholder collaboration. The structures of the evaluative mechanisms are for the pragmatic oversight of the collaboration. Establishing SDI subcommittees or working groups to carry out the work of the SDI were discussed earlier. Within the SASDI, a Data Subcommittee was established, whose responsibility it is to appoint base dataset custodians. In comparison with the other subcommittee profiles, the Data Subcommittee is the most suitable to monitor collaborations for improved access to geospatial data.

User groups were introduced under the relational mechanisms, but they were specific to datasets addressed by the collaboration. The SDI user role has gained importance over the years because they determine how effective the SDI is. To distinguish between the collaboration user groups, the term 'SDI user' is adopted here. Between 2019 and 2021, members from the SASDI Education and Training Subcommittee undertook a capacity building project in which they developed a framework to determine user needs within municipalities (refer to Section 4.3.1 and 5.1.2). As a pilot study, municipalities in the Western Cape were invited to attend workshops where they could provide detailed feedback on their data needs and related matters. Valuable insights were gained from the workshops, demonstrating the suitability of the user needs framework. This type of user needs analysis provides a general perspective of data usability and usefulness for the SDI. The same framework can be applied to determine whether a collaboration has provided users with better access to specific datasets. Beyond the day-to-day

user data needs, the CSI should be also able to determine the long-term impact of improved access to data, for example, improved provincial oversight and governance of municipalities.

8.4.5.2 Influences on the Evaluative Mechanisms

The SASDI vision and strategic objectives will have a big influence on the evaluative mechanisms. Siebritz et al. (2021) state that the lack of vision and strategy has led to incoherent management of the SASDI. With these aspects lacking, evaluation and impact analysis becomes meaningless.

Another influence on the evaluative mechanisms, is the state of the CSI's intergovernmental relationships (refer to Section 7.7.3). The CSI needs to have a way of determining the type and level of impact of the SASDI on national objectives. Relationships with the respective Office of Premier who undertake monitoring and evaluation at the provincial level, the parliamentary portfolio committees who are responsible for oversight of the respective departments, the DPME etc. are vital to determining the impact of SASDI.

8.5 Chapter Summary

This chapter provided recommendations for a SASDI stakeholder collaboration framework. The conceptual model for the framework was derived from the data governance literature, more specifically the mechanisms model proposed by Peterson (2004). Furthermore, the land use case study provided valuable details that were used to supplement the collaboration framework and make it applicable to the South African context. The framework is meant to be implemented by the CSI, the coordinating body of the SASDI in a holistic manner. A holistic approach requires a sound SDI governance and a clear vision. This would be first step for the CSI to implement the proposed collaboration framework.

The mechanisms approach provides a practical way for the CSI to coordinate, monitor and evaluate stakeholder collaborations that focus on access to geospatial data. Importantly, the collaboration framework enables bottom-up influences from the local sphere with the aim of improving access to data, especially to municipalities. Many of the structures that were proposed in this chapter are already in practice within the organisational environment and within the SASDI. However, review and improvement of the existing instruments is required. A number of instruments have been proposed to facilitate implementation of the structures, some at NSDI level and others at the organisational and interorganisational level. The possible influences for each mechanism were also discussed. The CSI may not have control over the organisational and interorganisational instruments, but they may provide guidelines in this regard. The instruments, guidelines as well as the balancing of influences will go a long way to minimise the risks involved in collaborations, and ultimately result in improved access to geospatial data.

There are a number of SASDI instruments that have never been developed or implemented,

like a SDI strategy and implementation plan. The SASDI could benefit greatly from such instruments. Fundamentally though, the success of such these instruments and thus the success of the SASDI, depends on the willingness of the CSI to decentralise the decision-making power, which allows for bottom-up influences.

Chapter 9

CONCLUSIONS

9.1 Introduction

The aim of this thesis was to propose a solution for the governance challenges related to geospatial datasets in the context of SASDI. This research was motivated by the inadequacies of the SASDI governance, and the consequences thereof, such as limited access to authoritative, good quality geospatial information. For many users this is still problematic, especially municipalities who depend on the availability of such information to fulfil their mandate for delivering services to the public. This thesis advocates for stakeholder collaboration as a means to improve access to geospatial information. The SASDI coordinating body, the CSI is perfectly positioned to coordinate, support and monitor such collaboration.

This chapter provides a brief overview of the key findings and the conclusions that were derived from the analysis. The last section presents ideas for further work.

9.2 Research Objectives

The objectives of the research are:

1. to understand possible governance options based on an investigation of the theory for SDI governance, SDI coordination approaches, and collaborative stakeholder theory;

2. to review the status quo of the SASDI development and implementation, with a focus on governance and municipal involvement

3. to understand and identify the shortcomings of the governance structure and business processes for the municipal land use application process in South Africa; and

4. based on the above, propose a collaboration framework for SASDI stakeholders to improve governance of and access to fundamental geospatial datasets.

Each of the research objectives are discussed in the sections that follow.

9.2.1 Objective 1

Before recommending a collaboration framework, or any instrument for that matter, it was important to understand the current state the SASDI, the intended future trajectory and the challenges that hamper its progress. The review required for this study was combined with the work undertaken for the Municipal Capacity Building Project. A detailed longitudinal review of the SASDI development and implementation was conducted for the last four decades. The results were presented in Chapters 4 and 5, which have also been published as articles in 2021 and 2022, respectively.

Because the review covered such a long period, it was invaluable for this thesis - it demonstrated how the SASDI governance has changed over time and highlighted the factors that have led to the inadequacies in its current state. The study revealed that the SASDI has been controlled hierarchically by national government and that nothing has changed in the coordination thereof over time, despite the significant changes that SDIs have undergone globally. Fundamental issues such as a vague, outdated SASDI vision and no strategic plan to direct the evolution and sustainability of the SASDI, underpin lack of progress.

Further to this, it became very apparent that municipalities (and other non-governmental stakeholders) have been overlooked as an important SASDI stakeholder. As a result, their awareness of the SASDI and thus, their participation has remained low since its inception. No opportunities or mechanisms for bottom-up influence have been made available through the CSI. Also, the pursuit of interdependent government spheres as legislated in the Constitution of the South Africa, have not been leveraged to enable participation of sub-national government.

9.2.2 Objective 2

Chapter 2 presented the pertinent literature on the evolution of SDIs, from the international perspective. There have been significant changes in the purpose, coordination and use of SDIs. Traditional hierarchical, product-focused SDIs would never be have been able to adequately respond to the evolving data revolution. Instead, the literature advocates for 'open' SDIs that have a sound governance, proactively involve sub-national government and non-governmental stakeholders and facilitate unrestricted access to good quality geospatial information. Another important international development in geospatial data governance is the IGIF, published by UN-GGIM the 2018. In addition to 'openness', the IGIF calls for an integrated SDI, where geospatial information serves multiple users from various spheres and sectors.

Defining SDI governance is complex - the practice has been to apply governance definitions from other disciplines. Definitions from pubic administration have been popular, since SDIs are typically government initiatives and are conducted according to public administrative principles and rules. In conjunction with the definitions, the implementation approaches from this discipline have also been applied to SDIs often. Previous research shows that the hierarchy, network and market implementation approaches are best used in complement. Further to the SDI governance,

the literature on data governance was also reviewed. The developments in this field make it suitable for defining SDI governance or it may be employed as an SDI implementation approach, which focuses on the data aspects.

Once the SDI has been implemented, it must be assessed to determine whether the SDI objectives are being met and whether these objectives are impacting the country's national objectives. This is the ultimate test to determine if the SDI benefits outweigh its costs. A number of assessment methods have already been developed, these were also reviewed in order to select the best method for the SASDI review.

The literature on stakeholder theory and methods for stakeholder analysis form part of the published article in Chapter 6. Understanding the fundamentals of stakeholder theory was vital for this thesis because, it enabled the researcher to ensure that the ideologies from the theoretical frameworks from different disciplines are aligned. In this case, it was multi-stakeholder, interorganisational stakeholder networks that promote bottom-up influences.

9.2.3 Objective 3

Analysis of the municipal land use application process was split into two phases. The first phase is presented in Chapter 6. The purpose was to determine the influences of the various stakeholders on the land use application process, which was the case study selected for this research. A statutory study was undertaken where the stakeholders and their roles were determined from the spatial planning and land use management legal framework. The results were presented quantitatively (i.e. an average percentage influence for each stakeholder) and qualitatively, as a discussion. Based on the results, shared custodianship was proposed for the municipal land use application process, a legislative custodian, a coordinating custodian and a data custodian. These roles were incorporated into the recommendations for the collaboration framework.

Phase two, as presented in Chapter 7, was the empirical study. A number of semi-structured interviews were conducted with representatives from municipalities in the Western Cape and the Gauteng provinces. This method of data collection proved highly effective, because the participants provided rich responses to the questions. They also voluntarily spoke about other aspects that were related to the topic. The limitations of this type of data collection are, 1. interviews could not be conducted with more municipalities in other provinces due to the time constraints and 2. the process was labour intensive and time-consuming.

An interpretive process was used to analyse the interviews and draw suitable conclusions. The results were presented qualitatively. Firstly, an indicator assessment was undertaken, and a summary was presented for each municipality in Appendix L.12. Secondly, the results were presented as themed discussions, covering topics such as the implementation of land use management, organisational culture, geospatial data management and the SDI implementation

in municipalities.

The chapter concludes with a comparison of the results from the two phases. There were no significant differences between the two sets of results, generally findings are in agreement.

9.2.4   Objective 4

The recommendations for a SASDI stakeholder collaboration framework were presented in Chapter 8. The domain of the framework is improved access to useful, usable geospatial data, which was one of the main challenges that municipalities experience with geospatial data. A model for the framework was proposed, using a mechanisms approach from the data governance literature. For each of the four mechanisms, the structures, instruments and influences were proposed. These were first defined more generically to promote adaptability. Then, using the results from the case study, context-specific guidelines were proposed. In the framework, the CSI takes up the important role as the coordinator of such stakeholder collaborations. Thus, for each mechanism the proposed interventions for the CSI's undertaking were given.

Many of the instruments proposed in the framework are already in practice within the organisational context. However, these need to be extended to the interorganisational environment. In terms of the SASDI instruments, a lot of work is still required - many of the crucial instruments do not exist yet and those that do exist need review, so that the implementation follows an agreed upon strategy. The framework also requires more engagement and cooperation between the CSI and other stakeholders to facilitate interorganisational relationships and structures, especially those stakeholders that perform a governance or monitoring function.

The results of this study have shown how willing and capable municipalities are to implement legislative instructions, provided they have the resources and support they need. This includes the SDI Act. In fact, many participants expressed that the implementation of the Act would greatly assist them with their daily functioning. But to do this, they need the support and guidance from the CSI. This work seeks to assist not only municipalities, but all SASDI stakeholders by clarifying the roles and presenting the means to fulfil their responsibilities.

9.3   Further Work

Further work includes pilot studies to test implementation options for the collaboration framework. The pilot study should include SASDI stakeholder workshops that extends to stakeholders from various sectors. This thesis uncovered a number of factors that influence the municipal space, however they may be many more to consider from other stakeholders. In the spirit of openness and transparency, stakeholders should have the opportunity to review and come to an agreement about the framework. The agreement amongst stakeholders should promote acceptance of the framework and lead to implementation.

Chapter 8 proposed the structures and instruments that require review or development by the CSI. Many of these can greatly strengthen the SASDI governance even without implementing the collaboration framework. This in itself will require presents opportunities for further research and should in fact, precede implementation.

It may also be useful to undertake similar studies to this, but for other fundamental datasets because each dataset presents its own challenges. Of particular interest to municipalities, is the addressing dataset and the cadastral and topographical datasets produced by the national departments. Issue related to interoperability and standardisation pose great challenges for every day users, like the municipalities. Thus, collaboration amongst the stakeholders of these datasets is required. The collaboration framework proposed here may provide the foundation for such collaborations, while the stakeholders involved may provide the details that are specific to the context of the fundamental datasets involved.

Lastly, the proposed collaboration framework was centred around improving access to data, but further work may focus on other crucial aspects such as, data quality and data sharing.

9.4   Chapter Summary

This chapter briefly summarised the findings and conclusions of the thesis. For each of the four research objectives, a description of was provided, explaining how it was addressed.

This thesis is the first practical SASDI governance instrument that aligns with the IGIF. It is also the first instrument to promote collaboration and collaboration that is multi-stakeholder and interorganisational.

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Appendices

A.1 APPENDIX: SDI-related activities and milestones for the different periods

	Before 1994	1994-2000	2001-2009	Since 2010
International context	Development of GIS software products Digitalization and digital cartography First mention of SDI (1990)	The Internet and World Wide Web (Web 1.0) become mainstream (mainly read-only) SDIs are product-based, focusing on datasets and catalogues GSDI established in 1996	Web 2.0 (read-write) SDIs evolve from being process-based and coordinated, focusing on users and their needs, to being uncoordinated and decentralized, aimed at problem solving and decision-making Non-professionals become involved in geospatial data collection and use, e.g. VGI, open data, OpenStreetMap, Google Maps A European SDI is established through the INSPIRE Directive (2007)	Web 3.0 (Semantic Web) Geospatial data is ubiquitous, available on many different devices and used in many different ways UN-GGIM established (2011) UN-GGIM Africa established (2014) In Europe, SDIs are being integrated into e-government infrastructures, focusing on governance IGIF Parts 1 and 2 published by the UN-GGIM
Focus	Changing from people making paper maps to computers making digital maps	Establishing an SDI for South Africa through voluntary participation	Establishment of SASDI, CSI and the EMC through legislation	SASDI implementation through the legislative framework

Legislative framework	Copyright Act No. 98 of 1978	Promotion of Access to Information Act No.2 of 2000	Spatial Data Infrastructure Act No. 54 of 2003 Draft Regulations in support of Act No. 54 of 2003	CSI Policy on Custodianship and CSI Policy on Pricing (2015) SDI Amendment Bill (2012) Draft SASDI Compliance Guidelines (2013) Stakeholder workshops to collect comments on the Draft Regulations in terms of the SDI Act (2016) Initial work on the SA Geospatial Information Strategy (until 2014)
Coordinating bodies	National Programme for Remote Sensing, established in 1975 State Inter-departmental Coordinating Committee for the National Land Information System, established in 1988	CSI, an inter-governmental committee with 3 subcommittees (Policies, Liaison, Technical) Coordinated by the NSIF in the Department of Land Affairs (DLA) SC71E, Geographic information, the local mirror committee for ISO/TC 211, established in 1999	CSI, a statutory body with 6 subcommittees (Policies, Data, Systems, Standards, Marketing & Communication, Education & Training) NSIF in the Department of Rural Development and Land Reform (formerly DLA) serves as CSI Secretariat	SABS/TC 211, Geographic information (renamed from SCI71E)
International involvement	Limited international involvement due to sanctions	South Africa becomes a member of ISO/TC 211 (1994)	South Africa joins the GSDI	GSDI disbanded in 2018 South Africans participate in UN-GGIM Africa working groups

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Available resources	ReGIS, locally developed GIS software, the first GIS to run on the Windows operating system	International GIS providers entered the market when sanctions were lifted SDDF, established by the NSIF	None	EMC outsourced to SAEON, (2015-2018) SASDI website (since 2020)
Outputs	National Exchange Standard (1987) National Topographic Information System, by the CD: NGI (then CD: SM) (1997)	SDDF populated with metadata, mainly by users outside of government EIS/NSIF Special workshop on Africa Spatial Data Infrastructure (1999) 4th GSDI Conference held in South Africa (2000)	Design of a metadata capturing tool based on ISO 19115:2003 SDDF has 3,000 metadata records about public and private sector datasets covering the SADC region SANS 1877:2004, A standard land-cover classification scheme for remote-sensing applications in South Africa SANS 1883-1:2009, Geographic information - Addresses Part 1: Data format of addresses SANS 1883-3:2009, Geographic information - Addresses Part 3: Guidelines for address allocation and updates	SANS 1878-1:2011, South African spatial metadata standard Part 1: Core metadata profile SANS 1880:2014, South African geospatial data dictionary (SAGDaD) and its application SANS 1876:2018, Rules for unique feature identifiers in South African geospatial datasets SANS 1883-2:2018, Geographic information - Addresses Part 2: Addresses data exchange, based on ISO 19160-1:2015 List of fundamental geospatial data themes (2016/17) and datasets for each theme published by the CSI subcommittee on Data Identification and appointment of data custodians

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| Role of municipalities | In the 1980s, larger municipalities, such as Durban, Cape Town, Johannesburg, Randburg, Midrand and Pretoria, acquire GIS software and start capturing (digital) geospatial data | Many changes in municipal boundaries, therefore municipalities focus on integration of their GIS Municipalities participate in the inter-governmental CSI and its subcommittees | In principle, municipalities are represented on the CSI, but no is CSI members are appointed A number of municipalities actively contribute to the development of the South African addressing standard (SANS 1883) | Municipal representatives, each with an alternate member, are appointed as CSI members: - one person representing the National Department for Provincial and Local Government - one person from a local municipality which is mainly rural in character - one person from a local municipality which is mainly urban in character (City of Johannesburg, City of Tshwane) These CSI members and other municipal representatives participate in various subcommittees |

Table 1: SDI-related activities and milestones for the different periods. Only developments during the respective period is shown, not the accumulation of developments

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B.2 APPENDIX: Descriptions of stakeholder connections, their interest and power level

No.	From	To	Description of responsibility	Interest	Power Level
1.	Ministry: Cooperative Governance & Traditional Affairs	Municipality	1. Oversees land use schemes; 2. alignment of authorisations, Municipal Planning Tribunals and application appeals	national	4
2.	South African Local Government Association Municipal Council (Head: Mayor Legislative	Executive)	1. articulates National policies best practices on land use & development planning	National	5
3.	Department: Agriculture, Rural Development & Land Reform	Provincial Legislature	1. provide and review laws and policies on national planning; 2. provide strategic support with land use management	National	7
4.	↑	Municipality	1. may prescribe norms and standards for land use management and land development	National	5
5.	↑	Land use application process	1. sets time frames for approval process	National	1
6.	↑	South African spatial data infrastructure	1. custodian of SDI Act 2. implements infrastructure	National	0
7.	Branch: Spatial Planning & Land Use Management	Provincial Executive	1. may prescribe norms and standards for land use management and land development	National	5
8.	Office of the Surveyor General	Municipal Planning Tribunal (or appointed official)	1. must comply with legal land parcel demarcation	National	2
9.	Office of the Registrar Deeds Registry	Municipal Planning Tribunal (or appointed official)	1. must comply with land tenure	National	2
10.	Department: Environmental Affairs	Municipal Planning Tribunal (or appointed official)	1. must comply with environmental legislation	National	2

No.	Actor	Related entity	Function	Level	Count
11.	South African spatial data infrastructure: Data Subcommittee	Geospatial land use data	1. identifies as national base dataset	National	1
12.	Provincial Legislature	Provincial Executive	1. passes legislation 2. oversees implementation of legislation	Provincial	7
13.	Provincial Executive	Municipal Planning Tribunal (or appointed official)	1. may appoint members	Provincial	6
14.	→	Municipality	1. coordinate & monitor performance 2. resolves conflict in land use management 3. provide guidance on national norms & standards for land use changes 4. support and assist with land use management	Provincial	3
15.	Municipal Administration (Head: Municipal Manager)	Municipal Planning Tribunal (or appointed official)	1. must be part of	Local	6
16.	→	Municipal Council (Head: Mayor Legislative & Executive)	1. report delayed applications	Local	1
17.	→	Land use application process	1. may manage application submissions	Local	1
18.	→	Public (includes Service Providers)	1. must make all land use records available to	Local	1
19.	Municipal Council (Head: Mayor Legislative & Executive)	Municipal Planning Tribunal (or appointed official)	1. passes By-laws 2. establishes MPT	Local	7
20.	→	Geospatial land use data	1. must adopt land use scheme	Local	6
21.	→	Provincial Executive	1. must submit land use scheme	Local	1
22.	Municipal Planning Tribunal (or appointed official)	Land use application process	1. considers all applications and makes final decision	Local	6
23.	Council Advisory Committee(s)	Municipal Council (Head: Mayor Legislative & Executive)	1. advises	Local	1

Table 2: Descriptions of stakeholder connections, their interest and power level

C.3 APPENDIX: University of Pretoria Ethics Approval

ETHICS SUBMISSION: LETTER OF APPROVAL

Miss L Siebritz
Department of Geography Geoinformatics and Meteorology
Faculty of Natural and Agricultural Science
University of Pretoria

Reference number: NAS113/2020
Project title: A Governance framework for SASDI stakeholder collaboration based on experiences from national land use planning

Dear Miss L Siebritz,

We are pleased to inform you that your submission conforms to the requirements of the Faculty of Natural and Agricultural Sciences Research Ethics committee.

Please note the following about your ethics approval:
- Please use your reference number (NAS113/2020) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.
- Please note that ethical approval is granted for the duration of the research (e.g. Honours studies: 1 year, Masters studies: two years, and PhD studies: three years) and should be extended when the approval period lapses.
- The digital archiving of data is a requirement of the University of Pretoria. The data should be accessible in the event of an enquiry or further analysis of the data.

Ethics approval is subject to the following:
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.
- **Applications using Animals:** NAS ethics recommendation does not imply that AEC approval is granted. The application has been pre-screened and recommended for review by the AEC. Research may not proceed until AEC approval is granted.

Post approval submissions including application for ethics extension and amendments to the approved application should be submitted online via the Ethics work centre.

We wish you the best with your research.

Yours sincerely,

Chairperson: NAS Ethics Committee

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences
Ethics Committee

E-mail: ethics.nas@up.ac.za

18 May 2022

ETHICS SUBMISSION: LETTER OF APPROVAL - AMENDMENT

Prof SM Coetzee
Department of Geography Geoinformatics and Meteorology
Faculty of Natural and Agricultural Science
University of Pretoria

Reference number: NAS113/2020 Line 1
Project title: A Governance framework for SASDI stakeholder collaboration based on experiences from national land use planning

Dear Prof SM Coetzee,

We are pleased to inform you that the **Amendment** conforms to the requirements of the Faculty of Natural and Agricultural Sciences Research Ethics Committee.

Please note the following about your ethics approval:
- Please use your reference number (NAS113/2020) on any documents or correspondence with the Research Ethics Committee regarding your research.
- Please note that the Research Ethics Committee may ask further questions, seek additional information, require further modification, monitor the conduct of your research, or suspend or withdraw ethics approval.
- Please note that ethical approval is granted for the duration of the research (e.g. Honours studies: 1 year, Masters studies: two years, and PhD studies: three years) and should be extended when the approval period lapses.
- The digital archiving of data is a requirement of the University of Pretoria. The data should be accessible in the event of an enquiry or further analysis of the data.

Ethics approval is subject to the following:
- The ethics approval is conditional on the research being conducted as stipulated by the details of all documents submitted to the Committee. In the event that a further need arises to change who the investigators are, the methods or any other aspect, such changes must be submitted as an Amendment for approval by the Committee.
- **If Applications using GM permits:** If the GM permit expires before the end of the study, please make an amendment to the application with the new GM permit before the old one expires.
- **If Applications using Animals:** NAS ethics recommendation does not imply that Animal Ethics Committee (AEC) approval is granted. The application has been pre-screened and recommended for review by the AEC. Research may not proceed until AEC approval is granted.

Post approval submissions including application for ethics extension and amendments to the approved application should be submitted online via the ethics work centre.

We wish you the best with your research.

Yours sincerely,

Prof VJ Maharaj
Chairperson: NAS Ethics Committee

E.5 APPENDIX: Stakeholder categories for land use management in South Africa

	Stakeholder Category	Description	Influence Level (Power)
1.	Legislative authority	An organisation, within the spheres of Government that has the legal right to initiate, amend and pass legislation and policies, including legislation and policies for spatial planning and land use management.	7
2.	Strategic direction and support	An organisation or body, within the spheres of Government that has been mandated by legislation to provide strategic direction and support to other organisations within the spheres of Government, specifically to spatial planning and land use management. Strategic direction may be in the form of policies, frameworks, plans, etc. and support may be in the form of guidelines, procedures and best practices.	5
3.	Coordinates, monitors and support	An organisation or body, within the spheres of Government that has been mandated by legislation to: (i) provide mechanisms for coordinating the concurrent plans and activities of the organisations it is responsible for; (ii) monitor the implementation of the SPLUM Act, specifically as pertains to land use management of the organisations it is responsible for (e.g. alignment with National, Provincial, Regional and Local SDFs, adoption and implementation of land use schemes, compliance with land use and land development application processes and compliance with principles, norms and standards); and (iii) provide support to the organisations it is responsible for with the implementation of spatial planning and land use management responsibilities, where support may be in the form of guidelines, procedures, best practices, technical systems or other mechanisms that may be appropriate	3

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#	Stakeholder role	Description	Value
4.	Oversees (Administrative)	This role is not mentioned in the SPLUMA legislation but in the Constitution (e.g. role of Provincial Legislature) and on organisational websites (e.g. CoGTA website). In the true sense of the word, oversees may refer to more interaction which may include direct instructions. It is unclear whether this role may be interpreted as "monitoring".	4
5.	Implements and regulates land use	An organisation or body, within the Local sphere of Government that has been mandated by legislation to consider land use and land development applications and to provide a decision on the application. The decision taken is legally binding.	6
6.	Participates in land use decisions	Any organisation or individual who has the right to participate in the land use management. The participation activities include participation in the adoption or amendment of a land use scheme or land use or land development application. Stakeholders in these categories do not have the legal right to decide on any land use or land development application. Note: This category specifically includes the Office of the Surveyor General and the Office of the Registrar of Deeds who may have assigned the cadastral boundaries and legal ownership of a land parcel prior to a land use or land development application.	2
7.	Uses (geospatial) land use data	Any organisation or individual who uses the land use data made available by a Municipality.	1
8.	Any other influence relationship	Administrative support; advising; reporting; application submission	1
9.	Non-influencing relationship	Any stakeholder relationship that has no influence on land use management in South Africa	0

Table 3: Stakeholder categories for land use management in South Africa

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F.6 APPENDIX: Informed Consent Letter

Dear Participant,

REF: Participation in a research study

We are conducting a field study on the stakeholder influences on the land use application process in South Africa. We are investigating the roles and impact of organisations on this process so that we may understand how the geospatial land use data, which results from this process, is created, maintained and used to answer questions about Spatial Planning and Land Use Management (SPLUM) in South Africa.

Based on the findings from the evaluation, we will design a governance framework for stakeholder collaboration aimed at providing access to geospatial datasets, such as the land use data. By engaging with stakeholders on their existing organisational context, business processes and inter-organisational stakeholder interactions the proposed framework will be applicable to a wide variety of stakeholders.

The research project is entitled: "A governance framework for SASDI stakeholder collaboration based on experiences from national land use planning". This research will assist organisations by proposing innovative ways to optimise the resources they need to capture, maintain and disseminate their geospatial data.

The objectives of the field study are: 1) To determine the organisational practices for the land use application process with respect to the legal framework for SPLUM, 2) To analyse the stakeholder relationships and determine their effectiveness in the provision of geospatial land use data and 3) To design an informed stakeholder collaboration framework to facilitate the management of geospatial datasets.

What does participation entail?

We would like to request your participation in this study. Participation in this study is voluntary.

All data will be treated confidentially and you may request to see your data. Data will be stored electronically at the University of Pretoria for 15 years as part of the ethical requirements of the University. No information identifying you as an individual will be used when writing and presenting the findings of this study.

The semi-structured interviews will be scheduled as a one and half hours ($1\frac{1}{2}$ hr) meeting online or at your office, but at a convenient time for you. I will write your responses on an interview response form. We have attached the interview questions for your perusal.

Who will have access to the results?

The results of this survey may be published in the media, a thesis and/or an academic journal. A summary of our findings will be made available to you on request.

If you have any questions or comments about the study, please contact Lindy-Anne Siebritz lindy-anne.siebritz@dalrrd.gov.za or my supervisor, Prof Serena Coetzee serena.coetzee@up.ac.za.

Kind regards,
Lindy-Anne Siebritz

G.7 APPENDIX: Consent Form

Consent to Participate in this Study

I confirm that the person asking my consent to take part in this study has told me about the nature, process, risks, discomforts and benefits of the study. I have read this form (Information Leaflet and Informed Consent) and I understood the information regarding the study. I am aware that the results of the study, including personal details, will be anonymously processed into research reports. I am participating willingly. I have had time to ask questions and have no objection to participate in the study. I understand that there is no penalty should I wish to discontinue with the study and my withdrawal will not affect any treatment in any way.
I have received a signed copy of this informed consent agreement.
Participant's name: .... (please print)
Participant's signature:............................. Date...................
Investigator's name: .... (please print)
Investigator's signature:............................. Date...................
Witness's name: .... (please print)
Witness's signature:............................. Date...................

H.8 APPENDIX: First Interview Questionnaire - The South African land use application process

Introductions [allow 20 mins]

- Introduce interviewer

- Introduce study and purpose of interview and scope

- Lay ground rules of interview

Problem statement

Various government organisations, including all spheres are required by law to capture geospatial data as per their respective mandates. The data they capture is vital for addressing the national development objectives of the country. At the national level, the data is used to inform policy development and implementation. In this way, it influences decisions that affect every citizen. At the sub-national level, geospatial information drives the day to day operations of organisations. Without good quality geospatial information, organisations struggle to effectively and efficiently manage the country's resources, which inevitably has a negative impact on public service delivery.

Many organisations struggle to provide the geospatial data for which they are responsible, due to problems such as lack of resources, which is particularly true in the municipal space. As a starting point, the South African spatial data infrastructure (SASDI), established by the SDI Act No 54 of 2003 has identified those geospatial data themes that are fundamentally required for country-wide sustainable planning and development. Part of this process is to appoint the custodians that are responsible for the respective datasets for each of the themes.

Land use was identified as one of those fundamental datasets, but no custodian has been appointed yet, because of the multi-stakeholder complexities within the land use management system. Moreover, there is no SASDI framework in place to guide those stakeholders who are involved with the land use data; a framework to leverage the stakeholder relationships that influence the availability and accessibility of the land use data.

Objective of the research

The objective of this research is to provide a governance framework for SASDI stakeholder collaboration in an endeavour to help organisations who are struggling to meet their geospatial data capture mandates. The framework will be based on the land use rights datasets that are captured and maintained by local municipalities. This dataset was chosen because of its multi-stakeholder nature. Thus far, no other dataset presents such complexity. This research seeks to leverage the cooperative, "bottom-up" nature of the land use management system, as is provided for in the Spatial Planning and Land Use Management (SPLUM) Act No 16 of 2013, to propose a collaboration framework for other SASDI fundamental datasets.

During the first phase of the research, stakeholders involved in the land use application process have been identified from the SPLUM legal framework. For each stakeholder, the

average influence they have on the land use rights data was determined. The influence was based on each stakeholder's role and responsibilities within the process for allocating land use rights. For the next phase, stakeholders will be engaged through semi-structured interviews to determine how the SPLUM legal framework facilitates the land use application process in local municipalities and how it enables the interdependencies between the spheres of government.

Purpose of interview

The purpose of the interview is to understand how the land use application process is implemented within municipalities. During the interview, the respondent will be asked about their organisation's/division's role in the process, how external stakeholders are engaged in the process, the management of the geospatial land use data and lastly, their awareness or involvement with the SASDI.

Interview Questions [allow 1 hour]

Land use application process

1. Allow respondent to introduce themselves
2. Briefly introduce generic Municipal land use application as per legislation process
3. Can you explain your organisation's/division's role and job description in terms of the land use application process and the creation of geospatial land use data?
4. How much power do you have to influence the outcome of the process and land use data?
5. Has your organisational established by-laws for land use management?
6. Do you consider your organisation a custodian of geospatial land use data?
7. If yes/ no why?
8. Based on the different/afore-mentioned custodianship roles, who do you think should fulfil the other custodianship roles for geospatial land use data?

Interdependencies and signs of collaboration

9. (including the proposed custodians in the afore-mentioned questions) Who do you have to interact with to complete the stages of the land use application process (including the creation of the geospatial land use data) for which you are responsible?
10. Are the interactions mandated by legislation or required (i.e. need to, to fulfil mandate/function)?
11. If required, why?
12. Can you describe the type of interactions?
13. How frequent is the interaction?
14. Are the relationships formal (e.g. documented agreements), or informal?
15. How do you enforce formal/informal relationships?
16. Are there any other stakeholders that you think should be part of the process?

Geospatial land use data needs

Users

17. Before you stated that you are responsible for capturing land use rights, do you have an approved land use scheme to guide this process?
18. How is the data captured and maintained for individual properties? How is the zoning map data (i.e. SDF) included in the process?
19. Are you allowed to deviate from the LSDF? (are there "special cases"?)
20. Does your organisation/division have decision-making power over how the data is captured?
21. Is your land use scheme aligned with any other municipality (or Provincial office)?
22. If yes, why? How?
23. If no, how does this impact spatial planning in your organisation/provincial and national planning? How does it affect the land use data ito interoperability (e.g. aggregated datasets)?
24. If no, has anyone (or a district level project) requested an aggregated dataset?

Producers

25. Before you stated that you are not responsible for capturing land use data, what do you use the geospatial land use data for?
26. Do you require the data to be changed in any way to better suit your needs?

SASDI awareness

27. (Producer) Are you aware the SASDI has the mandate to establish data standards and mechanisms to build standardised datasets at various levels to allow interoperability of the land use data, which increases the value of the data significantly?
28. (User) Are you aware that under the SASDI, you as a data consumer may put forward your data requirements for existing or planned data capture projects?
29. If no, how much does your organisation know about implementing the SASDI?
30. If not implemented, what limitations do you experience in the implementation?
31. If implemented, how has implementing the SASDI principles/requirements benefited your land use application process? Give examples: increased data-sharing, standardise metadata, increased user access, duplication has reduced, partnerships etc.
32. Which of those principles does your organisation implement anyway?
33. How do you implement it?
34. If not part of land use application process, in general?
35. How do you think the SASDI could assist your organisation?

Closure

36. Ensure all questions have been covered.
37. Explain the process of transcribing the interview.

38. Thank the participant.

I.9 APPENDIX: Second Interview Questionnaire -The South African land use application process (not used)

Interview Questions [allow 1 hour]

Interdependencies and signs of collaboration

1. Review stakeholder relationships previously identified, including motivations, i.e. mandated or required; communication or data flows.
2. Are any of the stakeholder relationships (two-way relationships or collective of interactions) formalised through an institutional arrangement, for example in an MoU/A document?
3. If yes, why was it formalised?
4. How was it formalised?
5. If no, are there informal arrangements?
6. How are the arrangements (formal and/or informal) maintained?

Collaboration fundamentals

7. What is the common goal of the interaction/arrangements?
8. Has it changed over time?
9. If yes, why has it changed?
10. Are there objectives and milestones?
11. What are the expected outcomes of the interactions over time?
12. Do the stakeholders generally trust each other?
13. Is there reciprocity in the relationships? Is it formalised through agreements?
14. If yes, when a stakeholder does not reciprocate, what is the impact?
15. What mitigation processes are in place for this situation?
16. Are there any risks associated with the interactions?

Collaboration Logistics

17. How are collaborations managed and facilitated?
18. What resources have been committed to the interaction/arrangement?
19. How are decisions taken?
20. How are meetings/discussions conducted?
21. What is the frequency of communication (meetings, but also in general)?
22. How are resolutions undertaken/enforced?

Role of contextual factors

23. What are the factors that enable data and communication flows between stakeholders?
24. How does it assist the interactions?
25. What are the factors that limit data and communication flows between stakeholders? (for example: political influence and no/support, technological factors (e.g. band-with

and firewalls/ use of personal internet), institutional/ organisation culture factors (e.g. un/willingness of staff, competing/common goals, in/valuable outcomes), legislation requirements/ restrictions, resource factors (in/ability to travel to attend meetings/workshops, too little staff, skills un/availability)

Closure

26. Ensure all questions have been covered.
27. Explain the process of transcribing the interview.
28. Thank the participant.

J.10 APPENDIX: Follow-up Interview Questionnaire - Geospatial Data Management in South Africa Municipalities, April 2022

Introductions [allow 20 mins]

- Introduce interviewer

- Introduce study and purpose of interview and scope

- Lay ground rules of interview

Problem statement

Various government organisations, including all spheres are required by law to capture geospatial data as per their respective mandates. The data they capture is vital for addressing the national development objectives of the country. At the national level, the data is used to inform policy development and implementation. In this way, it influences decisions that affect every citizen. At the sub-national level, geospatial information drives the day to day operations of organisations. However, many organisations struggle to provide the geospatial data for which they are responsible, due to problems such as lack of resources, which is particularly true in the municipal space. As a result, organisations who rely on this data, struggle to effectively and efficiently manage the country's resources, which inevitably has a negative impact on public service delivery.

The South African spatial data infrastructure (SASDI), established by the SDI Act No 54 of 2003 is intended to assist public organisations with managing their geospatial data. Though the various SASDI capacity building initiatives have been undertaken over the years, to this purpose, municipalities require solutions that are specific to their context. To provide context-specific guidance and solutions to the municipalities, the SASDI policies and frameworks need to be informed by municipalities (i.e. a bottom-up approach). However, there has been no systematic process for engaging with municipalities at this level.

Objective of the Research

The objective of this research is to provide a governance framework for SASDI stakeholder collaboration in an endeavour to help organisations who are struggling to meet their geospatial data capture mandates. The municipal land use application process was used as a case study, as it provides an understanding of various aspects, such as implantation of legislation (in this case the Spatial Planning and Land Use Management (SPLUM) Act No 16 of 2013), intra-departmental inter-organisational collaborations and the geospatial data activities that support the process – all of which will inform the governance framework for stakeholder collaboration.

Semi-structured interviews have already been undertaken with municipal representatives from municipalities in the Western Cape and Gauteng. The participants provided detailed information about the land use applications process. However, the data management is

undertaken by a different functional unit within the municipality, and therefore follow-up interviews will be conducted.

Purpose of interview

The purpose of the interview is to understand how geospatial data is managed in the municipality. During the interview, the participant will be asked to explain the strategy aspects of managing the data, the technical aspects, organisational culture of SDI and/or data management and the stakeholder interactions that are required for managing their data.

Interview Questions

[allow 1 hour]

Strategic Management of Geospatial Data

1. Is there an organisation-wide geospatial data management/ corporate GIS strategy?
2. What kind of data distribution policy does the municipality have?
3. Is there enough political and/or managerial support for effective and efficient data management in the municipality?
4. How would you rate the GIS interest from municipal departments?

Technical Aspects of Data Management

5. Does the municipality have a centralised GIS, distributed GIS or a hybrid system?
6. How are data models implemented in the municipality?
7. Are any data standards used in the municipality?
8. Are any metadata standards used in the municipality?
9. To what extent are service providers employed regarding the municipality's geospatial data management?
10. How would you rate the usability of external data that the municipality relies on (e.g. cadastral data)?

SDI/Data Management Culture

11. What is the municipality's culture on data access and data sharing, both within the organisation and externally to users?
12. How does the municipality avoid duplicate data capture?
13. Does the municipality subscribe to data custodianship? If yes, how is it enforced?
14. Is there an awareness of the South African spatial data infrastructure (SASDI)? If yes, what is the municipality's involvement?

Stakeholders Interactions

15. Are there any formal agreements between municipal departments and the corporate GIS unit regarding the provision, access and maintenance of geospatial data?

16. Are there are formal agreements with external stakeholders regarding the provision, access and maintenance of geospatial data?
17. Are there any collaborations with other organisations regarding the provision, access and maintenance of geospatial data?

Closure

18. Ensure all questions have been covered.
19. Explain the process of transcribing the interview.
20. Thank the participant.

K.11 APPENDIX: Indicator Assessment Framework

INDICATOR ASSESSMENT FRAMEWORK: INPUT SYSTEM COMPONENT

Component	Indicator	Definition	Attribute 1	Attribute 2	Attribute 3
SPLUMA Legislative Framework	By-law & land use scheme	Municipal planning by-law developed in accordance with the SPLUMA (as per sections 6(1)(a), 32(1)) and provincial land use legislation (if available).	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed
	Land use registry & map	A register (hard-copy or digital) documenting land use applications and the decisions taken. The zoning (and the associated land use rights) must also be represented spatially in accordance with an approved land use scheme as per SPLUMA sections 25(2)(c), 18(7), 25(2)(b).	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed
	Municipal Planning Tribunal (MPT) & authorised official	Municipal Planning Tribunal and authorised official is established/appointed to take final decisions on applications as per SPLUMA sections 35(1)-(4).	High: established & fully operational	Medium: established, but not fully operational	Low: not established
	Appeals authority & appeals procedure	Appeals authority and municipal procedures established as per SPLUMA section 51 and SPLUMA Regulations Chapter 4.	High: established & fully operational	Medium: established, but not fully operational	Low: not established

Category	Sub-category	Description	High	Medium	Low
SPLUMA Policy Framework	Application fees	Land use application fees and fees for appeals determined by the municipality in accordance with SPLUMA Regulations sections 14(1)(b), 21(h).	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed
	Legal agreements	A legal agreement entered into by the municipality that is connected with the land use application process.	Restrictive	Enabling	N/A or none in place
	Implementation of Municipal Spatial Development Framework (MSDF)	Municipal Spatial Development Framework adopted as per SPLUMA sections 20, 21 and 22.	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed
Land Use Unit Structure	Municipality category	Municipal category as per Municipal Structures Act No.117 of 1998, that is category A (i.e. metropolitan), B (i.e. district) or C (i.e. local).	Category A (Metropolitan)	Category B (District)	Category C (Local)
	Functional task division (of land use application process)	Similar or related activities of the land use application process are brought together in separate organisational units (Dessers et al. 2010).	High	Medium	Low
Geospatial Data Management	Data management/ GIS strategy	An organisational strategy for the management of data resources. The strategy includes the governance, principles and activities (acquisition, use, distribution, outsourcing etc.) related to the data which will enable the municipality to achieve its objectives.	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed

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Indicator	Description	High	Medium	Low
Centralised/ decentralised GIS	A centralised GIS where municipal departments capture their data; no data is stored locally. OR A hybrid system (or distributed system) where municipal departments capture their data within their respective departments (i.e. locally) and contribute (some of) their data to the central GIS periodically. OR A decentralised GIS where municipal departments capture and store their data within their respective departments (i.e. locally) and no central GIS exists.	High: centralised GIS	Medium: hybrid GIS	Low: decentralised GIS
SDI implementation plan	A plan describing the municipal SDI or their plan to comply with the SDI Act No. 54 of 2003. It includes all SDI components with respect to the municipal context.	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed
Access to internal geospatial data	Municipal departments are able to access the data produced internally (manually or automatically).	High: unrestricted access	Medium: limited access	Low: no access
Access to external fundamental geospatial data	The municipality has the necessary resources to access the external data they require.	High: unrestricted access	Medium: limited access	Low: no access

Table 4: Indicator Assessment Framework: Input Component

INDICATOR ASSESSMENT FRAMEWORK: THROUGHPUT SYSTEM COMPONENT					
Component	Indicator	Definition	Attribute 1	Attribute 2	Attribute 3
SPLUMA Legislative Framework	Internal adherence to time-frames	Municipal adherence to time-frames of the land use application process as per SPLUMA section 44, provincial land use legislation (if available) and municipal by-laws.	High: 100-85%	Medium: 85-65%	Low: below 65%
	Internal adherence to decision-making	Municipal adherence to the decision-making procedures of the land use application process as per SPLUMA sections 40(4), 40(9), 42, SPLUMA Regulations 15(1), provincial land use legislation (if available) and municipal by-laws.	High: 100-85%	Medium: 85-65%	Low: below 65%
SPLUMA Policy Framework	Compliance with Municipal Spatial Development Framework (MSDF)	Municipal compliance with the adopted MSDF when taking a land use decision, as per SPLUMA Regulations sections 15(2)(e) and 18(6).	High: 100-85%	Medium: 85-65%	Low: below 65%
Land Use Unit Structure	Standard Operating Procedure (SOP) for land use application	A documented standard operating procedure detailing each step of the municipal land use application process in accordance with SPLUMA, provincial land use legislation (if available) and by-laws.	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed

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		High	Medium	Low
Land use application system	An electronic system whereby applicants can submit their land use applications and the application progress can be tracked internally, as per SPLUMA section 35(3).	High: automated	Medium: manual	Low: no system
Intra-organisational collaboration	The process whereby the department/unit responsible for processing the land use application collaborates with other affected departments in the municipality in order to reach an informed decision on the application, as per SPLUMA sections 33(2) and 42(1)(c)(iv), (v). Affected departments are required to provide their recommendations in terms of their legislated mandates.	High: coordinated	Medium: some coordination	Low: no coordination
Geospatial Data Management Uptake of custodianship	Custodianship of the land use rights information is assumed by the responsible department/unit. The information is captured according to the adopted land use scheme. The custodian ensures the availability of the information for subsequent processes.	High: custodianship taken up	Medium: custodianship taken up to a certain degree	Low: no awareness
Update land use register	The process of capturing land use applications and the decisions taken in the land use register (hard-copy or digital) as per SPLUMA sections 25(2)(c) and 18(7).	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed

	Description	High	Medium	Low
Capture land use spatially	The process of capturing the decisions taken on land use applications spatially (hard-copy or digital) as per SPLUMA section 25(2)(b).	High: integrated, automated system	Medium: manual system with daily updates	Low: manual system with periodic/regular updates
Implement data model	Land use rights data is captured using a data model. The data model specifies the data structure, feature descriptions, feature rules, model component relationships etc.	High: fully implemented	Medium: in process - developed, not implemented/ not fully implemented	Low: not developed
Implement metadata standards	Standardised metadata is captured for the land use rights data using a metadata standard (internal, provincial or national data standards).	High: national/provincial metadata standard implemented	Medium: internal standard implemented	Low: no standards implemented
Centralised/ decentralised data capture	Land use rights data is captured on a centralised system; no data is stored locally. OR Land use rights data is captured within the land use department/unit and contributed to the centralised system periodically (i.e. distributed system). OR Land use rights data is captured and stored within the land use department/unit and no centralised system exists/ the data is not contributed to the centralised system.	High: centralised data capture	Medium: distributed data capture (i.e. hybrid)	Low: localised data capture

Category	Indicator	Description	High	Medium	Low
	Outsourcing of land use rights data	Land use rights data is captured and maintained by a service provider. OR Land use rights data is captured internally, however external support is provided by a service provider (e.g. maintaining data model integrity). OR Land use rights data is captured and maintained internally.	High: data is captured and maintained by service provider	Medium: data capture process is supported by service provider	Low: little-no outsourcing
	Use of internal geospatial data for land use application process	Internal data (i.e. data produced by municipal departments) are used for processing a land use application.	High	Medium	Low
	Use of external geospatial data for land use application process	External data (i.e. data not produced by municipal departments) is used for processing a land use application.	High	Medium	Low
Stakeholder Engagement	Interorganisational collaboration	The process whereby the department/unit responsible for processing the land use application collaborates with affected organisations in order to reach an informed decision on the application. Affected organisations are required to provide their recommendations in terms of their legislated mandate.	High: coordinated	Medium: some coordination	Low: no coordination

Public participation	The process whereby the department/unit responsible for processing the land use application engages the public to give their inputs on an application in order to reach an informed decision, as per SPLUMA sections 7(e)(iv), (v), 14(1)(d), 16(6).	High: 100-85%	Medium: 85-65%	Low: below 65%

Table 5: Indicator Assessment Framework: Throughput Component

INDICATOR ASSESSMENT FRAMEWORK: INTERNAL INFLUENCES SYSTEM COMPONENT

Component	Indicator	Definition	Attribute 1	Attribute 2	Attribute 3
SPLUMA Legislative Framework	Applicant compliance	The degree to which applicants implement their land use rights. Applicants are obligated to implement the decision taken on their application within the given time period (i.e. no longer than five years), otherwise the application lapses.	High: 100-85%	Medium: 85-65%	Low: below 65%
Data Distribution Policy	Data distribution policy	An organisational policy that describes the principles of and mechanisms for data distribution. The policy describes the level of openness of data (e.g. restrictions on personal information, licensing etc.).	Restrictive	Enabling	Not developed or N/A
Geospatial Data Management	Data access	The degree to which the land use rights data may be accessed.	High: external and internal access	Medium: limited external access and/or internal access	Low: limited/no internal access
	Data usability (standards & formats)	The degree to which the land use rights data is usable to users. The usability depends on the data standards used to capture the data and the output format that is used for distribution.	High	Medium	Low
Stakeholder Engagement	Stakeholder notifications	The degree to which land use decisions are communicated to applicants and affected stakeholders within the prescribed time period, as per the SPLUMA sections 46(1), (2).	High: 100-85%	Medium: 85-65%	Low: below 65%

Financial Systems	Updated rates & taxes	Property rates and taxes are adjusted as per the zoning and allocated land use rights.	High: Automated	Medium: manual system with daily update	Low: manual system with periodic/regular updates

Table 6: Indicator Assessment Framework: Output Component

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INDICATOR ASSESSMENT FRAMEWORK: INTERNAL INFLUENCES

Component	Indicator	Definition	Attribute 1	Attribute 2	Attribute 3
Organisational Structure & Operations	Functional focused	Organisational structure is divided by function/tasks, where similar or related activities are brought together in separate organisational units (Dessers et al. 2010).	High	Medium	Low
	Process focused	All the activities that relate to a specific process are kept together in one organisational unit (Dessers et al. 2010).	High	Medium	Low
	Support for land use process	Any organisational support that is specifically aimed at providing assistance to the land use unit (e.g. legal support with by-laws).	High	Medium	Low
	Monitoring through performance agreements	Employees' performance agreements contain indicators to ensure the land use application process is undertaken as per legislation (e.g. adherence to time frames) and any other internal SOPs.	High: suitable indicators that align with process	Medium: indicators somewhat align with process	Low: Indicators are unsuitable
	Degree of data standardisation	The level of organisational knowledge on standardising geospatial data, and the degree to which geospatial standards are implemented in the organisation.	High: good knowledge and standards are implemented	Medium: good knowledge, working toward implementation	Low: Little/no knowledge
Organisational Culture	Political/ managerial support for GIS	The level of support municipal managers and/or political heads offer for GIS implementation in the municipality.	High	Medium	Low

Category	Criterion	Description	High	Medium	Low
	Political/ managerial support for data governance/ SDI	The level of support municipal managers and/or political heads offer for SDI implementation in the municipality.	High	Medium	Low
	Degree of data sharing	The willingness of and the degree to which the municipality shares their data with users.	High: external and internal sharing	Medium: limited external sharing and/or internal sharing	Low: no external sharing & limited/no internal sharing
	Degree of duplicate data capture	The degree to which municipal departments capture similar datasets as part of different processes and intended for different purposes.	High	Medium	Low
	Intra-organisational collaboration	The process whereby the municipal departments/units collaborate to achieve pre-defined objectives, other than for processing a land use application.	High: coordinated collaboration	Medium: uncoordinated collaboration	Low: None
	Internal support groups/ forums	Internal groups or forums that provide support in terms of data management.	High: group(s)/ forum(s) established and support provided effectively	Medium: group(s)/ forum(s) established but support limited/ ineffective	Low: No support groups/ forums available
	Municipal urgency of spatial planning & land use management	The degree to which the municipality is prepared to go to any length to achieve the desired the requirements of SPLUMA (Mitchell et al. 1997).	High	Medium	Low
Geospatial Data Governance & Management	Hardware and software availability	Availability of the necessary hardware and software systems to enable effective and efficient data management in the municipality.	High: adequate systems	Medium: system improvements required	Low: inadequate system

Budgetary Allocations for SPLUM Implementation			High	Medium	Low
	Spatial data expertise	The level of spatial data expertise available to support the functions/ departments/ units of the municipality.	High	Medium	Low
	Outsourcing & provider dependency	The degree to which the municipality depends on service providers to support the functions/ processes of the municipality.	High	Medium	Low
	Budgetary Allocations	The municipal budget allocated for the implementation of SPLUMA.	High: sufficient budget	Medium: budget allocations lacking	Low: budget allocations insufficient

Table 7: Indicator Assessment Framework: Internal Influences

INDICATOR ASSESSMENT FRAMEWORK: EXTERNAL INFLUENCES

Component	Indicator	Definition	Attribute 1	Attribute 2	Attribute 3
Inter-governmental Relationships	Relationships with national government	Relationships between the municipality and national government departments regarding the implementation of SPLUMA. May also refer to relationships that support SPLUMA (e.g. data management).	Restrictive	Enabling	N/A
	Relationships with provincial government	Relationships between the municipality and provincial government departments regarding the implementation of SPLUMA. May also refer to relationships that support SPLUMA (e.g. data management).	Restrictive	Enabling	N/A
Geospatial Data Governance & Management	Access to & re-use of external fundamental data	The ease with which the municipality is able to access external geospatial data they require to fulfil their mandates.	High: no restrictions, easy access	Medium: some restrictions, limited access	Low: many restrictions, little/no access
	Standardisation of land use rights data	Provision of geospatial data standards and support for standards implementation for municipal land use rights data from national or provincial government.	High: standards & support available	Medium: standards available but limited support	Low: no standards available
	Provincial coordination of land use data	The process whereby the responsible provincial office coordinates municipal land use management and provides the necessary support for the implementation of the land use application process.	High: coordination & support available	Medium: limited coordination & support	Low: no coordination, no support

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			High: 100-85%	Medium: 85-65%	Low: below 65%
Stakeholder Relationships	External stakeholder adherence to time-frames	External stakeholder adherence to time-frames of the land use application process as per SPLUMA section 44, provincial land use legislation (if available) and municipal by-laws.	High	Medium	Low
	Public interest	The level to which the public expresses their interest and provides inputs/ feedback on land use applications.	High	Medium	Low
External support (for municipalities)	Forums	The availability of external forums to support municipalities with their the land use application process.	High: group(s)/ forum(s) established & support provided effectively	Medium: group(s)/ forum(s) established but support limited/ineffective	Low: no support groups/ forums available
	Interorganisational collaboration	The process whereby the municipality collaborates with other organisations to achieve pre-defined objectives, other than for processing a land use application, but may support the land use application process.	High: coordinated collaboration	Medium: uncoordinated collaboration	Low: none

Table 8: Indicator Assessment Framework: External Influences

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L.12 APPENDIX: Indicator Assessment Results

SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 2

		Component	Indicator Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	High: fully implemented
	3	Land Use Unit Structure	Category C - medium functional task division
	4	Geospatial Data Management	Medium - low
Throughput	1	SPLUMA Legislative framework	High - medium
	2	SPLUMA Policy Framework	High
	3	Land Use Unit Structure	High coordination with manual application system
	4	Geospatial Data Management	Hybrid GIS, medium outsourcing, low data standardisation
	5	Stakeholder Engagement	High coordination, high-medium public participation
Output	1	SPLUMA Legislative Framework	Unknown applicant compliance
	2	Data Distribution Policy	Not developed/N/A
	3	Geospatial Data Management	Low data accessibility, low data usability
	4	Stakeholder Engagement	Medium: Stakeholder notifications mostly within prescribed time
	5	Financial Systems	Medium-low: manual updating daily/periodically
Internal Influences	1	Organisational Structure & Operations	High - medium process-focused, unknown support for land use, unknown performance monitoring
	2	Organisational Culture	Medium - low SDI culture, medium urgency for SPLUM
	3	Geospatial Data Governance & Management	High: fully implemented
	4	Budgetary Allocations (for SPLUM implementation)	Medium: budget allocations lacking
External Influences	1	Intergovernmental relationships	Unknown national, enabling provincial relationship
	2	Geospatial Data Governance & Management	Low access to external data, low external standards available, low provincial coordination (data)
	3	Stakeholder Relationships	Medium stakeholder adherence, unknown public interest
	4	External support (for municipalities)	Medium external support, low inter-organisational collaboration

Table 9: Summary of indicator assessment for Municipality 2

SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 4

		Component	Indicator Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	Medium: In process - developed, not implemented/not fully implemented
	3	Land Use Unit Structure	Category C - medium functional task division
	4	Geospatial Data Management	Medium - low
Throughput	1	SPLUMA Legislative framework	High - medium
	2	SPLUMA Policy Framework	High
	3	Land Use Unit Structure	High coordination with manual application system
	4	Geospatial Data Management	Centralised GIS, medium outsourcing, medium (internal) data standardisation
	5	Stakeholder Engagement	High coordination, high-medium public participation
Output	1	SPLUMA Legislative Framework	Medium applicant compliance
	2	Data Distribution Policy	Not developed/N/A
	3	Geospatial Data Management	Medium data accessibility, medium data usability
	4	Stakeholder Engagement	High: Stakeholder notifications within prescribed time
	5	Financial Systems	Medium-low: manual updating daily/periodically
Internal Influences	1	Organisational Structure & Operations	Medium - low process-focused, unknown support for land use, unknown performance monitoring
	2	Organisational Culture	Medium - low SDI culture, high urgency for SPLUM
	3	Geospatial Data Governance & Management	High: fully implemented
	4	Budgetary Allocations (for SPLUM implementation)	Medium: budget allocations lacking
External Influences	1	Intergovernmental relationships	Unknown national, enabling provincial relationship
	2	Geospatial Data Governance & Management	Low access to external data, low external standards available, medium provincial coordination (data)
	3	Stakeholder Relationships	Unknown stakeholder adherence, high public interest
	4	External support (for municipalities)	Unknown external support, low inter-organisational collaboration

Table 10: Summary of indicator assessment for Municipality 4

SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 5

		Component	Indicator Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	High: fully implemented
	3	Land Use Unit Structure	Category C - medium functional task division
	4	Geospatial Data Management	Unknown - no follow-up interview
Throughput	1	SPLUMA Legislative framework	High
	2	SPLUMA Policy Framework	High
	3	Land Use Unit Structure	High coordination with manual application system
	4	Geospatial Data Management	Unknown - no follow-up interview
	5	Stakeholder Engagement	High coordination, medium public participation
Output	1	SPLUMA Legislative Framework	Unknown applicant compliance
	2	Data Distribution Policy	Unknown - follow-up interview
	3	Geospatial Data Management	Unknown - follow-up interview
	4	Stakeholder Engagement	High: Stakeholder notifications within prescribed
	5	Financial Systems	Unknown
Internal Influences	1	Organisational Structure & Operations	Medium process-focused, unknown support for land use, high performance monitoring
	2	Organisational Culture	Unknown SDI culture, high urgency for SPLUM
	3	Geospatial Data Governance & Management	Unknown - no follow-up interview
	4	Budgetary Allocations (for SPLUM implementation)	Medium: budget allocations lacking
External Influences	1	Intergovernmental relationships	Restrictive national, enabling provincial relationship
	2	Geospatial Data Governance & Management	Low access to external data, low external standards available, unknown provincial coordination (data)
	3	Stakeholder Relationships	Medium stakeholder adherence, medium public interest
	4	External support (for municipalities)	Medium external support, low inter-organisational collaboration

Table 11: Summary of indicator assessment for Municipality 5

SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 6

		Component	Indicator Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	High: fully implemented
	3	Land Use Unit Structure	Category C - medium functional task division
	4	Geospatial Data Management	Unknown - no follow-up interview
Throughput	1	SPLUMA Legislative framework	High
	2	SPLUMA Policy Framework	High
	3	Land Use Unit Structure	High coordination with manual application system
	4	Geospatial Data Management	Unknown - no follow-up interview
	5	Stakeholder Engagement	High coordination, unknown public participation
Output	1	SPLUMA Legislative Framework	Unknown applicant compliance
	2	Data Distribution Policy	Unknown - follow-up interview
	3	Geospatial Data Management	Medium data accessibility, low data usability
	4	Stakeholder Engagement	High: Stakeholder notifications within prescribed
	5	Financial Systems	Unknown
Internal Influences	1	Organisational Structure & Operations	High-medium process-focused, unknown support for land use, unknown performance monitoring
	2	Organisational Culture	Unknown SDI culture, high urgency for SPLUM
	3	Geospatial Data Governance & Management	Unknown - no follow-up interview
	4	Budgetary Allocations (for SPLUM implementation)	Medium: budget allocations lacking
External Influences	1	Intergovernmental relationships	Restrictive national (data), enabling provincial relationship
	2	Geospatial Data Governance & Management	Medium access to external data, low external standards available, unknown provincial coordination (data)
	3	Stakeholder Relationships	Medium stakeholder adherence, unknown public interest
	4	External support (for municipalities)	Unknown external support, low inter-organisational collaboration

Table 12: Summary of indicator assessment for Municipality 6

SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 7

		Component	Indicator Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	High: fully implemented
	3	Land Use Unit Structure	Category A - medium functional task division
	4	Geospatial Data Management	Medium - low
Throughput	1	SPLUMA Legislative framework	High - medium
	2	SPLUMA Policy Framework	High
	3	Land Use Unit Structure	High coordination with manual application system
	4	Geospatial Data Management	Centralised GIS, low outsourcing, low data standardisation
	5	Stakeholder Engagement	High coordination, unknown public participation
Output	1	SPLUMA Legislative Framework	High - medium applicant compliance
	2	Data Distribution Policy	Restrictive distribution policy
	3	Geospatial Data Management	Medium data accessibility, low data usability
	4	Stakeholder Engagement	Medium: Stakeholder notifications mostly within prescribed time
	5	Financial Systems	Unknown
Internal Influences	1	Organisational Structure & Operations	Medium process-focused, unknown support for land use, unknown performance monitoring
	2	Organisational Culture	Low SDI culture, high urgency for SPLUM
	3	Geospatial Data Governance & Management	Medium: in process - developed, not implemented/not fully implemented
	4	Budgetary Allocations (for SPLUM implementation)	Low: budget allocations insufficient
External Influences	1	Intergovernmental relationships	Enabling national, enabling provincial relationship
	2	Geospatial Data Governance & Management	Low access to external data, low external standards available, low provincial coordination (data)
	3	Stakeholder Relationships	Unknown stakeholder adherence, unknown public interest
	4	External support (for municipalities)	High external support, low inter-organisational collaboration

Table 13: Summary of indicator assessment for Municipality 7

SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 8

		Component	Indicator Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	High: fully implemented
	3	Land Use Unit Structure	Category A - medium functional task division
	4	Geospatial Data Management	High - medium
Throughput	1	SPLUMA Legislative framework	High - medium
	2	SPLUMA Policy Framework	High
	3	Land Use Unit Structure	High coordination with manual application system
	4	Geospatial Data Management	Hybrid GIS, low outsourcing, high data standardisation
	5	Stakeholder Engagement	High coordination, unknown public participation
Output	1	SPLUMA Legislative Framework	Unknown applicant compliance
	2	Data Distribution Policy	Unknown
	3	Geospatial Data Management	Low data accessibility, low data usability
	4	Stakeholder Engagement	Unknown
	5	Financial Systems	Unknown
Internal Influences	1	Organisational Structure & Operations	Medium - low process-focused, high support for land use, medium performance monitoring
	2	Organisational Culture	High SDI culture, high urgency for SPLUM
	3	Geospatial Data Governance & Management	High: fully implemented
	4	Budgetary Allocations (for SPLUM implementation)	High: sufficient budget
External Influences	1	Intergovernmental relationships	N/A, N/A
	2	Geospatial Data Governance & Management	Low access to external data, low external standards available, low provincial coordination (data)
	3	Stakeholder Relationships	Unknown stakeholder adherence, unknown public interest
	4	External support (for municipalities)	Medium external support, high inter-organisational collaboration

Table 14: Summary of indicator assessment for Municipality 8

SUMMARY OF INDICATOR ASSESSMENT FOR MUNICIPALITY 9

		Component	Indicator Ranking
Input	1	SPLUMA Legislative Framework	High: fully implemented
	2	SPLUMA Policy Framework	Medium: in process - developed, not implemented/not fully implemented
	3	Land Use Unit Structure	Category A - high functional task division
	4	Geospatial Data Management	High - medium
Throughput	1	SPLUMA Legislative framework	High - medium
	2	SPLUMA Policy Framework	High - medium
	3	Land Use Unit Structure	High coordination with manual application system
	4	Geospatial Data Management	Hybrid GIS, unknown outsourcing, high data standardisation
	5	Stakeholder Engagement	Unknown coordination, unknown public participation
Output	1	SPLUMA Legislative Framework	Medium applicant compliance
	2	Data Distribution Policy	Not developed/N/A
	3	Geospatial Data Management	Medium data accessibility, medium - low data usability
	4	Stakeholder Engagement	Unknown
	5	Financial Systems	Unknown
Internal Influences	1	Organisational Structure & Operations	Medium process-focused, unknown support for land use, unknown performance monitoring
	2	Organisational Culture	Low SDI culture, medium urgency for SPLUM
	3	Geospatial Data Governance & Management	Medium - low
	4	Budgetary Allocations (for SPLUM implementation)	Low: budget allocations insufficient
External Influences	1	Intergovernmental relationships	Restrictive national, enabling provincial relationship
	2	Geospatial Data Governance & Management	Low access to external data, unknown external standards available, unknown provincial coordination (data)
	3	Stakeholder Relationships	Unknown stakeholder adherence, unknown public interest
	4	External support (for municipalities)	Unknown external support, low inter-organisational collaboration

Table 15: Summary of indicator assessment for Municipality 9