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"Our struggle with addressing in South Africa" – Capturing public stakeholder perspectives

Addresses are important for socio-economic gains and good governance in cities and municipalities. However, some countries, including South Africa, experience deficiencies in their address infrastructure. As a result, stakeholders who need addresses and address data to perform their respective mandates need to manoeuvre to find workarounds to overcome these deficiencies. In this paper, we explore the challenges and responses within the South African address infrastructure from the vantage point of governance stakeholders. Findings from semi-structured interviews reveal ambiguity about the need for addressing and uncertainty about its implementation. Adaptive strategies are deployed to overcome governance deficiencies, but these come at a significant cost. To resolve the struggle for an address infrastructure in South Africa, a congruent and coordinated governance approach informed by clear definitions, mandates and responsibilities is recommended. This study represents the first of its kind in capturing insiders' perspectives on governance-related challenges from the vantage point of addressing stakeholders. The improved understanding of addressing governance challenges paves the way for further research into a transformative way forward for addressing in the country.

Significance:
This deeper understanding of the governance challenges in the struggle for an effective and efficient address infrastructure in South Africa can inform the way forward to a congruent and coordinated governance framework based on clear mandates and responsibilities.

Introduction

An address is structured information that allows the unambiguous determination of an object for purposes of identification and location.[1] The maturity of address infrastructures differs from one country to another. In some more developed countries, good governance leads to comprehensive address assignment and availability of up-to-date address registers[2], while other countries experience ambiguities in addresses[3,4] and limited availability of address data[5]. Often, the cause of addressing deficiencies is linked to historical backlogs, rapid urbanisation, and lack of basic infrastructure, like streets and roads, and names for them. The challenges associated with addressing are global but more widespread in sub-Saharan Africa.[6]

The state of addressing in South Africa is particularly problematic and undeniably seen as an expression of the country's apartheid legacy[7], because street names and addresses were not allocated to large swaths of the country, specifically, traditional rural villages and urban townships. In post-apartheid times, rapid urbanisation has led to informal settlements without addresses. However, even in some city-regions, the quality of addresses is a concern.[8] The backlog in addressing is estimated at about 5 million.[9]

Despite the availability of South African national address standards since 2009, the struggle with addressing persists. The standards define an address as "an unambiguous specification of a point of service delivery"[10]. Therefore, an address is the actual location where a service is provided, thus emphasising the important role of addresses in service delivery. These services are postal and utility services, municipal billings and revenue generation, disaster management and emergency response, and opening bank accounts, amongst others. Addresses have also been associated with providing a sense of identity and recognition as a proper citizen.[11]

Despite general assumptions and the existence of national address databases at different organisations, an authoritative register of addresses in South Africa does not exist.[8] Additionally, there is no clarity over stakeholder responsibilities in the governance of addresses and address data[8] – the primary concern of this research. The consequences of this were acutely visible during the recent COVID-19 pandemic, during which the lack of awareness and use of national addressing standards in data collection hindered the effective use of addresses in life-saving circumstances.[11] To add to the country's addressing challenges, there is financial distress at the address sources, namely the South African Post Office and the local municipalities.[12,13]

A systematic literature review revealed the multiple purposes for addresses, and the emergence of new purposes driven by evolving technologies and a growing base of stakeholders, uses and users.[14] For South Africa in particular, it was found that, despite a greater demand for addresses due to emerging new purposes, addressing challenges remain a reality and are experienced at various levels of governance.[4] A better understanding of barriers and opportunities in the South African addressing infrastructure is therefore needed.[8] However, the nature of these challenges and organisational responses from the vantage point of governance stakeholders, have not been investigated to date in any coherent manner. This stated gap in existing knowledge informed the purpose of this paper.

The aim of this paper is twofold. Firstly, we capture addressing challenges in South Africa, and how organisations deal with them, from the vantage point of key governance stakeholders in the public and private sector who need addresses and address data to fulfil their respective mandates and business functions. Secondly, we interpret the stakeholder perspectives with reference to governance, allowing us to identify and describe the nature, strengths, and shortcomings of addressing governance in South Africa. The results contribute to an improved understanding

of governance challenges in the struggle for an address infrastructure in South Africa, and how to overcome these challenges.

A governance perspective

Governance refers to the structures, processes, rules, and traditions that determine how people in societies make decisions, share power, exercise responsibility and ensure accountability.[15] A generic definition of governance is: "The sum of rules and regulations, processes as well as structures, justified with reference to a public problem brought about by actors."[16] Good governance is defined as an effective, efficient and reliable set of legitimate institutions and actors engaged in a process of dealing with a matter of public concern; what ultimately lies behind the complex challenge of governance is the increased interdependencies amongst the actors across policy fields.[17]

Governing starts with the identification of societal problems, which can then shift to finding solutions.[18] In this context, problem-solving is not the preserve of a central authority that imposes solutions on subordinate agencies and individuals, but the result of the interaction of a plurality of actors, who often have different interests, values, cognitive orientations and power resources.[19] Governance complexity arises from interdependencies and interactions.[20] The governance perspective starts from the diversity, dynamics and complexities of the societies to be governed. The concept of interactions is central in the governance perspective; governance issues arise in these interactions and are handled in governing interactions. The governance approach assumes that many of these interrelations are based on the recognition of interdependencies, as no single actor, public or private, has all the knowledge and information required to solve complex, dynamic and diversified societal challenges.[20] In other words, governance is fundamentally about change.[19] From this perspective, governance is a process by which problems are collectively solved to meet society's needs.[21]

First- and second-order governance can be distinguished.[22] First-order governance is essentially about power and politics in the larger sense, as the interplay between the exercise of legitimate power and its support endowed by stakeholders, whereas second-order governance is about the rules and regulations needed and how to enact them. Finally, governance is about policy outcomes that result from the first- and second-order governance arrangements. Outcome refers to the extent to which the governance system has brought about a solution, obtained a desired level of goal attainment, and brought about intended outcomes. This reading of governance thus centralises the need to understand stakeholder perspectives and manoeuvres in performing their mandated functions.

Method

A qualitative analysis approach was adopted, which entailed semi-structured interviews with addressing stakeholders to capture their unique insights and daily experiences. The interviews focused only on organisational issues from their perspectives. Their individual perspectives on addresses or the lack thereof, as well as how the public uses addresses, were not in the scope of this research. A set of pre-determined open-ended questions was prepared with opportunities for input.[23]

A purposive sampling approach was used to recruit knowledgeable representatives who work directly with addresses or address data, and who understand the strategic role of addresses in the organisation. Moreover, representatives across the three spheres of government – national, provincial and local – were selected, because each of these spheres has legislative and executive authority functioning in distinctive, interdependent and interrelated roles. Due to time constraints, only urban-based municipal representatives from the Gauteng Province were recruited. This limitation implies that the study's findings cannot be generalised to all municipalities. To address this bias, we followed a stratified sampling approach by recruiting representatives from national entities who had in-depth experience of addressing and other projects, in both urban and rural settlements. Representatives interviewed were from national entities (5), metropolitan municipalities (3) (i.e. metropolitan), local municipalities (6), and private sector companies (2) that collect, integrate and sell address data and related services. The non-proportional nature of participant involvement is acknowledged, but the intent of the study was exploratory in nature, seeking to obtain nuanced insights from insiders rather than generalisable confirmatory trends. Quantitative proportional analysis was therefore beyond the scope of the study as the aim was to highlight participants' unique perspectives, i.e. their voices.

Deploying these purposive selection criteria, 21 semi-structured open-ended interviews were conducted. Upon accepting the interview invitation, each participant signed an informed consent agreement. They also received an interview guide, which covered the purposes, requirements and mechanisms (or systems) for addresses, and considerations towards a transformative way forward for addressing in the country. The guide allowed participants to prepare for the interview so that their responses would be well thought through. This may have reduced the spontaneity of their responses; however, we conducted the semi-structured interview in such a way that participants could freely express their perspectives and opinions. Interviews were conducted over a 7-month period during 2022. All participants preferred scheduled online interviews conducted on Microsoft Teams. Research ethics approval was obtained from the Research Ethics Committee of the Faculty of Natural and Agricultural Sciences at the University of Pretoria.

We approached the data-gathering process with prior thematic understanding of the subject, but the open-ended nature of the questions allowed new categories to emerge inductively as well, therefore following a mixed or hybrid approach.[24] The approach meant that we were able to validate our prior knowledge of possible themes (deductive) while allowing other themes to emerge during the interview process (inductive), thus enabling us to capture the unique perspectives of the participants.

The interview scripts were loaded into Atlas.ti (Version 23.3.4.28863). The thematic analysis was data-driven (inductive)[25], that is, coded as obtained from the interview responses to all sections of the interview guide. Approximately 300 codes were created and organised into themes and sub-themes that summarise the main outcomes of the study.

Results

The four themes and nine sub-themes that emerged from the inductive thematic analysis are illustrated in Figure 1 and presented in the subsequent sections. Tables 1–7 show the second order sub-themes

Theme 1: There are NEEDS for addresses and address data	Theme 2: There is NO NEED for addresses and address data	Theme 3: There are DEFICIENCIES in the address infrastructure	Theme 4: There are ADAPTIONS to overcome the deficiencies
There are clear needs	They can do all their work without addresses	There are governance deficiencies	There are organizational adaptions
There is uncertainty about needs and there are potential future needs	They have other pressing priorities	There are planning and implementation deficiencies	There are external adaptions
	They cannot accommodate dysfunctionality anymore		

Figure 1: Themes and sub-themes that emerged from the inductive thematic analysis.

(i.e. codes assigned to the responses). A cross (X) indicates that a participant from the respective stakeholder group mentioned a given sub-theme during the interview. The tables, in conjunction with the paragraphs that capture the responses of representatives from the various stakeholder groups, thus reflect unique insider perspectives, i.e. voices of daily lived encounters.

Theme 1: There are needs for addresses and address data

Stakeholders generally believe that they need addresses and/or address data to deliver their mandated service. However, there was a distinction between (1) participants who regularly perform activities for which they identified a clear need for addresses, and (2) those who mentioned some uncertainty about the extent to which legislation requires addresses in the execution of their functions, and they also mentioned potential future needs.

There are clear needs

All participants in the *local municipality* stakeholder group explained that addresses need to be included in the financial system so that bills can be delivered for revenue collection, e.g. addresses are “part and parcel of the accounts or revenue” of the municipality. They elaborated that addresses are needed for municipal service delivery, the “supply, upgrading and maintenance of municipal services”. Addresses are also seen as important for communication with the public: without an address the “interface with the public will be difficult”. They described the different ways that addresses are integrated into their operating procedures, e.g. when “a township is established then the address is added”; when “the title deeds are issued then the address goes on it”; and when “consolidations and sub-divisions take place”. Addresses are shared with other sections in the municipality, sometimes “in a spreadsheet format”. Respondents acknowledged that addresses are required in terms of various pieces of legislation, e.g. the *Municipal Property Rates Act No.6 of 2004* which, for some participants, gives “a mandate for addresses”.

Similarly, participants in the *metropolitan* stakeholder group responded that addresses are needed for billings and revenue generation. Participants suggested that a proper address ensures delivery of “the bigger mandate”, which is “to deliver services to everyone”. Addresses are also seen as important for digitalisation, which was especially evident during the COVID-19 pandemic when reporting dashboards required addresses to be correct and legitimate. Web portals were created for

Table 1:   Clear needs expressed by participants

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Local	X	X	X	X	X	X	X	X	X	X				X							
Metropolitan	X	X	X	X	X	X	X	X	X	X	X	X	X		X						
National	X	X	X	X	X	X	X	X	X		X			X	X	X	X	X	X		
Private	X	X	X	X	X					X	X	X	X			X				X	X
Second order sub-theme																					

1.   **Billings and revenue generation**

2.   **Finding places**

3.   **For various legislation**

4.   **Part of entity’s operating procedure**

5.   **Voting**

6.   **Corporate-wide use and management efficiencies**

7.   **Linked to entity’s mandate**

8.   **Service delivery**

9.   **We are custodians**

10.   **Emergency services**

11.   **Sense of belonging**

12.   **Digitalisation**

13.   **Social and economic services**

14.   **Communicate with the public**

15.   **Disaster management**

16.   **Visualisation**

17.   **Address compliance**

18.   **Data collection**

19.   **Mail and parcel delivery**

20.   **Goods delivery**

21.   **Verification, financial risk management and fraud**

various processes conducted face-to-face before the pandemic. A participant referred to the geocodes included with their addresses on the websites, as "online mapping viewers", which can be used for billing, health care, and in general by the public. Awareness of the legislative requirements for addressing was confirmed, with participants referring to "section 69 of the *Local Government Ordinance Act (No. 17 of 1939)*", elaborating that "Council is the authorised body to allocate addresses, from this a Bylaw was done".

The needs for addresses by *national entities* are different for each entity. However, all of them mentioned that their needs are based on organisational mandates and objectives, e.g. according to the *Electoral Act No. 73 of 1998*, for a person to register on the voter's roll, the address where the voter ordinarily resides needs to be known. Addresses are incorporated into operating processes or organisational value chains, e.g. for statistical data collection, the recruitment system uses addresses to identify fieldworkers within the study area. For participants from utility companies, addresses are a point of service delivery with the main purpose of generating revenue. Most participants spoke about the importance of address data for analysis and data visualisation, e.g. to locate their customers and fix service delivery problems, to conduct gap analysis for more targeted interventions, to aggregate data from the granular level, and to analyse information by location.

Participants from *private companies* need addresses for the economic (or business or paid) services they offer. For these entities, addresses empower various sectors of the economy to deliver services optimally to their customers. They "source, maintain and sell address data" obtained from municipalities, and create products that provide "property solutions", "reports" and "analytical services" to various institutions. In fact, they have created a standardised and comprehensive national database of addresses for various institutions, but this does not include addresses in the rural and informal settlements. They raised the importance of addresses for financial risk mitigation and fraud management: "If banks know your address or location, they know your risks."

There is uncertainty about needs and there are potential future needs

All *local municipality* representatives perceive addresses to be needed to fulfil various mandates, but there is seemingly uncertainty about how they are needed. Respondents mentioned that the "*Spatial Planning and Land Use Management Act (No. 16 of 2013)* (SPLUMA) requires addresses; but the act is not explicit on how to use addresses". There is recognition of the importance of an organisational database of addresses so that the different sections of the municipality can make use of it, but there is uncertainty about how to implement it.

Metropolitan participants also perceive addresses to be required by legislation, referring to "SPLUMA (No. 16 of 2013)", and the *Municipal Property Rates Act*. One respondent, however, highlighted uncertainty about legislative mandates: "We are not certain whether it is legislated from that side, or not." Another explained that, for property evaluations, they do not need Acts, because they can use postal addresses, aerial photography, or other geospatial information.

Some *national entity* representatives perceive addresses to be important for the application of the *National Environmental Management Act No. 107 of 1998*, e.g. for environmental impact assessments, "the land parcels, land administration, and address becomes critical" to specify the location of an intended development. However, uncertainty emerges because others did not recognise the legislative importance of an address for environmental impact assessments.

Regarding *future potential needs*, respondents perceived the future to be in digitalisation: "smart billing, smart planning, meters that report themselves, the smart city concept", which requires an adequate address infrastructure. For these observers, the future benefits of address data reside in "data science", i.e. "we are trying to integrate geospatial information and other data" and "once we have gone through the journey of integration, it will revolutionise how we utilise the address". Participants from *private companies* perceived that an address unlocks "future potential to start a business". These participants felt strongly that addresses are urgently needed for informal settlements: "People living in informal settlements need addresses because these are different players who need to enter the market."

Theme 2: There is no need for addresses and address data

The second theme groups responses as: (1) They can do all their work without addresses; (2) They have other pressing priorities; and (3) They cannot accommodate dysfunctionality any longer. Responses for (2) and (3) were evident only for local municipalities. None of the private company responses was related to this theme.

Three sub-themes emerged for the *local municipality* stakeholder group. Firstly, some participants felt that addresses are not needed because they can do all their work without an address, as they make use of the surveyor-general code (land parcel identifier). They consider this code to be "more important", "the main reference", "a priority", and that "every property has a code but not necessarily an address", which enables

Table 2: Needs about which respondents expressed uncertainty and potential future needs

	1	2	3	4	5	6	7
Local	X	X	X	X			
Metropolitan	X	X			X		
National	X	X				X	
Private	X						X
Second order sub-themes							
1. Socio-economic development							
2. Various legislation							
3. Corporate-wide use of addresses							
4. Digitalisation							
5. Incapacity of other entities							
6. Data science							
7. Social and economic activities							

Table 3: They can do all their work without addresses (except to communicate with the public)

	1	2	3	4	5	6
Local	X	X	X	X		
Metropolitan	X	X				
National					X	X
Second order sub-themes						
1. They service informal settlements but do not bill them						
2. They use the surveyor-general code (or cadastral code or land information code)						
3. They use aerial photography and geospatial information						
4. They use the postal address						
5. Addresses are not needed to achieve their organisational objectives; they are not legally bound regarding addresses						
6. The coordinates are becoming more important than the address						

them to perform their service delivery mandate. Secondly, due to other pressing priorities, some participants mentioned that they do not need to be concerned with addresses, it is not their mandate: "addresses are low on our priority list compared to other duties like changing land use" and "we have a mandate for land use management", which indicates that their mandated responsibilities take precedence. Thirdly, participants noted that, due to the dysfunctionality in the addressing infrastructure, they did not need addresses to perform their daily functions. Some participants observed "why do we need addresses if we struggle with the Post Office, mail does not get delivered" and "people don't collect their mail anymore".

Metropolitan participants also use address alternatives like the surveyor-general code.

Some *national entity* participants stated outright that addresses are not needed to achieve their organisational objectives and that they are not legally bound. They admit that location is important, "but location is not an address". The surveyor-general code "is not cumbersome to use", but they acknowledged that the public can more easily locate themselves via an address, concluding that "it can be beneficial to start incorporating addresses with our data". Some participants prioritised coordinates over an address, declaring that "addresses have become less important for us", because coordinates are used to navigate to the dwelling and the address is only needed for confirmation that people live at that location.

Theme 3: There are deficiencies in the address infrastructure

The third theme groups (1) responses that identify governance deficiencies, e.g. the lack of addressing mandates, ownership and policies; and (2) responses that refer to the lack of decision-making and resources which stifles planning and implementation.

There are governance deficiencies

The *local municipality* stakeholders unanimously responded that they did not have a mandate for addressing because there is no "policy like SPLUMA that regulates addresses". Most noted that there was no custodian for addressing in the local municipality and, to their knowledge, there is also not a national custodian. There are no policies imposing the national address standard: "we don't follow it [the address standard]". Participants attributed the current conditions to the lack of communication about the standard. Most respondents honestly admitted that their addresses were of poor quality, "not complete", "not reliable", "not consistent", and "not maintained". Participants also mentioned concerns about confidentiality of address information as per the *Protection of Personal Information Act No. 4 of 2013;* however, this is only relevant if a person is associated with an address.

Participants from the *metropolitan municipalities* pointed out that there is no national custodian or requirements for addressing, because "national requirements must come from national sphere". Stakeholder management for addressing is lacking; for example, a participant mentioned that "in the informal settlements, the ambulance service uses geocodes, we don't keep record of it, and have no idea who manages it". Although there are no policies imposing the addressing standard, some metropolitan municipalities make use of the standard because they are aware of it, while others refer to "a spoken standard that we [they] use which started from years back".

National entity participants pointed out that local municipalities do not have a mandate for addressing: "Nothing compels local municipalities to compile an address database." Participants question which national organisation is "accountable and responsible for addressing in South Africa". They acknowledge that there are addressing gaps, because municipalities assign addresses in proclaimed townships only; they do not cover the full extent of their areas of jurisdiction.

Participants from *private companies* concluded that there is no mandate for addressing at the source (that is, local municipalities), as "not all municipalities include addresses on their valuation rolls". They were not aware of a national custodian for addressing, nor policies imposing the standard, as data from different sources were structured differently. They observed that address data quality differs between local municipalities and metropolitan municipalities. Participants noted the lack of collaboration – there is a "silo approach amongst the different government departments towards addressing, which detrimentally slows down address assignment".

Table 4: Governance-related deficiencies identified by respondents

	1	2	3	4	5	6	7	8	9	10	11
Local	X	X	X	X	X	X		X			
Metropolitan	X	X					X				
National	X	X	X	X	X				X	X	
Private	X	X	X			X	X				X
Second order sub-themes											

1.	No national custodian
2.	No policies imposing the standard
3.	No mandate for addressing
4.	Confidentiality of address information limits sharing
5.	Lack of communication about the standard
6.	Addresses are poor quality
7.	No stakeholder management
8.	No custodian at local municipality
9.	Gaps in addressing (rural traditional and informal settlements)
10.	Lack of geospatial leadership and strategic thinking
11.	Negative impacts from other legislation

There are planning and implementation deficiencies

Participants from *local municipalities* observed a lack of cooperation amongst the different sections to keep addresses updated and maintained in a master database. They all mentioned "resources are a problem" and "we struggle to get approvals, commitment and support". Generally, participants noted that their geospatial data and aerial photography were outdated. They confirmed that layout plans or zoning for informal settlements do not exist.

Metropolitan representatives voiced strong opinions about the lack of implementation of supporting legislation, such as the *Spatial Data Infrastructure Act No. 54 of 2003* that should "bring the address community together to deal with the challenges". Participants noted concern with incomplete national cadastral data with given backlogs in street names and address assignments in former townships and informal settlements.

Some *national entity* participants expressed frustration because an official national database of addresses is not available. They noted difficulties in implementing supporting legislation – "the implementation of the *Spatial Data Infrastructure Act No. 54 of 2003* and the address standard are two things that are very difficult". Rural traditional and informal settlements are deprived of addresses, which requires intervention.

Participants from *private companies* also observed a lack of addresses at local municipalities, which makes it difficult for them to "access address data"; and "that's where we spend [waste] our time". These participants agreed that "poor quality data needs to be fixed at the source", and "many municipalities have burnt their fingers with consultants building proprietary systems".

Theme 4: There are adaptions to overcome the deficiencies

This theme reflects adaptions to deficiencies in the address infrastructure: firstly, what the stakeholders themselves do to overcome the deficiencies in the current address infrastructure, and secondly, what other entities do, which the stakeholders have accepted.

There are organisational adaptions

Generally, participants from *local municipalities* reported that they are adopting digital communication media like email and short message service (SMS) for service delivery and billings. A participant also explained that the surveyor-general code (land parcel identifier) is also increasingly adopted as the key for all local municipalities: "The cadastral is the backbone of the municipality" and "addresses are additional to it". It was also reported that adaptions for informal settlements vary, including numbering dwellings on aerial photography and assigning a barcode and coordinates to each dwelling. Some mentioned that, in future, private developers will have to provide street names for new developments, which will go through the municipal approval processes and, thereafter, be included on layout plans.

Participants from the *metropolitan* stakeholder group mentioned that they have adapted in similar ways, e.g. in informal settlements, only the location of "emergency assembly points" is known and used by other social services like mobile healthcare services.

Except for a few, *national entity* representatives have included addressing in their organisational mandates so that they can deliver their organisational outputs. However, for some, this approach has come at a cost: "If addresses were available, our funds [could] be used elsewhere." Participants also mentioned the use of descriptive addresses for rural traditional and informal settlements where cadastral data are not available; others have adapted by not requiring proof of residential address. Participants reported some examples of collaboration: "Stats SA must spatialise the Post Office addresses", and in return, Stats SA has relied on the Post Office to assign addresses in rural traditional settlements. Most participants indicated that they followed the addressing standard.

Table 5: Deficiencies related to the lack of decision-making and resources for planning and implementation

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Local	X	X		X	X			X						
Metropolitan	X		X	X		X	X		X					
National	X	X	X		X	X	X			X	X	X	X	
Private	X	X	X											X
Second order sub-themes														

1. **Informal settlements are deprived of addresses**

2. **There are limited resources for addressing**

3. **No (official) address database**

4. **Lack of cooperation amongst different sections for addressing**

5. **Lack of institutional decision-making hampers the implementation**

6. **Lack of implementation of supporting legislation**

7. **Lack of street names**

8. **Their geospatial data is outdated**

9. **The national set of cadastral data is incomplete**

10. **Geocodes as addresses might not work**

11. **Residents in some townships prefer the surveyor-general code as an address**

12. **Rural traditional settlements are deprived of addresses**

13. **There is misalignment of place names**

14. **There is a lack of address data at the source**

Table 6: Adaptions to deficiencies by the respondents' institutions (what they do)

	1	2	3	4	5	6	7	8	9	10
Local	X	X		X	X	X				
Metropolitan	X	X	X	X	X	X				
National	X	X	X				X	X	X	X
Private	X	X	X				X	X		
Second order sub-themes										
1. They have a way to deal with addressing in formal proclaimed areas										
2. They have a way to deal with informal settlements										
3. They have adapted to following the address standard										
4. They are adopting digital approaches for service delivery										
5. The finance section is the keeper of the billings addresses, and town planning the physical addresses										
6. They have a way to deal with street naming										
7. They have a way to deal with address data disclosure										
8. They have a way to deal with not having a national set of addresses										
9. They have a way to deal with rural traditional settlements										
10. They have included addressing in their organisational mandates and budgets										

Table 7: Adaptions by other institutions (what others do), accepted by the respondents

	1	2	3	4
Local	X	X		
Metropolitan	X			
National	X		X	
Private				X
Second order sub-themes				
1. There are national entity initiatives				
2. There are community-driven initiatives				
3. They collaborate				
4. They benefit from legislation imposed on the address source				

Participants from *private companies* mentioned that they had created national address databases by standardising and integrating address information from municipalities, which is used in the services they offer, and is purchased and utilised by various entities.

There are external adaptions

Participants from *local municipalities* spoke about community-driven addressing initiatives in informal settlements, e.g. "the community assigns their own addresses" or "when they want to open a bank account, the ward councillor confirms where they are staying". In the absence of addresses, some national entities have informal settlement initiatives for identifying dwellings or to determine the number of dwellings for service delivery purposes. For example, electricity is supplied and billed by the country's electricity supply commission (Eskom) who have assigned identifiers for the dwellings they electrify. The National Upgrading Support Programme of the National Department of Human Settlements conducts housing surveys in these settlements using their dwelling identifiers, and the municipality makes use of the census data to learn more about informal settlements.

Metropolitan representatives indicated that they have adapted to using house numbers from national entity initiatives, e.g. numbers assigned by the SA Post Office or Stats SA to informal dwellings, instead of re-assigning different numbers.

Participants from *national entities* confirmed their use of municipalities' addresses in proclaimed urban areas, obtained from municipal valuation rolls, and street names supplied by the municipalities. In some municipalities, they have more up-to-date and complete address data than the municipality, especially in rural traditional and informal settlements due to the national projects they conduct. These data are shared with other institutions.

Private companies indicated that they have no influence on how local governments fulfil their responsibilities, but they benefit from addressing-related legislation imposed on municipalities.

Discussion

The addressing struggle reflected in the results section (see Tables 4 and 5) suggests that we are dealing with a matter of public concern[17] for which governance is required – "rules and regulations, processes as well as structures"[16], to make decisions, share power, exercise responsibility and ensure accountability.[15] The governance deficiencies observed by our participants reveal the pockets of tension (or sources of problems)[20] that have led to the problematic situations they are experiencing.

All stakeholder groups confirmed the need for addresses to advance socio-economic development in the country. Municipalities particularly mentioned the important role of addresses for billing and revenue generation (Table 1). Given that the country's social and economic challenges are mounting[26], such a realisation by all stakeholder groups is a typical characteristic of a societal problem[20] in which problem-solving (e.g. tackling the country's socio-economic challenges) and opportunity creation are a public as well as a private challenge. Therefore, all stakeholder groups should be part of the 'who' or the 'multiple actors or stakeholders' included in the governance[17] of the address infrastructure.

However, governance solutions can only be sought after societal problems have been identified.[22] While there was agreement that addresses are required in terms of various pieces of legislation (Table 1) and generally needed for socio-economic development, there was also disagreement

about whether addresses are needed or not (Table 3), suggesting that the societal problem related to addressing is not clearly identified and defined. Without a clearly identified problem, deciding who can legitimately resolve the public problem, for whom and how[17], is not possible.

Uncertainty about the need for addresses, and potential future needs expressed by participants (e.g. promoting socio-economic development, improving economic outlook, digitalisation, data science, supporting legislation) shown in Table 2, can also be seen as opportunities for organisations and the country. In practice, such opportunities may be realised through governing activities aimed at solving the problem.[20] The private sector has already recognised opportunities by providing address data products and services, an example of problem-solving structures already in place[20], which could be considered when looking for addressing governance solutions in South Africa.

Addressing in South Africa necessitates governance complexity, arising from interdependencies and interactions[20] between the many diverse stakeholders who use addresses for a multitude of purposes, at different levels of government, in different sectors of the economy, and each with varying capacity to cope or deal with addressing. The interview results expose several problems related to first-order governance, namely the interplay between the exercise of legitimate power and its support endowed by stakeholders.[22] National entities identified a lack of leadership and vision (Table 4) related to geospatial data at the local government level, but at the same time questioned who should take the lead with addresses at the national level. Thus, there are leadership and vision issues at different levels of government, which will have a knock-on effect on the country's ability to advance governance of an address infrastructure.

First-order governance challenges are further exhibited by the South African Post Office, which was recently placed in business rescue[27], and by local municipalities that were adamant that a mandate for addressing had not been assigned to them (Table 4), and confirmed by national entities that stated that nothing compelled local municipalities to compile a database of addresses. Local municipalities also raised concern about their limited resources for implementing addressing and utilising what limited resources there are for other pressing priorities. National entities and private companies agreed by mentioning that local municipality's mandate was not empowered, and that addresses required money and skill. The first-order governance question of legitimate power and support by stakeholders is clearly not resolved.

Governance problems also arise if the actors involved in interactions regard certain tensions within and between the different elements of interactions as unwanted and changeable.[19] The fact that for some participants work continues, even without addresses (because of dysfunctionality or other pressing priorities), is a sign of problems arising from such tensions.

Interview results also exposed significant challenges in second-order governance, which deals with the rules and regulations and how to enact them. For example, none of the respondents was aware of any policies (rules and regulations) making conformance to the national address standard mandatory. There is a lack of conformance to the address standard amongst the municipalities.[8] In this regard, challenges related to the implementation of the South African *Spatial Data Infrastructure Act No. 54 of 2003* also have a negative impact on conformance to standards and the availability of address data. A firm decision, strong political leadership and sustainable funding are required to move forward.[11]

Representatives from the metropolitan stakeholder group reported that addresses are now generally maintained as a corporate-wide resource (although some also mentioned lack of cooperation) and some organisations have incorporated addresses into their operating procedures and organisational value chains – positive evidence of second-order governance. However, a lack of institutional decision-making for address strategy implementation was experienced at some national entities and at local municipalities, where approvals just did not happen, and implementation was stuck, in some cases for years.

Based on the above-mentioned first- and second-order governance challenges, it is no surprise that the desired outcome – resolving the struggle for addressing – remains elusive. To date, there is no authoritative national address data set (Table 5) to support socio-economic needs, such as voter registration, credit risk assessment, or locating people during disasters. This has resulted in private companies leveraging the business opportunity of selling address data and related services, maintained in parallel and leading to costly duplication and data integrity concerns.[7] Respondents also raised concerns about address data quality, with local municipalities admitting that their addresses were not correct and therefore not reliable. In fact, some organisations considered the desired outcome (addresses for their daily functions) to be so undesirable and dysfunctional that they had resorted to other means.

Inadequate road and street networks are a challenge for building effective addressing systems in many developing countries.[28] In the case of Ghana, in the absence of a publicly available database of street names, not even at the district or town level, standard geocoding procedures based on street names are almost impossible.[6] In South Africa, the absence of streets and street names in some rural and informal settlements continues to hinder establishment of a uniform address infrastructure. Public participation processes at municipal level are often impacted by politics and power play, where it can become so heated that no action is taken, and this is often the case for street naming, and is one reason why settlements do not yet have street names.[9]

Finally, respondents reflected on innovative and adaptive strategies in the face of undesirable and dysfunctional outcomes (Tables 6 and 7). Some organisations are now implementing addressing standards, even though there are no rules or regulations enforcing this, and others have incorporated addressing into their organisational mandates, legitimising the time and money spent on addresses and address data. Community-driven and collaborative initiatives or assigning (numeric) identifiers instead of (textual) addresses in rural and informal settlements are examples aimed at overcoming shortcomings in the address infrastructure. However, concerns were raised about the costs arising from such adaptions.

Conclusion

In this paper, we have described the nature, strengths and shortcomings of addressing governance in South Africa. We have captured organisational addressing challenges, and how they are dealt with, from the perspective of key governance stakeholders in different spheres of government and the private sector. Semi-structured interviews were conducted to obtain an insider perspective on what addresses are used for, how they are used, challenges that are experienced and how these are overcome in the pursuit of achieving mandates and business functions.

Interpreting the stakeholder perspectives in the context of governance theory allowed us to identify and describe the nature, strengths and shortcomings of addressing governance and accountability concerns in South Africa. Responses confirmed that there is a societal problem related to addressing, but it is not clearly defined, leading to first-order governance issues (e.g. uncertainty about mandates and responsibilities together with accountability), as the issue of legitimate power and support by stakeholders is not resolved. Furthermore, addressing in South Africa necessitates governance – coherence, arising from the interdependencies and interactions of a multitude of stakeholders and address purposes. While there is positive evidence of second-order governance (e.g. addresses are maintained as corporate resources and integrated into value chains), there are also signs of deficiencies in second-order governance (e.g. lack of policies related to addressing), some of which can be overcome by correcting the first-order governance problems. However, other issues – e.g. limited resources, and deadlocks in public participation processes –will require more dedicated interventions. Interestingly, organisations are finding solutions and alternatives in the absence of addresses and address data, but concerns were raised about the costs of these.

The results of our study contribute to a deeper understanding of the governance challenges in the struggle for an effective and efficient address infrastructure in South Africa. From the vantage point of key governance stakeholders, this provides a unique opportunity for the different organisations to better understand the needs, priorities and challenges from each other's perspectives. This improved understanding

of addressing governance challenges paves the way for further research into a transformative way forward for addressing in the country. As part of this, one needs to understand the role of legislation and accountability in overcoming challenges and facilitating a way forward.

Acknowledgements

Data availability

The data supporting the results of this study are available upon request to the corresponding author.

Declarations

We have no competing interests to declare. We have no AI or LLM use to declare. Ethical clearance was obtained from the University of Pretoria's Faculty of Natural and Agricultural Sciences Research Ethics Committee (NAS073/2022).

Authors' contributions

S.L.: Conceptualisation, methodology, data collection, sample analysis, data analysis, validation, data curation, writing – the original draft, writing – revisions. N.D.: Conceptualisation, student supervision. S.C.: Conceptualisation, student supervision. All authors read and approved the final manuscript.

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