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Perceptions about the value of addresses and address data in South Africa

by

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I, **Azile Mdleleni** declare that the dissertation, which I hereby submit for the degree **MSc Geoinformatics** at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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Abstract

Addresses are an integral part of daily life, but little is understood about what South Africans' perceptions of them are. This was explored through three groups; residents of informal settlements and surrounding areas who do not currently have addresses, the general public who have addresses and use them, as well as geospatial professionals who have more insight on addresses and address data. The effect that not having an address has on residents of informal settlements has not been explored in addition to the value and importance of having an address in their day-to-day lives. South Africa does not currently have a national open address dataset; as a result, both the general public and geospatial professionals write addresses in different formats, use different sources for address data and navigate to addresses in various ways. Knowing these three groups' thoughts are concerning addresses and address data would help understanding each group's needs for improvement. In an effort to understand the value and importance that residents of informal settlements have on addresses, semi-structured phone interviews were conducted, whereafter these interviews were coded and analysed. Both the general public and geospatial professionals shared their perceptions through a survey, which was distributed online and analysed statistically. The residents of informal settlements and surrounding areas indicated that they regard addresses as important for their day-to-day life, for example in terms of opening a bank account but especially in times of emergency to help people find them. The general public and professionals responded that they mostly use memory and GPS devices or applications to navigate to addresses that they do not know. While also indicating that if they (23% of respondents) could improve one thing about addresses and address data it would be the standardisation of addresses. The geospatial professionals indicated their preferences of the format which they receive and retrieve address data, with web services the preferred format to receive data, while a downloadable link was the preferred way to retrieve data. Understanding the needs and uses of each of these groups is important as it can be used to improve addressing in South Africa to the benefit of citizens and inform the design of an open address dataset with national coverage. Further research could explore how this can be done.

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To my father, this one is for you. Robala ka khotso moKoena.

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1. Chapter 1 Introduction

1.1. Overview

The rate at which cities in developing countries are growing in recent decades has been extremely rapid. This urbanisation has resulted in infrastructure development not being able to keep up with the needs of the number of people that now live in the cities. A lack of appropriate infrastructure leads to many underserviced areas, where the required services include emergency services, the ability to receive mail as well as any municipal services. Having proper infrastructure, which includes addresses, is vital for these services which need to be done by municipal and local governments as they can manage their cities in a more efficient way with them. Addresses allow governments to collect information on the facilities in their jurisdiction and which ones need maintaining and updating, in order to plan or said updates as well as to distribute resources more efficiently (Farvacque-Vitkovic, Godin, Leroux, Verdet and Chavez, 2005). As a developing nation, South Africa is included in the list of countries that have a challenge when it comes to urbanisation and the inability to keep up when it comes to infrastructure.

Having a functional system of addressing is important as addresses allow for the better function of society and its governance. It is difficult for an individual to be a functioning member of society without an address, specifically in South Africa proof of residence is required for basic services such as opening a bank account, buying a SIM card and even for medical services (Crush and Tawodzera, 2014). In South Africa, ward councillors have the ability to issue affidavits as proof of residence, but this method is not always guaranteed to work as institutions may reject this documentation. With no addresses, rights and claims cannot be recorded, and thus are not valid in a court of law. Addresses allow for freedom of movement, access to resources and an identity.

The existing literature does not expand on what the perception of addresses and address data is for citizens of a given country, including South Africa. This is important to understand because in order for improvements to be made in services such as governance, and for these improvements to be effective, they need to be made with the citizens in mind (UPU, 2012). Areas that are particularly vulnerable are informal settlements; information from community members and all standards that currently exist will help in understanding how addressing can be improved and adapted in a functional way in informal settlements in order to include them in greater society. The inclusion of individuals in society using addresses is significant as addresses have value and according to Prescott (2015), without an identity one does not exist as they are not able to participate in socio-economic, political, and civil society. The value of

addresses according to Prescott (2015) is that with better addressing, one can have better access to resources resulting in a better quality of life.

A national address dataset does not currently exist in South Africa, which makes it difficult to keep track and regulate whether each municipality is able to follow the guidelines (Coetzee and Cooper, 2007b). It is important to understand what should go into this national address dataset and those that work with addresses, namely those in the geospatial field can provide the most input as seen in the study conducted by Cooper, Katumba and Coetzee (2020) where they asked for input of those that work regularly with addresses. Having and understanding a national address dataset can provide economic benefits, as transport systems and businesses can be built efficiently using the same dataset (Danish Enterprise and Construction Authority, 2010).

1.2. Problem Statement

Addresses play a vital role in everyday life, but the perception that individuals have about them and the value which they place on addresses is not known. The value that standardised address data would have on those that work with addresses is also not known.

Due to the lack of addresses in informal settlements, the value and importance that they have to its residents, municipalities and other service providers is not known. The way in which the general public engages with addresses on a day-to-day basis is not known, and because there is no national address dataset in South Africa, it is not known what geospatial professionals and people who work with addresses would like to get from one.

1.3. Research aims and objectives

To understand the perception that residents of informal settlements, the general public and geospatial professionals have about addresses, and address data and to compare this view and understanding to what is stated in literature and standards.

1. Understand addresses worldwide, their value, compare different addressing methods, review existing standards, addresses in a South African context, and also related work.
2. Conduct semi-structured interviews and analyse them in order to understand what the value and importance of addresses to community members of informal settlements compared to what is currently known.
3. Distribute surveys to the general public and analyse them in order to understand their perception of addresses and assess what geospatial professionals deem important when it comes to a national address dataset

4. Based on findings, draw conclusions, and make recommendations on the value that addresses have in informal settlements, what the public understands about addresses and what geospatial professionals would like to see in a national address dataset.

1.4. Methodology

The method of research that was used in this research was empirical, using convenience sampling methods, which are useful to get a wide variety of responses (Bryman, Bell, dos Santos, du Toit, Masenge, van Aardt and Wagner, 2017).

To understand informal settlement dwellers' perceptions about addresses, semi-structured interviews were conducted.

The semi-structured interviews with informal settlement dwellers allowed probing if useful information was brought up. This method of asking questions allows the information collected to be less intimidating as it would be conducted like a conversation (Chambers, 2017). This method was informed by those that were explored in Addressing the Unaddressed, where in this project they aim to understand the level of access that participants have (Burton, 2020). Due to the COVID-19 pandemic (this research took place within the first 7 - 10 months) the interviews had to be conducted telephonically which meant that VIVA Foundation which is a non-government organisation (NGO) in Alaska Informal Settlement that serves as a link to the community provided a list of phone numbers of the parents of pupils who attend their primary school. The interviews were conducted in whichever language suited the interviewee, namely isiZulu or seSotho. The reason for the call was explained and verbal consent was given. After consent was given, a list of questions which prompted conversation were read out. These interviews, after being transcribed were coded and analysed using ATLAS.ti. The design of the semi-structured interviews, the coding and the results of the analysis are presented in Chapter 3.

To understand the perceptions about addresses and address data of the general public and geospatial professionals, responses were collected through an online survey. The surveys consisted of both open and closed questions with the benefit of open questions being that respondents could answer on their own terms, which prompts unusual responses (Bryman *et al.*, 2017). The closed questions, which were easier to process allowed for easy comparability between the responses of different groups. A Qualtrics survey was created based on existing literature about addresses and address data in South Africa as well as local knowledge. This survey was distributed through online communication platforms which included email and social media where consent was given before the approximately 10-minute-long survey

began. The results of this survey were then cleaned, grouped/coded, and analysed using SPSS. The design of the survey and the analysis of the reposes are presented in Chapter 4.

1.5. Significance of research

Research has been done about how addressing is currently implemented, as well as about the importance and value of addressing in South Africa and other parts of the world (Danish Enterprise and Construction Authority, 2010; Coetzee and Cooper, 2007a; Coetzee and Cooper, 2007b). There have been no South African studies conducted to evaluate the perception of addresses for those that have addresses, those without them as well as those that work with them. It is important to understand this in different contexts, such as the South African context, because addresses are deeply related to the culture and social systems of a place (Prescott, 2015).

Implementing an efficient national address dataset would prove useful to service providers and municipalities, which are currently tasked with assigning addresses and maintaining them for their respective jurisdictions. While there is research that has been done on how this can be implemented (Cooper, Katumba and Coetzee, 2020) the type of data which professionals would like to get out this potential dataset is unknown. Furthermore, it is also unknown how the general public could benefit from having addresses be standardised at a national level.

1.6. Overview of chapters

The remaining chapters in this dissertation are as follows:

Chapter 2 – Background and Related Work. Exploring literature on various topics covered in this dissertation, including addresses, their importance and value, informal settlements and current standards on addresses and address data and their uses. The literature review informed the design of the semi-structured interview and online survey and provided context for interpreting and discussion the results.

Chapter 3 – Semi-Structured Interviews with Residents of Alaska Informal Settlement and Surrounding Areas. This chapter presents the results and discussion of the qualitative analysis of semi-structured interviews in order to understand the value and importance that addresses have to community members of informal settlements. In the discussion these results are also compared to what is currently known, and recommendations are made for improving the situation.

Chapter 4 – Online Survey to Geoinformatics Professionals and the General Public in South Africa. This chapter consists of the results and discussion of quantitative analysis, which was based on the surveys that were distributed. This was done in order to understand the perception that survey responders have of addresses, as well as to assess what those

that work with addresses would like to see in a national address dataset, should it ever be created in South Africa.

Chapter 5 – Conclusion. The most significant results obtained from this project and future research topics are discussed. Based on the findings from the interviews and survey, conclusions are drawn about the value that addresses have in informal settlements, what the survey responders understand about addresses, as well as what those that work with addresses would like a national address dataset to look like.

2. Chapter 2 Background and Related Work

2.1. Introduction

The aim of the literature review is to examine and understand what addresses and address data look like, both locally and internationally, in an effort to understand how they affect those that engage with them regularly. The literature review will cover addresses in a broader context including definitions, the value of addresses and current international standards of addresses. This literature review will also include literature concerning addresses in a South African context, which includes standards, the uses of addresses, any existing datasets, as well as what addresses look like in informal settlements. There is not extensive literature available on the topic and as a result, the research that has been done is referenced quite frequently. The Universal Postal Union (UPU) white paper, “Addressing the world – An address for everyone” is comprised of different chapters that each have their own focus. These chapters range from studies on the social and economic value of addresses, to the different address policies that exist (UPU, 2012).

2.2. Addresses

2.2.1. Definition

In order to get understand what addresses are and the role that they play, it is important to first define them. Addresses, simply put, are structured information that help one find a location. They can further be defined as any specification that refers to a unique location on Earth and is an association between people and their spatial surroundings (Javidaneh, Karimipour and Alinaghi, 2020). There are different definitions of addresses based on the type of address, for example, there are street addresses, postal addresses, and location addresses to name a few (Coetzee and Cooper, 2007b). It is important to understand the different types of addresses and their uses, as what individuals consider an address can vary.

Farvacque-Vitkovic *et al.*, (2005) place emphasis on street addressing, which they define as an address that makes it possible to identify the location of a plot of land or a dwelling on the ground. Street addresses in particular are necessary for the public, local government and the private sector each with their own objectives and uses. The public has three main objectives: to be able to locate different facilities, to get around easily and to receive emergency services like health, fire, and police. The local government has two main objectives, which are to increase revenue by improving urban management through planning and managing municipal services, for example better service delivery and improved systems for tax collection purposes. Finally, for the private sector, street addresses serve the objective of being able to manage customer/client networks and to collect fees (Farvacque-Vitkovic *et al.*, 2005).

An address infrastructure, which is the network in which structured addresses are housed, is simply defined as something that offers a specific example of communication (UPU, 2012). These infrastructures have practical benefits in society, mainly including policies and how to inform decision making. Address infrastructures help to develop, implement and support policies at a national level on topics that affect citizens, such as how to govern, how to mitigate lack of emergency services in remote locations, and disaster management (UPU, 2012).

Addresses mainly function as a means to find locations but they are not just for buildings; they are necessary for undeveloped plots of land, parks and other open spaces, as well as to find places relative to landmarks for emergency services.

2.2.2. History of Addresses

This section provides some historical context on the origin of addresses and what their intended use was. The history of identifying streets began during the 17th century in Paris, France, when the city was restructured, and streets were intended to replace the walls of the city. Once the streets were created, they were given names. Over the centuries, this process evolved from a small task that could be done by the owner of the house at the end of the street to it being the job of the municipal council. Meanwhile, in Africa street addressing systems were implemented for tax collection purposes, most specifically in Bamako, Mali, where cadastre was introduced in the 1980s. Burkina Faso also began implementing street addressing for the purpose of collection residence tax and this initiate was done with the help of the World Bank. The World Bank began having street addressing initiatives in sub-Saharan Africa in 1991 with Chad being the first country and this was done with the assistance of the French Cooperation Agency and the city of Paris (Farvacque-Vitkovic *et al.*, 2005).

2.2.3. Addressing Standards

There are many different addressing standards and schemes that exist around the world, each unique to the culture of said society, which would make it difficult to replicate in another part of the world (AFNOR XP Z10-011; INSPIRE D2.8.I.5 Data Specification on Addresses – Guidelines; SANS 1883-1:2009; SANS 1883-3:2009; UPU S42:2006; UPU S53:2009). Understanding these standards that exist is relevant to this research because how addresses are implemented and structured could affect the perceptions that people have of them. ISO 19160 was created with the aim of having one international standard that combines all of the existing national standards in order for it to be used as a blueprint for countries without any standards. ISO 19160, *Addressing* is the standard that informs addresses by outlining the international standards for addressing. ISO 19160 works as a template so that addresses worldwide can be supported by software from different vendors, and thus the vendors can

process the same address data, and that address data from different countries can be processed using the same software (UPU, 2012).

There is a review that was performed of the existing address standards in 2011 by the ISO/TC 211, which was the beginning stages of ISO 19160. These results were then compiled into a Review Summary called “Review summary of project 19160, Addressing” which I will be referencing. The ISO 19160 review summary begins, as seen in Figure 1, by reviewing thirteen address standards from around the world based on what each standard addressed. This was done to avoid any redundancy with existing standards that might occur when creating the ISO standard. The elements of each standard that was reviewed included address assignment scheme, terminology, conceptual model, metadata, encoding, address data maintenance and address rendering (print/write/display).

	AFNOR XP Z10-011	AS/NZ 4819	AS 4590	BS 7666	INSPIRE Address	ISO 19112	ISO/TS 15000-5	OASIS	SANS 1883-1	SANS 1883-3	UPU S42	UPU S53	US FGDC Address
Address assignment scheme		Y		Y						Y			Y
Terminology	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Conceptual model	Y	Y	Y	Y	Y	Y		Y	Y		Y	Y	Y
Metadata					Y			Y	Y			Y	Y
Encoding			Y		Y			Y				Y	Y
Address data maintenance					Y					Y			Y
Address rendering	Y										Y		

Y = Standard included in the review

Figure 1: Standards reviewed and their address standardisation (ISO 19160 Review Summary, 2011)

Five recommendations were then made from the ISO 19160 preparatory work, which consist of ISO 19160-1 through to ISO 19160-5 (ISO, 2011). ISO 19160-1, *Addressing terminology and conceptual model*, states that the conceptual model for addressing should be a guideline to the specific requirements of each country and should be a blueprint for address databases. ISO 19160-2, *Good practices for address assignment schemes*, serves as a guide for countries that have to develop new address assignment schemes or who have to update an existing one so that they can keep good maintenance of their address datasets. ISO 19160-3, *Quality management for address data*, is a measure to assess and communicate the quality of the address data, namely attribute (thematic) accuracy, logical consistency, completeness, positional accuracy, and temporal accuracy. If there are any existing standards on quality

management, they should be taken into consideration and the ISO standard need only serve as a guideline. ISO 19160-4, *International postal address components*, proposes that the existing UPU S42, *International postal address components and templates*, be adopted as this international addressing standard in order to support the interoperability of address rendering rules, which is essential for streamlining global postal services. ISO 19160-5, *Address rendering for purposes other than mail*, serves as a guide on how to analyse the manner by which addresses are rendered for purposes other than mail, such as web-based maps, graphic displays of handheld devices and mobile phones. This is necessary in order to determine whether a standard is in fact required to help developers of said software to display addresses on digital outputs and user interfaces (ISO, 2011). Of these recommendations made for ISO 19160, three have been published as standards and implemented; they are ISO 19160-1, 19160-3 and 19160-4, while ISO 19160-2 is still under development. The current state of ISO 19160-5 is unknown at the time which this dissertation is being completed.

There are benefits for each of the standardisation requirements that are reviewed in ISO 19160, which include (as mentioned above) address assignment scheme, terminology conceptual model, rendering of addresses on mail items, encoding, address data maintenance and address quality management. The benefits of an address assignment scheme are that there would be consistent address assignment in the physical world as well as a better understanding of addresses. A benefit of standardised terminology is that there would be unambiguous communication about addresses, which would lead to a better understanding of addresses. Conceptual models provide the benefit of having address databases, which would be based on these models, and would also lead to a better understanding of addresses. Rendering of addresses on mail items is beneficial because it could lead to a more automated processing of mail, which would be more efficient than the current system. The benefit of encoding is that there would be the ability to exchange digital address data in bulk or one by one through web services. Address data maintenance is beneficial in that it gives users a definitive address dataset. Lastly, address quality management is beneficial as it improves the overall quality of addresses (ISO, 2011).

2.2.4. Value of addresses

The importance and usefulness that addresses have can be viewed in three main categories namely the economy, society, and government. All three of these categories are interlinked, for example, the value of addresses in the economy can be seen jointly with those of governance or society. It is important to understand the value of addresses within the context of this research, as it helps highlight the importance of addresses in most aspects of daily life. Without an address or proper address infrastructure, people's lives are impacted to varying degrees which is explored in this dissertation.

2.2.4.1. Economy

Addresses affect the economy in different ways, from the ability to have a functioning business, to being an active individual in said economy. The absence of addresses and poor implementation of addresses have the possibility of affecting how business is conducted by raising the cost of having a functioning business (UPU, 2012). When land tenure is formal, there is security provided to land users, and thus there is more of an incentive for them to invest in the property. Land tenure can be described as the system in which land ownership is defined; it determines who can use the land as well as how they can use it (Udry, 2012). When land property right is undefined/without an address such as in informal settlements, it is difficult to access individuals in those areas for business deliveries or even to conduct business with them, and so their property comes what de Soto (2000) defines as *dead capital*. Dead capital is property that cannot be used as an asset and prevents access to credit (de Soto, 2000). When it comes to land and property rights, addresses can help identify a specific plot of land; once this is established the property can then be taxed by the government thus stimulating the economy. Additionally, being able to find individuals using addresses means they are accessible to the government and can be taxpayers, raising public funds (UPU, 2012).

The value of addresses in the economy is also emphasised by the ability of working individuals to reach their places of employment in order to generate income. Without accurate information on the address infrastructure, it is not possible to have adequate transportation planning. Knowing how the population is distributed can help improve where public transport is located, for example it can be located based on where people live, travel time and overall traffic patterns. Countries with emerging and growing economies could greatly benefit from having well-structured transport and communication systems (Dobbs and Sankhe, 2010). Using addresses and addressing information to improve transport systems would improve accessibility, and in turn, the circulation of goods and services not only locally but also on a global scale (UPU, 2012).

Addresses and their improved infrastructures could benefit the way in which business are operated on an international scale. For international trade, by improving the identification of delivery points, one allows for a more efficient delivery where a customer would have the ability to track their packages. Addresses can also be important for identifying new businesses and locating them; this is improved through services such as Google Places where businesses can add information about their location, operating hours and contacts which would then appear on Google Maps (Danish Enterprise and Construction Authority, 2010; UPU, 2012). This is beneficial as it draws in new customers and helps businesses market themselves. Having an address infrastructure makes it easier for businesses to have and maintain the personal information of their customers by ensuring that there is no repetition (Winer, 2009).

Having an official address is mandatory in order to open an account at a bank in most countries, as this kind of personal information helps maintain relations with customers. Furthermore, it is also used as a means to make sure financial institutions stay reputable, thus an official address is legally required in order avoid money laundering and fraud. This requirement to opening a bank account is a barrier for those without an address. While some countries have proposed that these individuals use other documents such as utility bills and title deeds to open their accounts, it is not always applicable to individuals who need access to credit (UPU, 2012).

On an individual basis, as a customer in an economy, one would need to have a stream of income – which in most cases is achieved through employment. The process of employment often requires a verification process of where an individual lives, which is proven using a proof of residence to ensure that the potential employee suits company needs by being in the correct location as well as to prove their identity. Once an individual is part of the economy as a customer, they become important to businesses, for example in retail individuals' addresses are used in order to maintain customer databases which are then used to send invoices, deliver goods and (if needed) direct debt collectors (Coetzee and Cooper, 2007a).

Addresses have a role to play when it comes to the economy; not only do they let customers find businesses, but they also allow the economic system as a whole to function smoothly. With the implementation of addresses, proper infrastructure can be put in place such as bus routes which would help people get to places of employment as well as places of economic activity.

2.2.4.2. Society

Society, as it functions at present, is interconnected. An important part of this interconnectedness is the ability to find places and people using addresses. According to Prescott (2015), "without an address you do not exist", as addresses hold a significant value on one's identity in that they give a sense of belonging. Addresses function as an identifier in most elements of society from retail to education. Addresses provide individuals the freedom of movement, the freedom to leave one's home and be secure that it will still be there upon return, which does not exist in areas that are unaddressed such as informal settlements. The freedom of movement provided by having an address also includes the ability to open a bank account, receive medical treatment in a hospital, register to go to school, get a license to drive and obtain legal employment (Prescott, 2015).

The ability to receive leisure visits through the use of an address is one that many take for granted. During the 'Addressing the Unaddressed' project in Kolkata, individuals who participated were interviewed and indicated that being able to give the address of their dwelling

rather than describing their location gave them a sense of belonging. This Addressing the Unaddressed project aimed to provide unique postal addresses in unplanned settlements, which individuals are then able to use for daily activities and healthcare services. In addition to all these social benefits of having an address, the value of addresses in society relies heavily on the ability to plan and distribute resources, including the effectiveness of emergency healthcare services (Burton, 2020).

Addresses play a role in people operating as members of society, as individuals without them experience barriers that hamper access to opportunities. These opportunities are primarily offered to “formal” members of society, and as a result those without addresses (including those that live in informal settlements) have poor access to jobs and education, and thus have insufficient wages (Farvacque-Vitkovic *et al.*, 2005).

A greater sense of belonging through a shared culture could also be created by having an address, for example if a street is named after a national hero or holds significant historical meaning to an area or a group of people. The more accessible these areas are through an adequate address infrastructure, the easier it would be for tourists to locate them, thus boosting the economy and a sense of national pride which further links to the value of addresses within the economy (Farvacque-Vitkovic *et al.*, 2005).

Access to quality education is also affected by addresses, as they are used to determine which school a child can go to, which is based on the proximity between a school and dwelling area. Thus, a lack of addresses could mean that a child would be at a disadvantage as they would not be able to attend school; in some countries, there are cases of forged documents and addresses that are rented out just so a child can go to school (UPU, 2012). This lack of an open national address dataset can be seen in a South African context where it impacts the access to quality education, for example in a study conducted by Schmitz and Eksteen (2014) it shows that not having a geospatial dataset affects the location of new schools, which ends up costing the government and puts those that need access to schools at a disadvantage.

When it comes to employment, most formal institutions require a proof of residence before they can offer employment; this is an obstacle for individuals who live without addresses and would like to work to improve their circumstances. The value of an address is that it enables a better quality of life because of access to resources, as individuals with addresses are able to take out loans from the bank for further education and get credit from a store in order to buy furniture (Prescott, 2015).

The social value of addresses also includes the ability for emergency services to get to the correct location (Coetzee and Cooper, 2007a). This is a problem especially in peri-urban, informal and rural areas where there is little to no spatial organisation, and therefore no

adequate address infrastructure, which results in emergency services not being able to reach those in need within these areas (UPU, 2012). Attempts to mitigate this issue have been made by geocoding locations and by using those geocodes as a means to locate people during emergencies.

Reliable infrastructure is important for the growth of an economy and, in turn, for poverty reduction. However, the lack of infrastructure - especially in informal settlements – affects the quality of life of those that live in these settlements. The lack of proper infrastructure affects the service delivery which reduces how competitive business in these settlements can be; this is in contract to policies on economic and social development that exist in countries in Africa. Due to the lack of proper infrastructure, informal settlements are left without access to electricity, access to improved sanitation and access to clean water (UPU, 2012).

Proper addressing systems, which are an important infrastructure for social integration and economic development, help improve quality of life in a number of ways. Addresses help people to be recognised as citizens and enable the proper distribution of basic goods and services; thus, in areas where there is a lack of addressing, this can prove to be an issue. The migration of people from rural to more urban areas means that cities are put under greater pressure to develop and manage urban areas. This leads to spontaneous settlements which have no planned road infrastructures, and as a result, it becomes difficult to locate individuals who live in these areas. The lack of infrastructure and addresses, prevents people from being identified and seen as a part of society; while improving infrastructure can remove the barriers when it comes to the freedom of movement, and the delivery of goods and services. These improvements could help better the living conditions, and in turn, can help better the economy too (UPU, 2012).

When properly implemented and maintained, addresses can help governments to understand the needs of the environment and its people, while also enabling them to provide better access to basic services. The overall quality of life can be improved by addresses because they enable access to bank accounts, phone subscriptions, the ability to participate in democratic elections and other government services such as social grants (UPU, 2012).

The social value of an address cannot be overlooked, as an address is proven necessary to individuals in order to be a part of a society. People cannot have freedom of movement if they are not able to leave their homes and still be certain that their homes will be there when they return. In South Africa, there have been instances where the Red Ants – security relocation and eviction services – have destroyed informal settlements. An example of this is Lakeview informal settlement in Johannesburg where the Red Ants, alongside the Johannesburg Metropolitan Police Department, destroyed properties in the area that were illegally occupied

(and had not address assigned to them). Residents of the area said that their homes and future homes were completely destroyed (Seleka, 2021). Communication using addresses, such as receiving mail or having someone visit you at your home using a GPS, is made difficult without an address. Having to remember and enter coordinates into a navigation system is a more time consuming and difficult task when compared to remembering and entering an address. This could also impact the access to the types of services that are available to people without addresses for example getting delivers or internet set up.

2.2.4.3. Governance

Addresses play an important role in how society is governed. The value of addresses in this regard should not be underestimated, as the planning and distribution of resources cannot be performed without a spatial reference. First and foremost, in order for individuals to be a part of civil society, they require some proof of personal identity; having an address is necessary for the application process of an identity document for the reason that having an address is a way in which citizens can communicate with the government. Without personal identification, it becomes difficult for individuals to have access to legal systems and to even vote; this often affects those with a low socio-economic background, migrants, and victims of displacement. This barrier can further be seen when it comes to applying for passports and visas to go abroad, as these processes also require an official address. This lack of freedom of movement links with how addresses are valuable in society, where the government's inability to issue a passport without an address affects how society is run (UPU, 2012).

Service delivery, emergency services and utility services all need to be location specific in order to ensure that people receive these services. An address's governance value is that it allows for the better delivery of services, such as utilities and routing emergency services. This is relevant because if the government or those providing services do not know where they are needed, they cannot be provided. The process of participating in democratic elections, which determine who will be responsible for delivering services, requires some sort of address for registration. The government's ability to plan efficient transport routes in order to deploy the correct emergency services also depends on the address infrastructure that is available (UPU, 2012).

The civil value of addresses is that police and debt collectors are able to locate individuals through their address, while rates and taxes are now payable by the individuals that have addresses (Coetzee and Cooper, 2007a). These rates, taxes and debts which can be tracked to a person living at a specific address, are then used to further develop areas and fuel the economy.

In South Africa, municipal councillors have the authority to issue letters which prove residence (South African Government, 2001). For example, municipalities like the Kouga Local Municipality in the Eastern Cape and the Polokwane Local Municipality in Limpopo Province mandate that the ward councillor issue affidavits that state an individual's proof of residence. This affidavit can then serve as an official document, however it is still up to the institution that is receiving this proof of residence, whether they would accept it or not.

The value that addresses have on governance is further highlighted in the European Commission's European Location Interoperability Solutions for e-Governance (ELISE) where it aims to encourage the sharing of location-based information across borders and sectors. The benefits of this e-governance would be saving time and costs by avoiding recreation of the same solutions – this could be applied to service delivery in both the public and private sector. (Euopean Commission, 2016)

The value that addresses have on governance are mostly cost saving; with a robust address system, governments could save costs on always having to provide basic services and rather focus on bettering the ones that exist. An example of this can be seen with ELISE, where efficiency is the goal, and thus there are more advancements towards a digital government using location intelligence.

2.2.5. Assigning addresses

Different address systems exist throughout the world based on each locations' legislation. In Europe, addresses are seen as a democratic system that play a role in society, as the data is accessible to the public, they are mainly a reference to a road network. The European Location Framework (ELF) is a single access point for countries that are a part of the European Union (EU) in order for them to access geospatial reference data and services from all countries within the EU. Such a system is only possible due to the extensive addressing that has occurred in the EU; this further supports the reasoning that when addresses are properly assigned, a society can be more efficient. In Asia, addresses are a hierarchy of administrative areas and do not reference road networks. Particularly in Japan particularly, where addresses consist of an administrative district name, area name and then a number. In Africa, a mostly developing continent, when assigning addresses place a value in large scale maps and the current systems that exist are credited to European colonial rule on the continent. In Cameroon, addresses are assigned with priority being given to cities, as they include transportation and with a higher population will most likely require more services such as utilities and resource distribution (Farvacque-Vitkovic *et al.*, 2005).

Denmark has a well-developed address system and standards which cover addresses, addressing and address data, thus an in depth look on how Danish addresses are assigned

will be done. There is also literature about the initial address system in Denmark (from 1850-1900) and how it developed into the modern era and how addresses are currently used (Lind, 2008). Initially an address system was introduced between 1850 and 1900 with systematic numbering of buildings and properties alongside the road. These numbers were assigned with odd and even on each side of the road and in the later 1900, 1967 the national post office introduced a four-digit postal code system. This addressing initially began only in Copenhagen, and it was later extended to the whole country in the 1970s with rural areas as a focus because they were given road names and address numbers. Each address had a domain of numbers from 1 to 999 and a possible uppercase character A-Z e.g., 19A. By 1980, all roads and streets had been assigned a name by the local municipality and developed properties, such as those in urban areas, were assigned at least one address number. This system is still functioning today, and has been maintained so well that it is used also used for postal purposes (Lind, 2008).

Farvacque-Vitkovic *et al.* (2005) explain how street addressing can be done in a series of thirteen steps, which can be replicated in countries such as developing countries that do not have a robust address infrastructure. The first step would be to prepare a street addressing programme in which planning would take place and at the end of this planning process, there should be an address map with a street index map that would define the position of street signs, the numbering of doorways using a codification system, setting up an address directory and finally involving the community through the use of media campaigns. The second step would be to see how feasible implementation would be, and this would be based on the scope of work to be done, the level of organisation needed and finally the costs that would be involved. The third step would be to set up the unit of individuals that would be responsible for assigning these addresses. Steps four and five would be part of project management where costs, time frames and the exact scope of the programme would be further described and defined. Step six would be to choose a codification system through which the city is divided up into address zones, a system to identify these addresses, number street and buildings are all decided on. In steps seven and eight the field work would begin where the codification systems are approved, as well as in which the addresses will be assigned and displayed. Step nine is the beginning of the implementation, in which the coding of numbers begins, and all data is entered on a system which is accessible to those that need it. Step nine would be the basis of what would be an open address dataset, which is implemented from the beginning of when addresses start being assigned. This would lessen the load of work that would need to happen at a later stage. Step ten would be the installation of street signs, where the signage system is defined, materials for street signs are made available and then they are installed. Step eleven would also add onto an open address dataset, as the map for the street addresses

would be complete by the end of this entire process and can be disseminated. Step twelve involves getting buy-in from the community once the project has been completed to make sure that they are also using the new street addresses. Finally, step thirteen would be to maintain the system, and if there are any changes to be made the system should adapt but all changes should be documented.

2.2.6. Geocoding systems

Geocoding is described as an essential process in geographic information retrieval in order to associate place names with unique coordinates because there is ambiguity when it comes to place names when they appear as text (Yan, Yang, Hu, Zhao, Jiang and Gong, 2021). The process geocoding is taking an address, postal code, place name or any other geographic coordinates

According to Jiang and Stefanakis (2018) the rise of location-based services has led to an increase in the demand of location data. This would lead to geocoded locations which are needed for geospatial analysis, cartography and various decision-making processes and a good, reliable geocoding system should be able to accurately get any location on earth.

Overall, a geocoding system consists of three components, first the input data which could be an address, the name of a place or some sort of code, secondly the geocoder itself which is a processing algorithm and finally the output data which is often location coordinates that correspond with whatever data was put in (Jiang and Stefanakis, 2018).

The process of geocoding is improved with standardised addresses. The less standardised addresses are, the less accurate they are likely to be which means that there is a greater level of effort that goes into geocoding.

2.2.7. Grid-based addressing

Grid-based addressing is a method where a grid of rectangles, squares or hexagons is placed over a country or the whole world, and each cell is assigned a reference or unique code (Spatial Data Research, 2003). For example, in the case of Uber, the grid cells are hexagons, which are used for efficiently optimizing ride pricing and how cars are sent to each location (Brodsky, 2018). With a grid, each cell is assigned a unique code, regardless of whether there is a building or a location to be navigated to. An in depth look at two different grid-based systems namely what3words and Addressing the Unaddressed will give an understanding of exactly these systems entail as well as their advantages and disadvantages as addresses. There are other grid-based systems that exist and have their own applications like Geohash and Google’s Open Location Code.

2.2.7.1. What3Words

What3Words (w3w) is a grid-based system that divides the entire earth's surface into 3m-by-3m squares which ultimately form a grid. Each square is assigned a unique code that is made up of three words from the dictionary in multiple languages from around the world, and each word is separated by a full stop as seen in Figure 2. W3w is a system that allows one to easily remember a location, which comes in handy especially in emergency situations as it is also able to work offline (Barr, 2015). It is being presented in detail as it is one of the most commercially known alternatives for delivering services to locations without addresses. W3w is available on various devices with a website, apps for iOS and android as well as an API; all of which allow the user to either enter the three words for any given grid cell in order to find the cell, or input longitude and latitude coordinates with the output being the three dictionary words. W3w comes with both advantages and limitations which would aid one when deciding whether to use it or not. Advantages include that millions of people around the world are without an address or do not have a reliable street address; this could be mitigated by using geocoding systems like w3w in order to get a sense of belonging and being able to give a point where people are able to locate them (Barr, 2015). Some limitations include that the w3w 3m-by-3m grid cells do not take into consideration any elevation (Jiang and Stefanakis, 2018) as well as the possibility that people would consider geocoded location as an address even though it cannot be used in any official capacity.

Often times, geocoding systems like w3w have real life application, such as in informal settlements and other inaccessible places of residence, where ambulances cannot get to individuals who need urgent medical assistance. In an effort to combat this, geocoding systems such as w3w have been adopted by emergency services in South Africa. ER24, an emergency service, collaborated with w3w in order to reduce confusion and the inability to reach specific locations. This has been proven to be useful according to EMRS Shift Supervisor Thembiknosi Dladla (ER24, 2019).

Figure 2: What3words geocode in an area that would be difficult to describe (ER24, 2019)

2.2.7.2. Addressing the Unaddressed

Addressing the Unaddressed is a not-for-profit charity that is attempting to provide unique addresses for the slum dwellers in Kolkata, India. It is relevant to this research because it is evidence that while formal addresses would be ideal for those without them, concessions can be made with address alternatives while legislation is being finalised. The people of Addressing the Unaddressed work together with communities through a process called sensitisation in which they explain the benefits of having an address while also meeting with residents and local councillors. Addresses are then allocated to each dwelling where an employee of Addressing the Unaddressed would stand in front of a dwelling with a smartphone and coverts the GPS signal into a 12-digit alphanumeric code e.g.,7MJCG969+C8Q6, and this is printed onto a sign. The sign, which is attached to each dwelling, serves an address for those who do not have them and the 12-digit alphanumeric code links to Google Maps which in turn makes it effective for locating dwellings (Mason, 2020).

In India, the code generated by Addressing the Unaddressed functions as an intelligent address that has official recognition, which means that individuals are able to use it in an official capacity. Slum dwellers in Kolkata are then able to have their post delivered directly to them, open bank accounts in order to save money securely, set up a utility account, register for a voter's card and most importantly obtain an ID card which allows them to receive social benefits. Having this intelligent address also makes it easier for emergency services to locate those in need as well as for children to be included in any in-field immunisation programmes (Mason, 2020).

In order for Addressing the Unaddressed to be beneficial for all involved, including the local authorities, the organisation also conducts a household-based survey where the details of access to water, sanitation, healthcare, and indoor air quality are recorded. This data is then shared with local authorities and other NGOs that work in the area. Workshops on how to effectively use these new 12-digit alphanumeric codes to deliver mail are also held with the local post office, thus that those that live in the slums can access the services (Mason, 2020).

2.3. Addresses in a South African context

2.3.1. Current standards

According to the South African National Standard (SANS) 1883-1:2009, one of the South African address standards, an address is an unambiguous specification of a point at which service can be delivered. This address is further explained to be an aggregation of a street, a street intersection, a street address, a street location, an addressee, a phone number, a postal code and a named place. While the is a basic understanding of what an address is in South Africa, there is no national address database. Different organisations and vendors have their

own collections of address data, however there is no guarantee that each organisation or municipality will follow the regulations set in SANS 1883-1:2009.

As per ISO 19160 review summary on addressing standards, SANS 1883-1, *Data format of addresses*, and 1883-3, *Guidelines for address allocation and updates*, meet most of the requirements which were assessed when it came to assessing the standards as seen in Table 1.

Table 1: SANS 1883-1 and 1883-3 reviewed in ISO 19130 (ISO, 2011)

Standardization topic	SANS 1883-1	SANS 1883-3
Address assignment scheme		Y
Terminology	Y	Y
Conceptual model	Y	
Metadata	Y	
Encoding		
Address data maintenance		Y
Address rendering		

Y = Included in the standard.

There are twelve address types in SANS 1883-1 (SABS, 2009a), with each type of address having its own defined structure. Collectively, these address types are defined as combination of different simple and complex data elements as seen in Table 2. Coetzee and Cooper (2007b) assess eleven of the twelve address types in SANS 1883-1 based on how common they are and what their general uses are. They state that two of the SA Post Office address types, SAPO box address and SAPO street address conform to the international postal address standard UPU S24. The third address type SAPO poste restante address is not that well known or used in South Africa in comparison to the rest of the world. When giving directions, there are four address types that are most commonly used and they are street address, intersection address, landmark address and building address. While these four are most commonly used, they often do not contain the necessary components and are not formally recorded with the proper authorities, such as in the case of street name in private estates (Coetzee and Cooper, 2007b).

Four types of addresses - site address, farm address, informal address and SAPO-type village address - were each assessed in greater detail by Coetzee and Cooper (2007b) in order to differentiate them from each other. Site addresses are said to be used for townships, which is considered to be a legacy of apartheid but are in the process of being replaced by two different types of street addresses which would aid in the navigation of these townships. Site addresses in rural areas are in the process of being replaced as part of a larger project by the South African Post Office with the formal system of SAPO-type village addresses. In security estates, site addresses do not have any immediate solution as they are not assigned by the appropriate authority, which is why they cannot be used or included in reference databases. Farm

addresses are similar to site addresses in security estates, as they have not been assigned by the correct authority and are changed without reason and proper procedure; this affects emergency services because it is often not clear where the proper demarcation of farms and proper access is. Informal addresses are common in many African countries but are in the process of being assigned formal addresses by the naming of streets and the SA Post Office's Rural Address Expansion Project in hopes to eliminate the need for informal address infrastructure. SAPO-type village addresses make use of community members by employing them to capture the details of all the dwellings and empty stands, as well as by considering any future planning. However, this is a concern as any hierarchal system which would be implemented would eventually run out of capacity. Villages are currently numbered relative to whichever post office services them, but as more post offices get added, it is believed that the villages will have changed to formal streets and will use street addressing before there is a need for too many post offices (Coetzee and Cooper, 2007b).

Table 2: SANS 1883-1 Address Types (SABS, 2009)

Address Type	Definition	Structure
Building address	Consists of a complete unit identifier, followed by a street identifier or an intersection identifier then by locality	CompleteBuildingUnitIdentifier, StreetIdentifier / IntersectionIdentifier, Locality
Farm address	Consists of an optional complete building unit identifier which is followed by a used farm name, optionally by either a road name followed by an optional milestone reference or a farm reference. These are then followed by a town name or a used area name, then an optional municipality name, and an optional province name in addition to an optional country name or country code	[CompleteBuildingUnitIdentifier], UsedFarmName, [(RoadName, [MilestoneReference / FarmReference]) | FarmReference], Town/UsedAreaName, [Municipality], [Province], [Country] / [CountryCode]
Informal address	Consists of an informal reference which is followed by an optional landmark identifier. This is followed an optional street identifier or an intersection identifier and lastly a locality	InformalReference, [LandmarkIdentifier], [StreetIdentifier / IntersectionIdentifier], Locality
Intersection address	Consists of an intersection identifier and then by locality	IntersectionIdentifier, Locality
Landmark address	Consists of a landmark identifier followed by an optional street identifier or intersection identifier or road name which is followed by a locality	LandmarkIdentifier, [StreetIdentifier / IntersectionIdentifier | Road Name], Locality
SA Post Office box address	Consists of either a South African Post Office (SAPO) box number or private bag or mail delivery agent identifier and followed by a SAPO locality	(SAPOBoxNumber / [MailDeliveryagentIdentifier], SAPOPrivateBagNumber), SAPOBoxLocality
SA Post Office poste restante address	Specifies a post office at which mail can be sent for a limited period of time for pick-up over the counter	SAPOBoxLocality
SA Post Office site address	Consists of a complete address number which is followed by an optional section identifier or cadastral reference then a SAPO street locality	(CompleteAddressNumber, [SectionIdentifier] / CadastralReference), SAPOStreetLocality
SA Post Office street address	Consists of either a street identifier or a complete building unit identifier which is followed by a street identifier and a SAPO street locality	[CompleteBuildingUnitIdentifier], StreetIdentifier, SAPOStreetLocality
SA Post Office-type village address	Consists of a SAPO-type village house number followed by a SAPO-type village name and a SAPO box locality	SAPOTypeVillageHouseNumber, SAPOTypeVillageName, SAPOBoxLocality
Site address	Consists of either a complete address number followed by a locality or a cadastral reference or a registration division followed by a locality	(CompleteAddressNumber, Locality) / (CadastralReference, RegistrationDivision | Locality)
Street address	Consists of a street identifier followed by a locality	StreetIdentifier, Locality

2.3.2. Addresses and their uses

Addresses worldwide are part of the fabric of society, as they are required to be considered a functioning member of society; and this is no different in South Africa (Prescott, 2015). In South Africa, there are two main approaches to addresses, the first being the approach of spatial address databases and how they can be used for addresses and location finding. The second approach is where the customer is the focus with their address being used to communicate and correspond, and this is what is geocoded (Coetzee and Cooper, 2007b).

The general uses of addresses in South African can be seen in Table 3, which shows that although addresses are mainly used to facilitate service delivery, the type of address per service differ. Service delivery can include a range of everyday things likes water, sewerage, telecommunications, electricity supply, refuse collection, billing, postal delivery, courier delivery, emergency response, good delivery, serving summonses, household surveys and visiting. Addresses are also used for third party services, which often need an individual to produce some sort of proof of where they live so that they are able to be reached if need be. According to the Financial Intelligence Centre Act (FICA) (South African Government, 2001) it is required that one have an address or proof of residence documentation when opening a bank account or buying on credit in stores. The Identification Act (South African Government, 1997) indicates that in order to get an identity document or a passport, one needs to be able to produce some sort of proof of residence. The same is required to register for elections in order to vote, according to the Electoral Act (South African Government, 2004) one needs to have an identity document. Employment also requires an identity document, which could be difficult to get without any proof of residence. Furthermore, addresses are also used for rates and taxes (Coetzee and Cooper, 2007b).

Table 3: Address usages based on the type (Coetzee and Cooper, 2007b)

Address type	Address usage																							
	Accident scenes	Billing	Courier delivery	Crime scenes	Electricity	Emergency response	Goods delivery	Household surveys	Land registration	Obtain employment	Obtain identity document or passport	Open spaces (e.g. parks)	Opening a bank account (FICA)	Postal delivery	Rates & taxes	Refuse collection	Serving summonses	Sewerage	Social status	Telecommunications	Undeveloped erven	Visiting	Voting	Water
Street address	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Intersection address	✓		✓	✓		✓	✓	✓				✓					✓		✓			✓		
Landmark address	✓		✓	✓		✓	✓	✓				✓					✓					✓		
Building address	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓				✓		✓			✓	✓	
Site address	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
Farm address	✓		✓	✓	✓	✓	✓	✓								✓	✓	✓		✓		✓		✓
Informal address	✓		✓	✓		✓	✓	✓									✓				✓	✓		
SAPO Box address		✓								✓				✓	✓									
SAPO street address	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓
SAPO poste restante address		✓												✓	✓									
SAPO-type rural village address	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓

✓ = address type can be used for that specific activity

2.3.3. Address data in South Africa

South Africa does not currently have a national database for addresses, which has proved to be a problem that was especially highlighted during the COVID-19 pandemic, where addresses were vital for tracking and mapping COVID cases (Cooper, Katumba and Coetzee, 2020). The use of addresses that were filled in on the forms at COVID-19 testing facilities did not fit the current standards (SANS 1883-1 and 1883-3), which inform the type of data needed and address types, which ultimately made it difficult to geocode these incomplete addresses.

It has been proposed in recent study conducted by the Gauteng City-Region Observatory (GCRO) that a single address dataset be implemented in the province of Gauteng, South Africa on a trial basis, to then be implemented in all provinces. This study found that address data in South Africa currently exists and is maintained in silos by the different government departments (Cooper, Katumba and Coetzee, 2020). The current address data in the government system is not well coordinated and does not adhere to the best practice of international standards. It is therefore suggested that using current South African standards on addresses and address data, which includes informal addresses, in order to build and maintain this dataset. This study also briefly discusses what implementation would look like by stating that currently, municipalities maintain address data for their own jurisdiction therefore they suggest a custodian of the national address dataset, which could either be the South African Post Office, Department of Home Affairs Department of Planning or Monitoring and Evaluation in the Presidency. There is currently no input on how experts who maintain or

use address data would like to retrieve or receive their data if a national database for addresses were to be implemented.

2.3.4. Addresses in Informal Settlements

2.3.4.1. Background

UPU (2012) states that the migration of people from rural to more urban areas means that cities are put under greater pressure to develop and manage urban areas. This leads to spontaneous settlements, which have no planned road infrastructures. Informal settlements, in general, are described as make-shift homes; and in South Africa they are found in urban and per-urban areas where the occupation of these areas are often unlawful (Huchzermeyer, 2004). Due to the ever-changing nature of these settlements, it is difficult for authorities to deliver basic services to these areas as they are often without addresses. These settlements often have a dense population in one location, which results in social exclusion based on limited resources that can be directed to these areas.

According to Marais and Ntema (2013), informal settlements in South Africa are a result of the Apartheid forced removal system and are dynamic and ever-changing (Kostof, 1991). When an individual wants to start looking at the quality of life within an informal settlement specifically and how this life is affected by lack of infrastructure, there are many resources to turn to. These quality of life factors include lack of housing and access to basic services, public facilities and amenities, access to leisure activities, unemployment, and any other factors which, in the perception of residents, needs to be changed (Richards, O'Leary and Mutsonziwa, 2007). The most essential elements to understand when considering informal settlements are those that include spatial elements (Smit, 2006). The above-mentioned spatial elements are best described using addresses and the general lack of understanding of addresses in informal settlements.

2.3.4.2. Addresses

The lack of addresses in informal settlements has been highlighted during Local Government Elections of 2016 (Commission, 2016), where potential voters were required to produce a valid address in order to register. Some changes have since been made for the Local Government Elections of 2021 (Commission, 2019), where voters need only produce a valid identity document and those that live in informal settlements are given a REC AS form to fill out, which is for citizens who do not have any formal or descriptive address. Citizens require a valid residential address in order to get an identity document so that they can be registered onto the voters roll ,which proves troublesome for those that live in informal settlements regardless of having other ways of obtaining documentation for other official uses (Balkaran, 2016).

According to Balkaran (2016) residents of informal settlements own cell phones, and each cell phone number is required to be registered using a valid place of dwelling in South Africa as per the Regulation of Interception of Communications and Provision of Communication-Related Information Act (RICA). In addition to having cell phones which are RICA compliant, dwellers of informal settlements also have registered bank accounts which require a valid address as mandated by Financial Intelligence Centre Act, 38 of 2001 (FICA) in order to fight financial crime and facilitate a way for citizens to open valid bank accounts. It is currently not known where dwellers of informal settlements get valid proof of address in order to open bank accounts and register their cell phone numbers as regulated by RICA.

3. Chapter 3 Semi-Structured Interviews with Residents of Alaska Informal Settlement and Surrounding Areas

3.1. Introduction

This chapter discusses the semi-structured interviews that took place with residents of Alaska Informal Settlement and surrounding areas, including how the interviews were designed and the results from these interviews.

3.2. Study Design

3.2.1. Overview

The study area, Alaska Informal Settlement is located approximately 30 km from Pretoria central business district (CBD), and it is an informal settlement that is located at the base of a mountain as seen in Figure 3. It has densely packed dwellings that are makeshift homes as characterised by it being an informal settlement.

The semi-structured interviews with the residents of Alaska Informal Settlement and its surrounding areas were conducted to gain an understanding of if and how they use an address, as well as the opinions that they have on the value of addresses. This study was be conducted in the form of semi-structured interviews, which allows for ease of conversation while still gathering the information required (Plester, Richards, Blades and Spencer, 2002). The interview questions were derived from existing literature around what addresses are, their place in informal settlements, as well as what the value of an address is (which can be seen in Table 4). The interviewees were selected through convenience sampling, and a guided conversation between the interviewee and interviewer took place.

The interviews were over the phone between July and October of 2020 because of COVID-19 restrictions that were in place at the time that this research was done. VIVA Foundation, which is a non-government organisation (NGO) in Alaska Informal Settlement that serves as a link to the community, provided a list of phone numbers of the parents of pupils who attend their primary school. Other materials besides a phone that were used during these interviews were a second device to record each interview and a laptop in order to make notes.

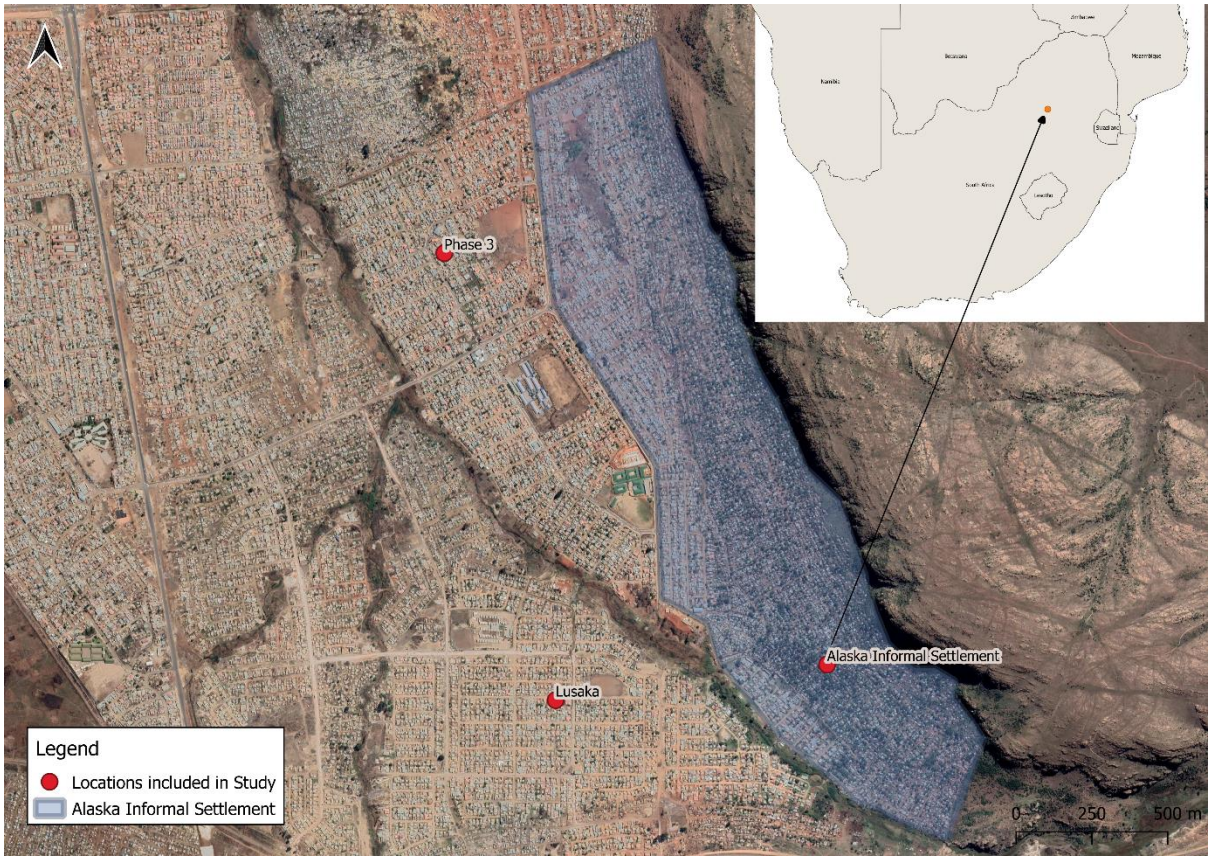


Figure 3: Alaska Informal Settlement at the base of the mountain in Mamelodi and surrounding areas Lusaka and Phase 3

3.2.2. Procedure

As there were strict COVD-19 restrictions (Adjusted Level 3, which meant that travel was limited and contact with people was to be kept at a minimum) at the time that this interview was conducted, interviews were conducted telephonically. A total list of forty phone numbers were given by the NGO, however of those forty only ten phone calls resulted in successful interviews. The other thirty phone calls either chose not to participate, did not answer, or had non-existent cell phone numbers. The phone call began with an explanation of the reason for the call and each person was given the option to opt out if they did not want to participant. If they chose to continue with the call, the consent form was read out to them in English and translated if there was any misunderstanding, and verbal consent was given by each interviewee. After everything was explained, the interviewee was given an option to choose what language they would prefer to have the interview in, and all interviews were conducted in either isiZulu or seSotho. Once the language of communication was established, the phone interview began, and the question prompts were read out to each interviewee based on the questions in Table 4. Each interview was recorded with the interviewee's permission and was later transcribed into English. A limitation to phone interviews, however, was that potential

interviewees were not always willing to participate in the study citing security reasons and the fear of getting “scammed”.

Table 4: Interview questions for Informal Settlement Study

Questions
1. Demographics and Background 1.1. What gender do you identify as? 1.2. How old are you? 1.3. Are you a South African citizen? 1.4. Is Alaska your permanent place of residence? 1.4.1.What is the reason for having a place of residence in Alaska? 1.5. What is your highest education qualification? 1.6. What environment did you grow up in? 1.7. Did you have an address where you grew up? 1.8. Are you currently employed?
2. Addresses 2.1. How do you direct a friend/ visitor to your house? 2.2. Do you have a bank account? 2.3. What do you tell/give the bank when they ask for your address? 2.4. Have you ever engaged with your local municipality? 2.4.1.When they have asked for your address, what did you give them? 2.5. Do you have an address? 2.5.1.Have you ever used it? How? 2.6. If you were to get issued an official address by CoT, would you find this useful? 2.7. Do you think you live a quality life? 2.8. Do you think getting an official address would improve your life in any way? 2.9. Who do you think should be responsible for making sure everyone in Alaska has an address? 2.10. Have you ever asked the councillor for a proof of address? 2.11. Have you ever used the documents anywhere? 2.12. Do you think having an address is important?

3.2.3. Participants

In order to understand the perceptions that people who live in informal settlements have on the value, importance, and uses of addresses, 10 individuals (8 females, 2 males) were interviewed. The age range of the 10 interviewees was 26 to 51 years, with an average age of 37 years. A demographic breakdown per interviewee can be seen in Table 5. The original aim was to have all participants be from Alaska Informal Settlement, however due to COVID-19 restrictions the responses of the few individuals that were willing participate via the phone had to be accepted. Of the 10 interviewees, 4 live in Alaska while the other 6 live in the townships surrounding Alaska, namely Lusaka and Phase 3 as seen in Figure 3. Those that live in Lusaka and Phase 3 offered their opinions on their own addresses as well as the perception of those in Alaska. Due to the proximity of Lusaka and Phase 3 to Alaska, the participants from Lusaka and Phase 3 also understand what life in an informal settlement is like and could have informal housing in the backyards of their own properties. This would mean that they are familiar with life an informal settlement, even if they do not live in one.

Table 5: Demographic overview of the interviewees for the informal settlement study

Interviewee	Gender	Age	Where do they live	Highest Education	Employment Status
1	Female	30	Lusaka	National Diploma	Unemployed
2	Female	51	Alaska	Matric	Employed
3	Female	36	Phase 3	Matric	Unemployed
4	Female	26	Alaska	National Diploma	Unemployed
5	Female	32	Alaska	Matric	Unemployed
6	Female	34	Lusaka	Grade 11	Unemployed
7	Male	44	Lusaka	Matric	Unemployed
8	Female	26	Lusaka	Grade 11	Employed
9	Male	45	Alaska	Matric	Unemployed
10	Female	47	Lusaka	Grade 10	Employed

3.3. Results

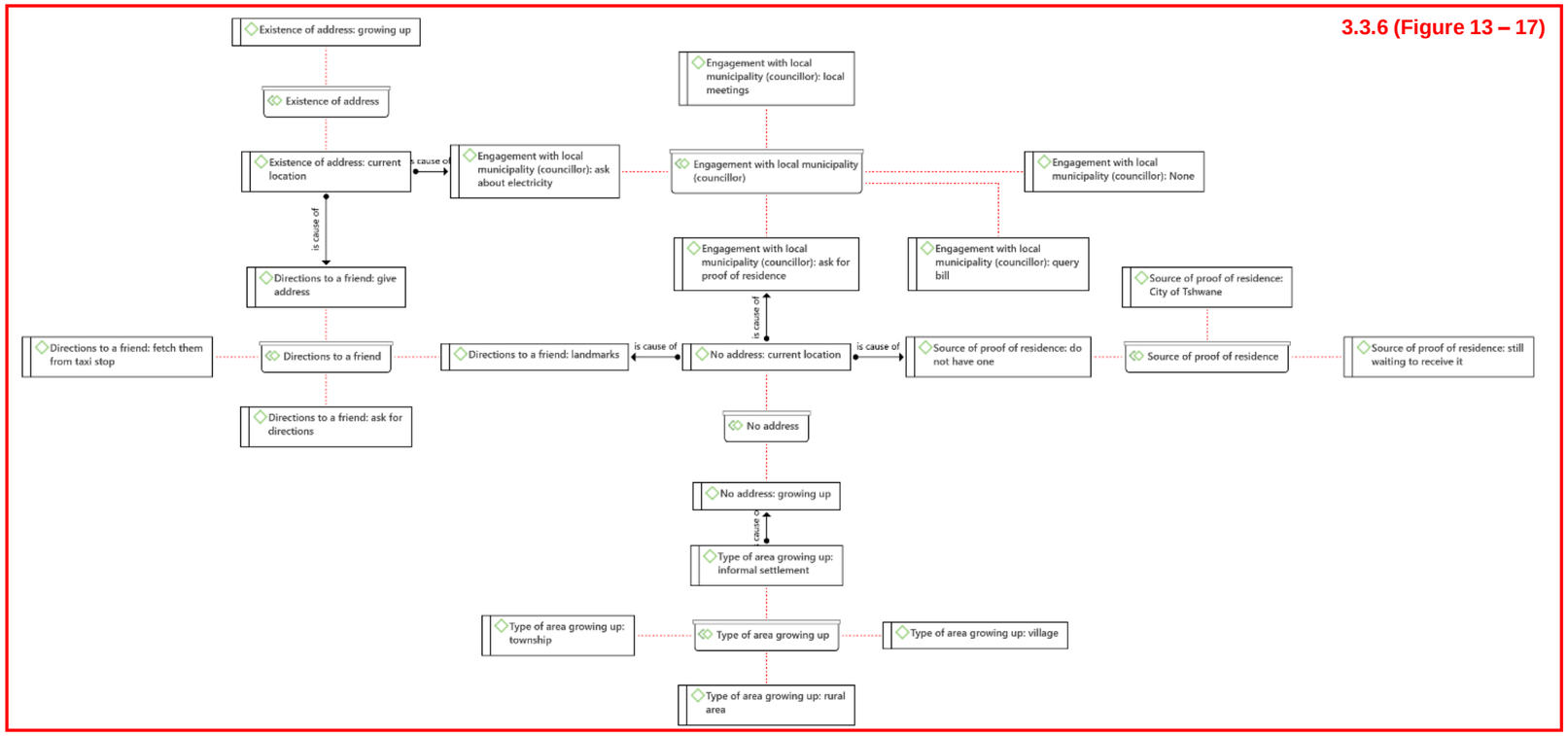
3.3.1. Overview

The results from the interviews with the participants that live in Alaska and the surrounding townships can be broken down into 5 main areas of interest which are: i) importance of addresses (3.3.2), ii) bank account and documentation (3.3.3), iii) quality of life (3.3.4), iv) benefit of giving people addresses (3.3.5) and v) exploring current interactions with addresses (3.3.6).

After the interviews were completed, they were then transcribed into English and then analysed in ATLAS.ti (Friese, 2019). First, open coding was performed, which is when similar responses in the transcripts are grouped; this was done manually in order to search for any existing themes. These themes were then coded into ATLAS.ti to gain an understanding of what the data looked like. These initial themes were then reviewed, categorised, and recoded into bigger themes/group codes which matched the aims and objectives of the study. The final coded themes were then properly defined. After all of the codes were finalised, the analysis could begin. (Friese, 2019)

Based on the codes generated and the relationships that were established between them during the initial analysis, they were added into the coded table, for example interviewees engaging with the local municipality was caused by the fact that they do not have addresses and they were enquiring about them. Networks were created of all the grouped codes (main category), each code group has a code (detailed category) which showed the quotes for each code from the interviewees (each quote begins with interviewee number : number of quote from interviewee then line in the document which has been quoted) . To make it easier to read the network diagrams – from the middle outward, they have been labelled with the first group has been shown with a 1, the following groups with a 2 and the quotes which are not numbered should be read third.

An overview network of all 5 of these areas of interest (as specified above) and how they relate to each other can be seen in Figure 4. Each area of interest can be further broken down into sub-categories that provide clarification on the main areas of interest, which will be shown as a network visual.



Symbols

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How to read diagram

Each red box is linked to a main area of interest indicated by the number

Figure 4: Network of all 5 areas of interest

3.3.2. Importance of addresses

In order to understand whether the interviewees place value on having an address or not, they were asked about the importance of an address in a general sense and in their daily lives. By further breaking down this main area of interest we can see that there 5 sub-categories which are: helps people find you, job application, open bank/store account, contact in case of emergency and enrol child at school.

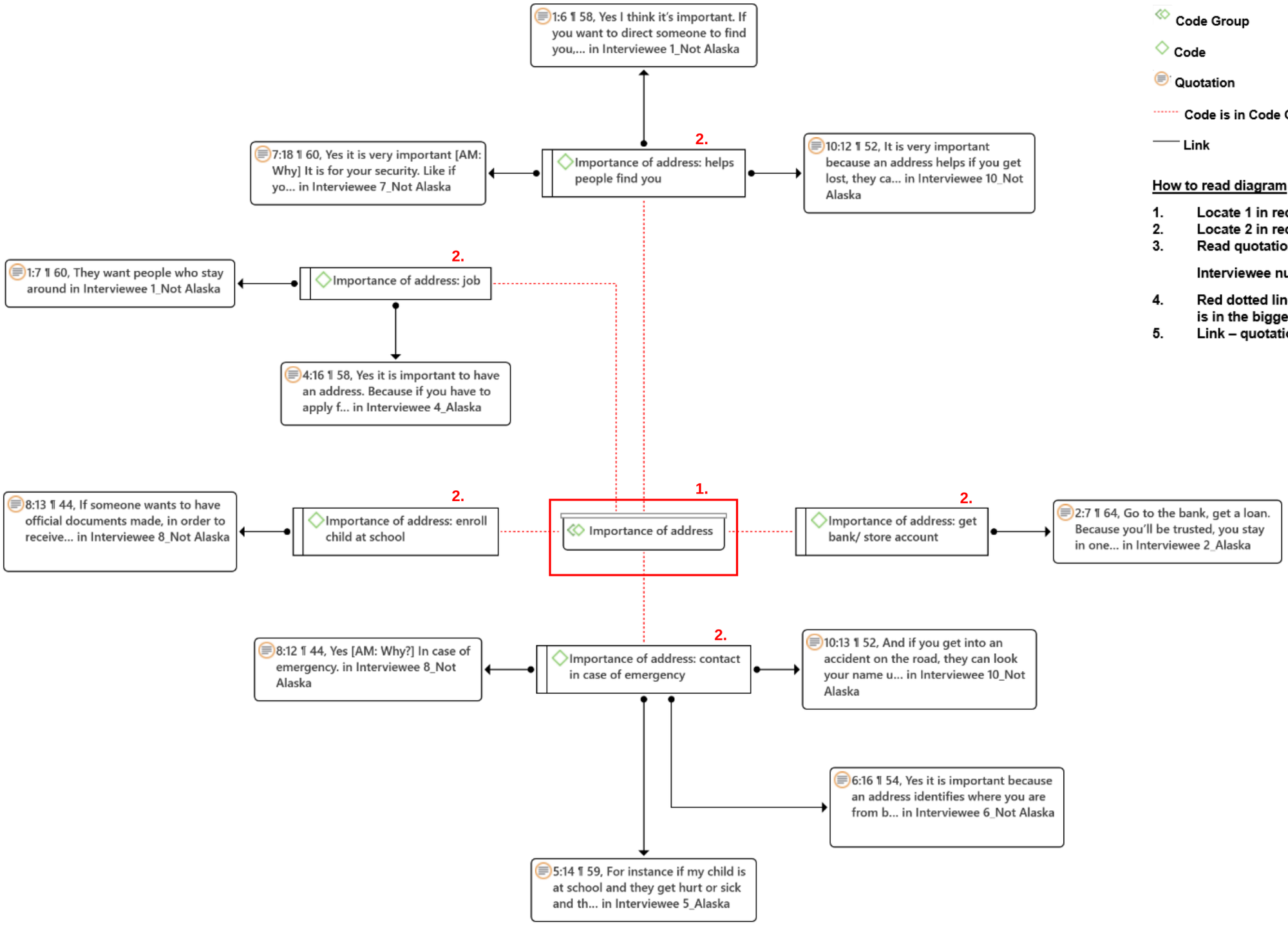
According to 3 of the interviewees, the importance of having an address is to help people find you. As seen in Figure 5, Interviewee 1 said, *"If you want to direct someone to find you, you need an address"* and this point is further supported by Interviewee 7 who said addresses are important for, *"courier or letter or delivery of furniture"*. While Interviewee 10 added that it is important to have an address because it helps you belong somewhere.

Interviewees 1 and 4 stated that the importance of an address is so that one can secure employment. Interviewee 1 indicated that often times employers want people that, *"stay around"* in the area, which is further supported by interviewee 4 who said that for any applications that they have submitted, they needed to submit proof of residence.

Opening bank or store accounts is an important factor for interviewee 2, as they said that in order to open a bank account or get a loan from a store it is necessary to have an address because according to these institutions, *"you'll be trusted because you stay in one place"*.

Having somewhere where people can find and contact you in cases of emergency is a top priority for 4 of the interviewees. Interviewees 6 and 10 explained that if you get into an accident for example, they could be able to use your identity document in order to look up where you live and then inform your next of kin of the accident. Interviewee 5 shares the same sentiment as interviewee 10 stating that, *"if my child is hurt at school or they get sick, and the school cannot get a hold of me on the phone because we constantly do not have electricity then they can check your address and they can come find you (the parent) to tell you what the situation is"*.

When it comes to the importance of having an address for the sole purpose of enrolling a child at school, Interviewee 8 explains that all schools (even the ones at NGOs) require official documents before a child can be enrolled.



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How to read diagram

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2. Locate 2 in red – code
3. Read quotations linked to each group

   Interviewee number : quote number
4. Red dotted line – the code is in the bigger code group
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Figure 5: Network of importance of addresses

3.3.3. Bank accounts and documents used

This main area of interest is to establish what documents interviewees used in order to open their bank accounts, as all interviewees stated that they have bank accounts even if they might not all be active at the moment (these are visualised in Figure 6). Interviewee responses can be broken down into 3 sub-categories which are: documents from a previous residence, current proof of residence and documents from a previous employer.

Three out of the ten interviewees stated that the documents that they used to open their bank accounts were proof of residence documents from their previous places of residence, in particular the proof of residence back home where their parents and other extended family live. Interviewee 4 stated that they, *"already had proof of residence from Limpopo, so that is the one that I use"*, while Interviewees 7 and 9 simply said that they use other proof of residence or one from home. Of these three, Interviewees 4 and 9 currently live in Alaska while interviewee 7 lives in Lusaka.

Only one interviewee, interviewee 5 who currently lives in Alaska said that they used a proof of residence from their previous place of residence to open a bank account. This previous place of residence was their previous employer's home where they were a domestic worker.

The remaining 6 interviewees all responded that they use their current proof of residence to open their bank accounts. Of these 6, Interviewee 2 lives in Alaska but it is unclear where they got their current proof of residence as they did not offer any further information.

Symbols

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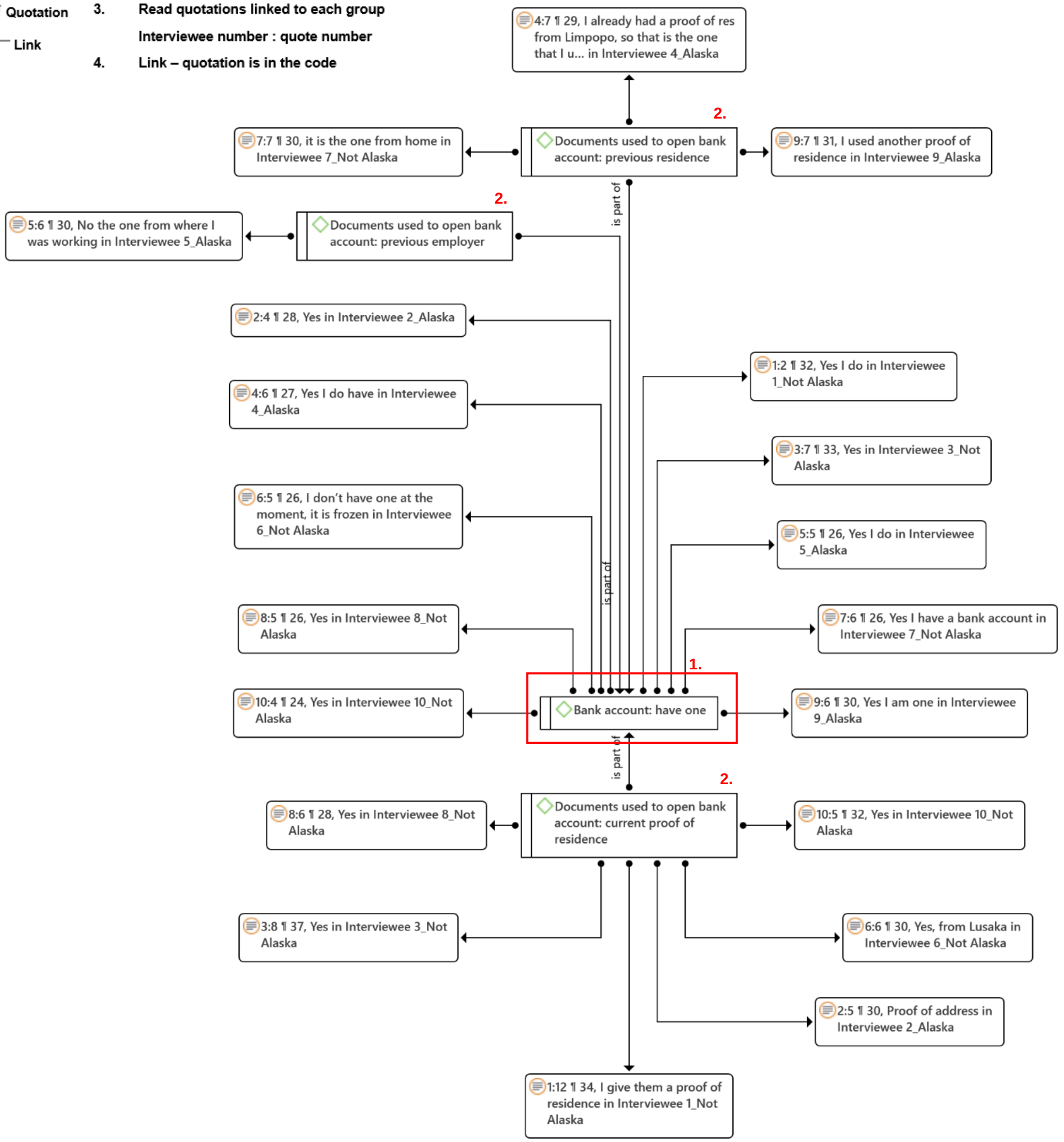


Figure 6: Network of bank accounts and documents used

3.3.4. Quality of Life

Quality of life is the perception that an individual has on their position in life regarding their comfort and living conditions. Quality of life is the focus of this section because it was important to establish whether there the lack of an address could have an impact on an individual's quality of life. Due to the varying location of the interviewees, some offered opinions on the quality of life in Alaska, while others only offered perceptions on the quality of life where they live. These can be broken down into five sub-categories as seen in Figure 7 which are: quality of life in Lusaka is good, quality of life in Lusaka is bad, quality of life in Phase 3 is good, quality of life in Alaska is bad and quality of life in Alaska is good.

When looking at the quality of life in Lusaka, which is an adjacent township to Alaska, three interviewees had opinions to offer. Interviewees 6 and 8 indicated that the quality of life in Lusaka is good with Interviewee 6 stating that, *"The quality of life is fine, but the only issue is that we struggle with electricity due to people in the informal settlement Alaska. They do not have electricity so they take/pull electricity from us and the cables are not safe for children"*. From Interviewee 6's response, there is a bit of insight on how the lack of infrastructure in Alaska not only affects those that live in the settlement itself but those neighbouring it as well. While interviewee 8 only offered opinions on life in Lusaka and they said, *"Yes…we are close to the train, there is a high school, there is an ATM"*. Interviewee 7 on the other hand did not have much positive to say about the quality of life in Lusaka, simply by saying that the quality of life is not good, further motivated by them stating that they do not have any basic services which they said included water, sanitation, and roads. Interviewee 7 gave an example of how the lack of basic services affects them by stating, *"Since there is no water and sanitation, the toilets here…can you even imagine the bathroom situation? You cannot say you a living fine"*.

Only one of the interviewees lived in Phase 3, which is also an adjacent township to Alaska. Interviewee 3 stated that life in Phase 3 is good besides from the fact that them and their sister recently lost their jobs due to the COVID-19 pandemic.

The responses for the quality of life in Alaska leaned overwhelmingly towards it being bad. Interviewee 9 offered an interesting response stating that they knew that they were moving into an informal settlement, so it is to be expected to have some issues. They said that they try to look on the bright side and that they at least have access to water although the sewage situation could be better. In addition, Interviewee 9 said that due to the informal nature of the settlement they are not involved when it comes to land rights issues which they view as a good thing. A further four interviewees offered opinions that supported that the quality of life in Alaska is bad due to a variety of reasons ranging from overcrowding (according to Interviewee 1) to lack of electricity and high crime according to (Interviewee 10). Interviewees 4 and 5 had

a bit more to say about the life in Alaska. Interviewee 4 said, *"…it is a place that is kind of congested and there are lots of basic needs lacking - like the electricity is always tripping. Sometimes there is no water, and the kids can't be playing around on the street, you have to always watch them because there are a lot of things happening here"*. Interviewee 5 stated, *"When I look close to where I stay, there are people who do drugs, and they inject themselves in public. So, it is not a decent place because when I look, imagine a child comes across this needle like in the dustbin or after someone has injected themselves with it and throws it on the floor. The child would want to take it and inject themselves."*

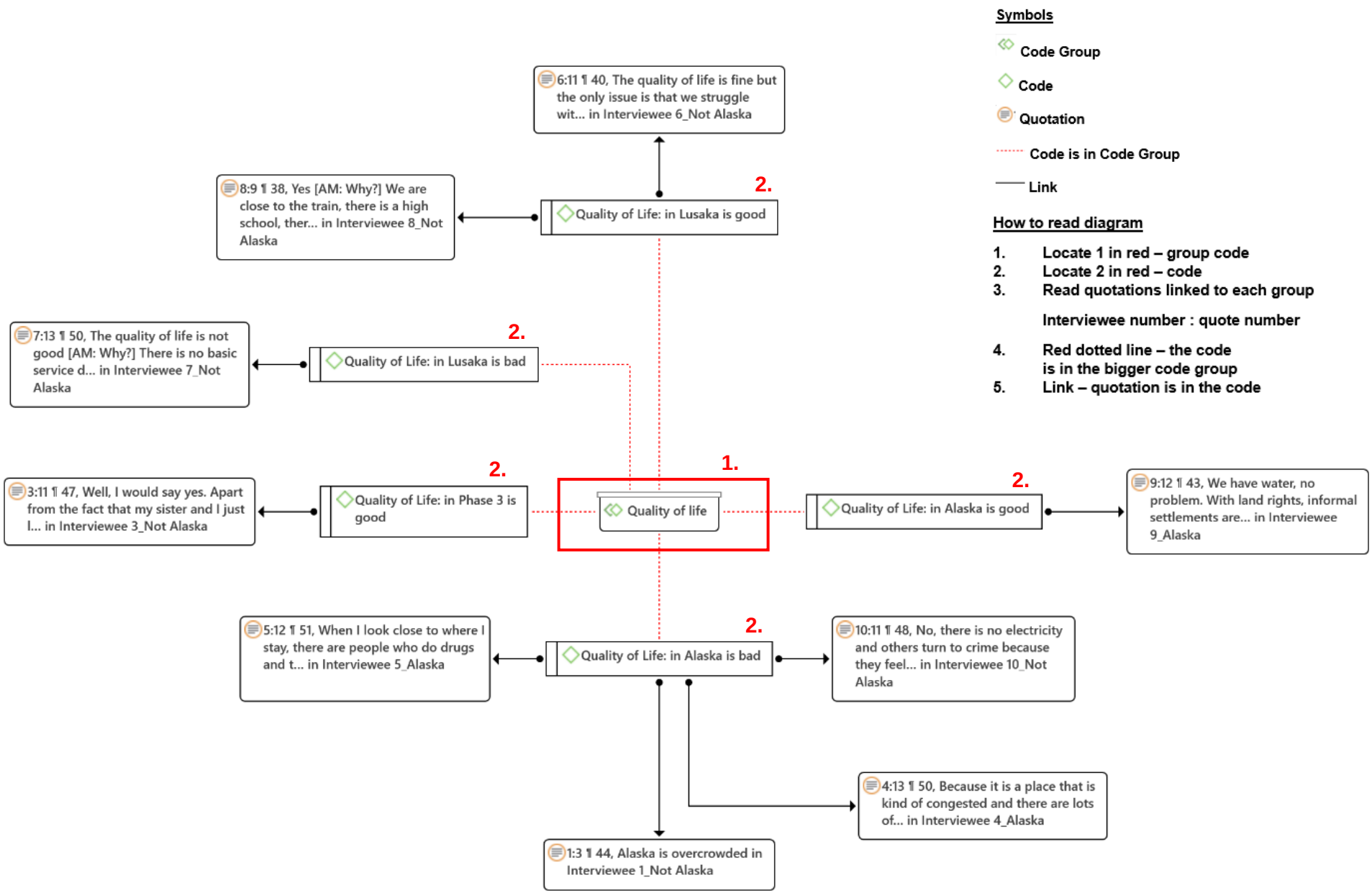


Figure 7: Network of quality of life

3.3.5. Benefits of giving people addresses

In order to gain understanding on whether the interviewees thought it would be beneficial for people who do not currently have addresses, such as those in informal settlements, to get addresses assigned to them - as well as where addresses are used in general - a series to topics were established. The sub-categories for this main area can be split into three main sections, namely benefits of giving people addresses, usefulness of proof of residence and the general use of proof of address; this can be further divided into subcategories themselves which can be seen in Figure 8 (the clearer breakdowns of this figure can be seen in Figure 9, Figure 10 and Figure 11). The further sub-categories are improving people's lives (Figure 11), allowing people better services (Figure 10), no benefit to giving addresses (Figure 10), usefulness of proof of residence (Figure 10) and general use of proof of address (Figure 9).

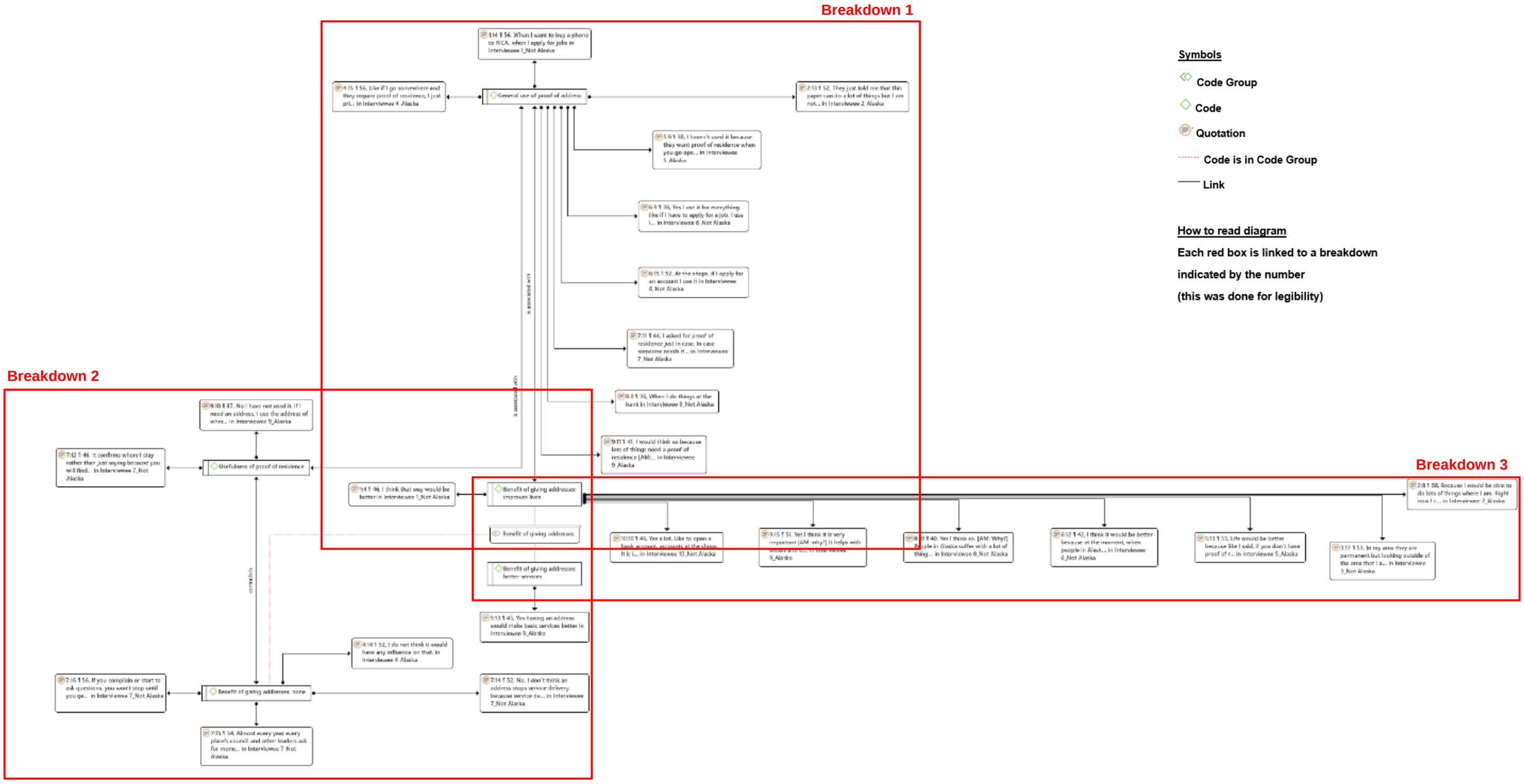
Eight out of ten interviewees said that the benefit of giving people addresses is that it would improve their lives, and each with their own motivation. Those interviewees who live in Alaska will be noted first with Interviewee 2 saying that they would be able to do a lot more things where they are if they simply had an address. Interviewee 2 emphasises the relationship between having an address and the certainty of having somewhere to live by stating, *"…right now even when building your shack, you are scared…if I build here, will the councillors come and demolish my home"*. While Interviewee 5, who also lives in Alaska, says that life would be better with an address because then that would mean that they can get a proof of residence further stating, *"At schools they want it [proof of residence], they do not give the child a form without proof of residence,"* having already had an experience where their child was turned away from a school because they did not have official documentation. Interviewee 9 also added that they use their proof of residence when applying for their child to go to school. The last interviewee out of the eight from Alaska was Interviewee 9, who simply stated that having an address would help with access and opening doors for them. Interviewees 1 and 3 who do not live in Alaska said that when comparing their lives with those that live in Alaska, having an address would make their lives better. Interviewee 6, resident of Lusaka township, which is next to Alaska, offered input on how the lack of addresses in informal settlements not only affect those that live in them but those around them by stating, *"It would be better [for people to get assigned addresses] because at the moment, when people in Alaska need proof of residence they come to us in Lusaka and they use ours"*. Interviewee 10 took a more overall approach by stating that lives can be improved by the freedom to open a bank account or a store account, as proof of residence is needed everywhere.

Another way that giving people addresses could be beneficial is that it would allow people to have access to basic services. Interviewee 9, who lives in Alaska, said that having an address would make service delivery better. This statement can be supported by Interviewee 8, who

says that people in Alaska suffer due to a number of things like no electricity, which results in them creating illegal connections.

Two of the interviewees said that there is no benefit in giving people addresses because addresses are not linked to the current problems that people in informal settlements face. Interviewee 4, who lives in Alaska, said having an address would have no influence on their life. An extensive explanation which cited corruption by council members and other leaders was given by Interviewee 7, who said that not having an address should not stop service delivery because they know where you are. They go on to explain that what stops service delivery is a lack of money in the budget and that if you ask exactly what the money is used for, you become a target because you are seen as taking food out of the mouths of the family members of the leaders.

To provide some context on some practical uses of proof of residence, the interviewees were asked to motivate the usefulness of these documents as well as their general use. When it came to the usefulness of a proof of residence, Interviewee 7 said it confirms where you stay, which is useful if you want to develop on your piece of land so that you can be certain that you are not developing on someone else's land. Interviewee 9, on the other hand, says there is no use in their own proof of residence as they do not have one and if they need one, they use the documentation of where their child's mother lives. Other general uses of proof of residence documents were also provided by the interviewees, which are important to note because many tasks are often not possible for people in informal settlements. Interviewees 1 and 6 said that they use their proof of residence when buying a new phone and registering for the Regulation of Interception of Communications and Provision of Communication-Related Information Act (RICA), as well as when applying for jobs. While Interviewees 5, 6, 8 and 9 said they use their proof of residence when opening new accounts either at the bank or in-store



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How to read diagram

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Figure 8: Network of the benefits of giving people addresses

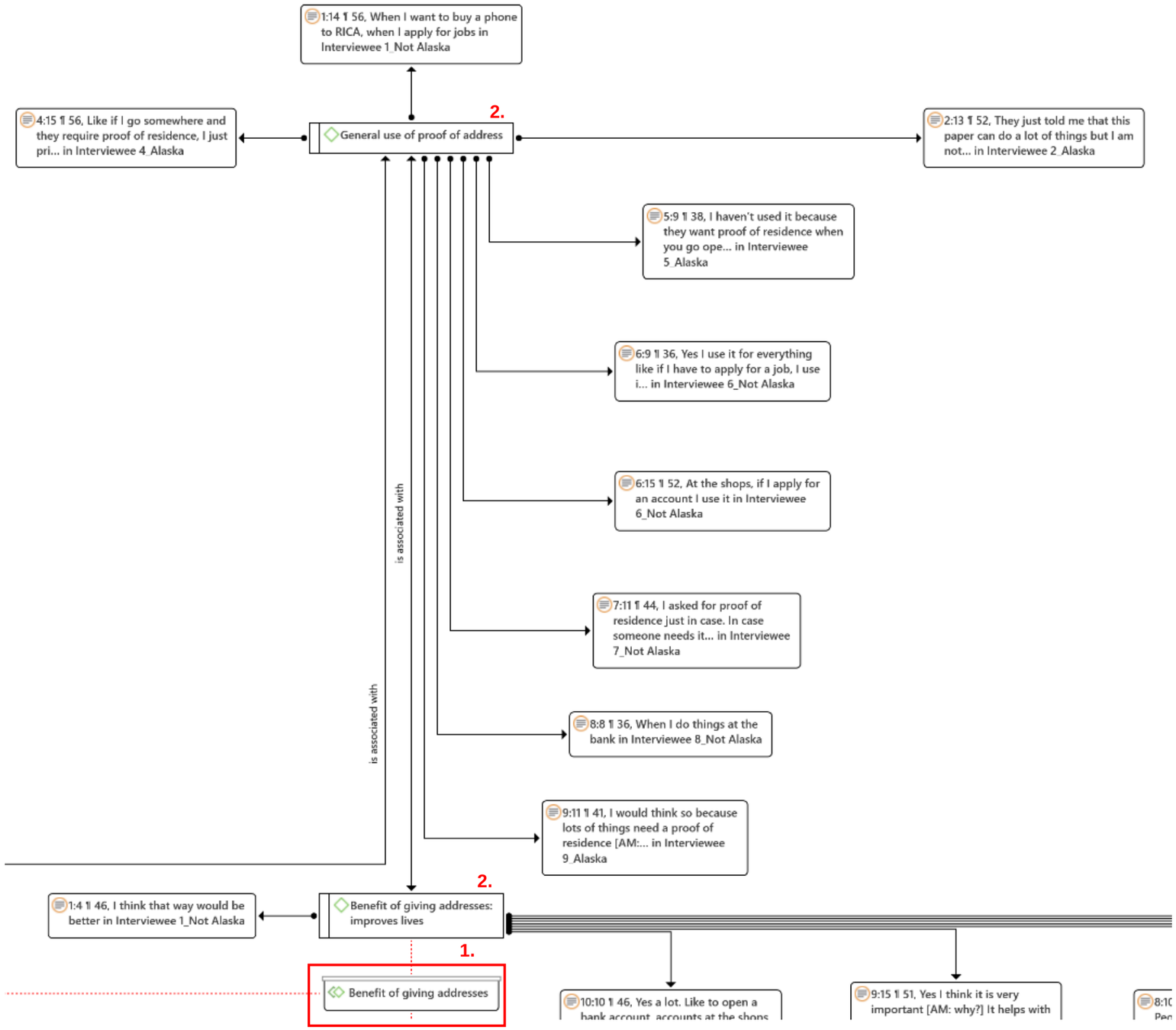

Figure 9: Network of the benefits of giving people addresses - Breakdown 1

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How to read diagram

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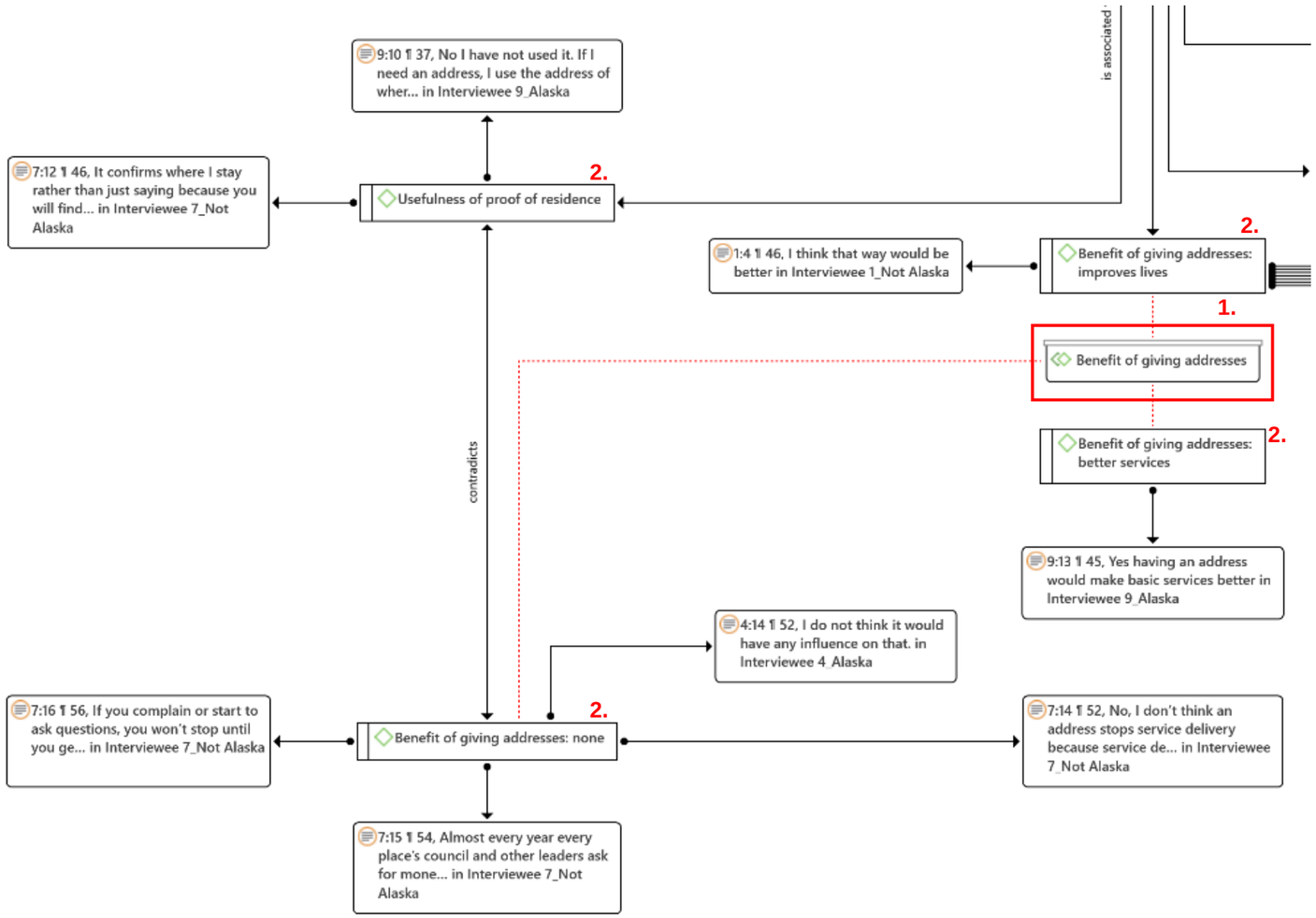

Figure 10: Network of the benefits of giving people addresses - Breakdown 2

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How to read diagram

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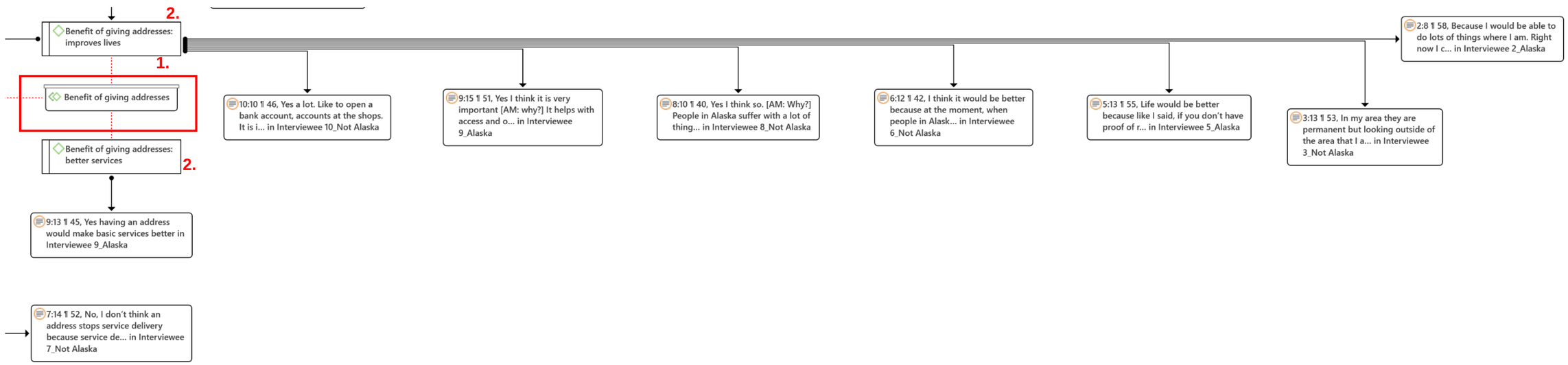


Figure 11: Network of the benefits of giving people addresses - Breakdown 3

3.3.6. Exploring current relationship with addresses

There are elements which surfaced during the interviews that are related to how interviewees engage with addresses in various different ways. These elements help provide context on the value and importance interviewees place on addresses. The elements in question are giving directions to a friend (Figure 14), the existence of addresses growing up and at present (Figure 16 and 17), type of area growing up (Figure 16), engagement with local municipality (Figure 17), as well as the source of the proof of residence (Figure 15). Each of these elements has their own subcategories as seen in Figure 13 (the clearer breakdown of this figure can be seen in Figure 14, Figure 15, Figure 16, and Figure 17).

An element that provided insight on how the interviewees engage with the world around them spatially was how they would give directions to a friend for a social visit. Interviewee responses ranged from simply giving the friend an address or GPS location through WhatsApp, to directing them using landmarks, encouraging them to ask for directions and fetching them from the nearest taxi stop. Interviewees 2, 6, 7, 9 and 10 all said that they would direct their friend using landmarks or main places that they see around them. While Interviewees 1, 6 and 8 said that they would simply give their friend their address – house number and street name and this is possible because they all live in either Lusaka or Phase 3. Interviewee 3 who seems to be the most tech-savvy of all the interviewees said, *"…WhatsApp location because it is easier"*, but if they had any issues with the GPS location, then they would simply tell them to get off at the taxi stop nearest to their house and would then fetch them from there. Interviewee 4 who lives in Alaska would do something similar stating, *"I would tell them to get off the taxi just before VIVA Foundation, then I would go and fetch them there because the roads are kind of complicated"*. Interviewee 5 said that they would direct their friend using taxi routes then when they get closer to the destination, ask for directions at the closest church. While Interviewee 7 said that they would encourage their friend to ask for directions in addition to giving them landmarks, *"…they will see a Chinese shop where they can ask for further directions".*

In order to understand what the interviewees considered as addresses or if they had ever had an address, one can take a look at if they had an address growing up or if they have an address where they currently live. Interviewees 2, 4, 5 and 8 said that growing up they had an address which they described as a house number and a street name. Interviewees 2, 5 and 8 said they grew up in a township and Interviewee 4 said that they lived in a village. While Interviewees 1, 3, 6, 7, 9 and 10 all said that they did not have addresses growing up, with Interviewee 1 adding that they only had a house number, which they do not consider an address. Interviewees 1, 7, 9 and 10 stated that they grew up in a villages, Interviewee 3 said they grew up in a rural area as well as an informal settlement, and Interviewee 6 said they

grew up in an informal settlement. Two interviewees who currently live in Alaska, Interviewees 5 and 9 said that they have an address where they currently live, and Interviewee 9 elaborated saying, *"We have the number that is written on the side of the shack, but we have no street name"*. Interviewees 3, 6, 7, 8 and 10 all said that they have addresses where they currently live; this is expected as they live in townships surrounding Alaska. The other two interviewees who currently live in Alaska said that they do not have an address where they live but went on to say that there are house numbers but they are not permanent (an example can be seen in Figure 12).

Figure 12: Numbers on a dwelling in Alaska

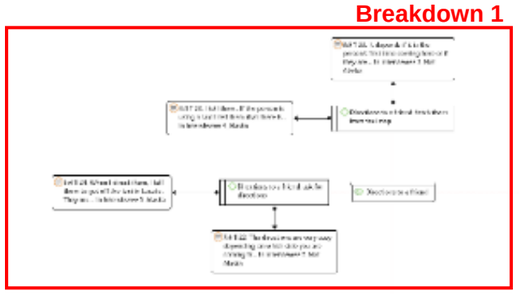
People who live informal settlements who would ordinarily not have any proof of residence documentation are allowed to ask their ward councillors for an official letter which would confirm their postal and residential address. To see how many of the interviewees have made use of this service, they were asked how often they engage with local municipality or the ward councillor. The interviewees that live in the surrounding townships answered relative to their situation which allowed for a variety on responses. Six out of ten of the interviewees said that they have never engaged with the local municipality, those interviewees being Interviewee 1, 3, 4, 8, 9 and 10. Interviewees 2 and 5 who both live in Alaska stated that they have engaged with their local municipality or ward councillor to ask for proof of residence documents and Interviewee 2 elaborated saying that they had gone to the ward councillors and were referred to the local municipality office, however they did not get any help because of the COVID-19 pandemic, but said that they will follow up when they can and that they hope at the end of this entire process that they can get papers to prove where they live. Interviewees 2 and 6 have engaged with the local municipality for different reasons; Interviewee 2 to enquire about when

they would be getting proper electricity supplies, and Interviewee 6 to query a utilities bill and to complain about the lack of electricity because of Alaska residents stealing their cables. Interviewee 7, who engaged with the ward councillor at local meetings where questions are raised, seemed to be the most involved in the community of all the interviewees.

Taking a look at the interviewees' current relationships with addresses, the next focus was to further explore where those that have proof of residence in fact got it. Those that live in townships surrounding Alaska namely Interviewees 1, 7 and 10 stated that they get their proof of residence from the City of Tshwane. Interviewee 2 indicated that they currently do not have any proof of residence but are still waiting to go to the local municipality offices to receive documentation. This process is supported by Interviewee 5, who also said that they do not have any proof of residence but had heard from their neighbour that there is a process where you can go to the municipality offices in Denneboom, Mamelodi and they can give you proof of residence that can then be used to register their child at school. Interviewee 4, who also lives in Alaska, simply said that they do not have any proof of residence.

After having extensively explored the interviewees' relationship with addresses, the last element was to figure out their understand of whose responsibility it is to assign addresses to people. All of the interviewees said that they think it is the City of Tshwane's responsibility to assign addresses to those that do not have any. Interviewee 4 who lives in Alaska said, *"…municipality is here to serve people*". Interviewee 5 said that because people who live in Alaska are not always South African nor do they have the correct documentation, it is difficult for them to approach any kind of authority especially when other people move into their shacks while they are away, thus the responsibility should be with the municipality to engage first. The sentiment that the responsibility to engage first is with the municipality is supported by interviewees 1, 6, 8 and 9, as they believe that people are suffering in the conditions that they are living under. Interviewee 10 stated, *"…people have rights that the municipality and government need to make sure they cater to, especially when they promised during elections"*.

Breakdown 1



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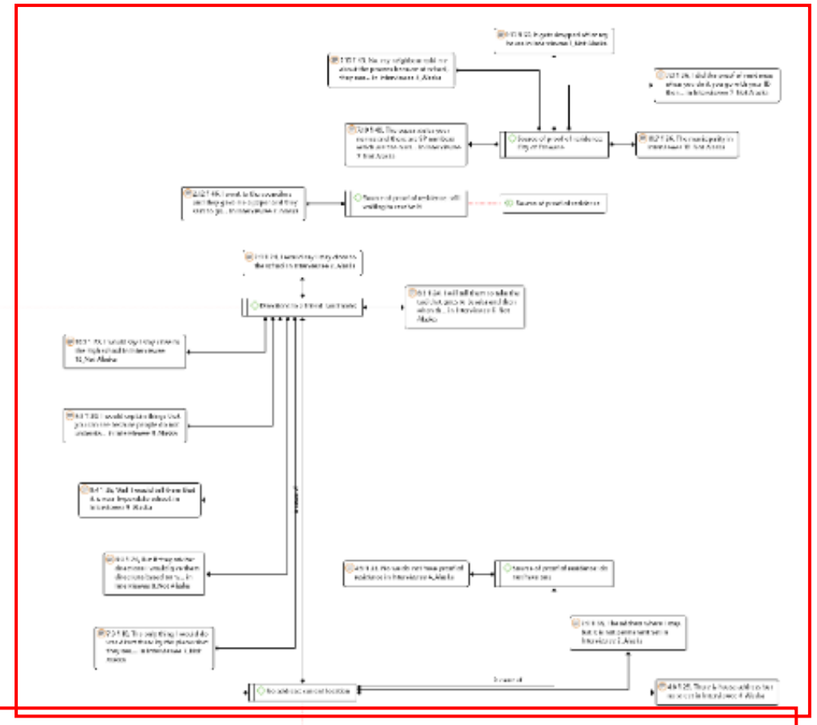
Breakdown 2



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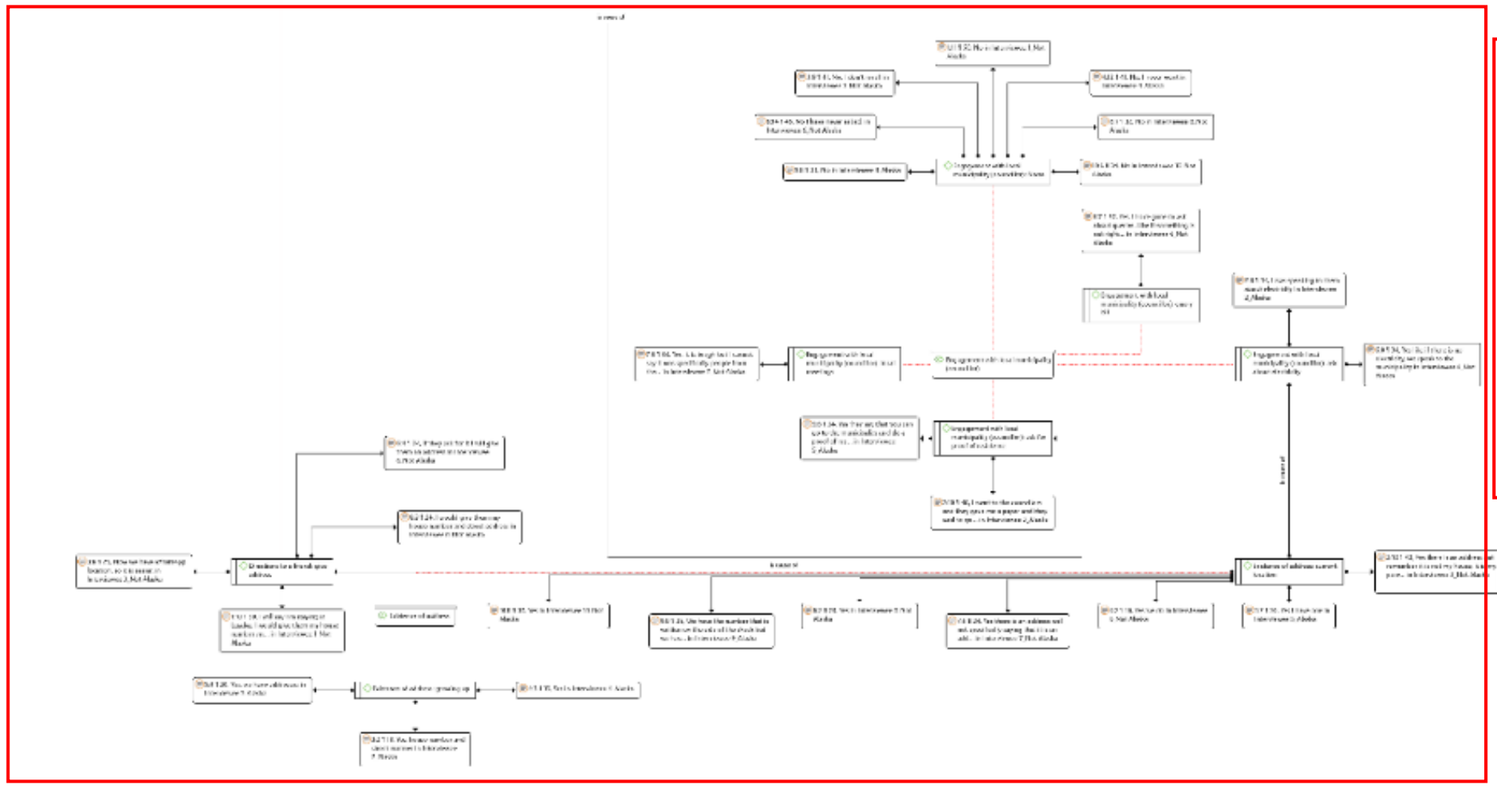
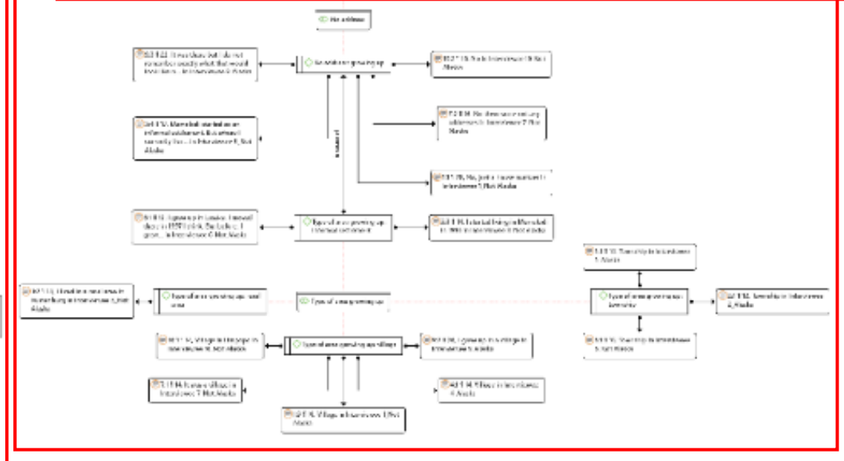




Breakdown 3

Figure 13: Network of exploring current relationship with addresses

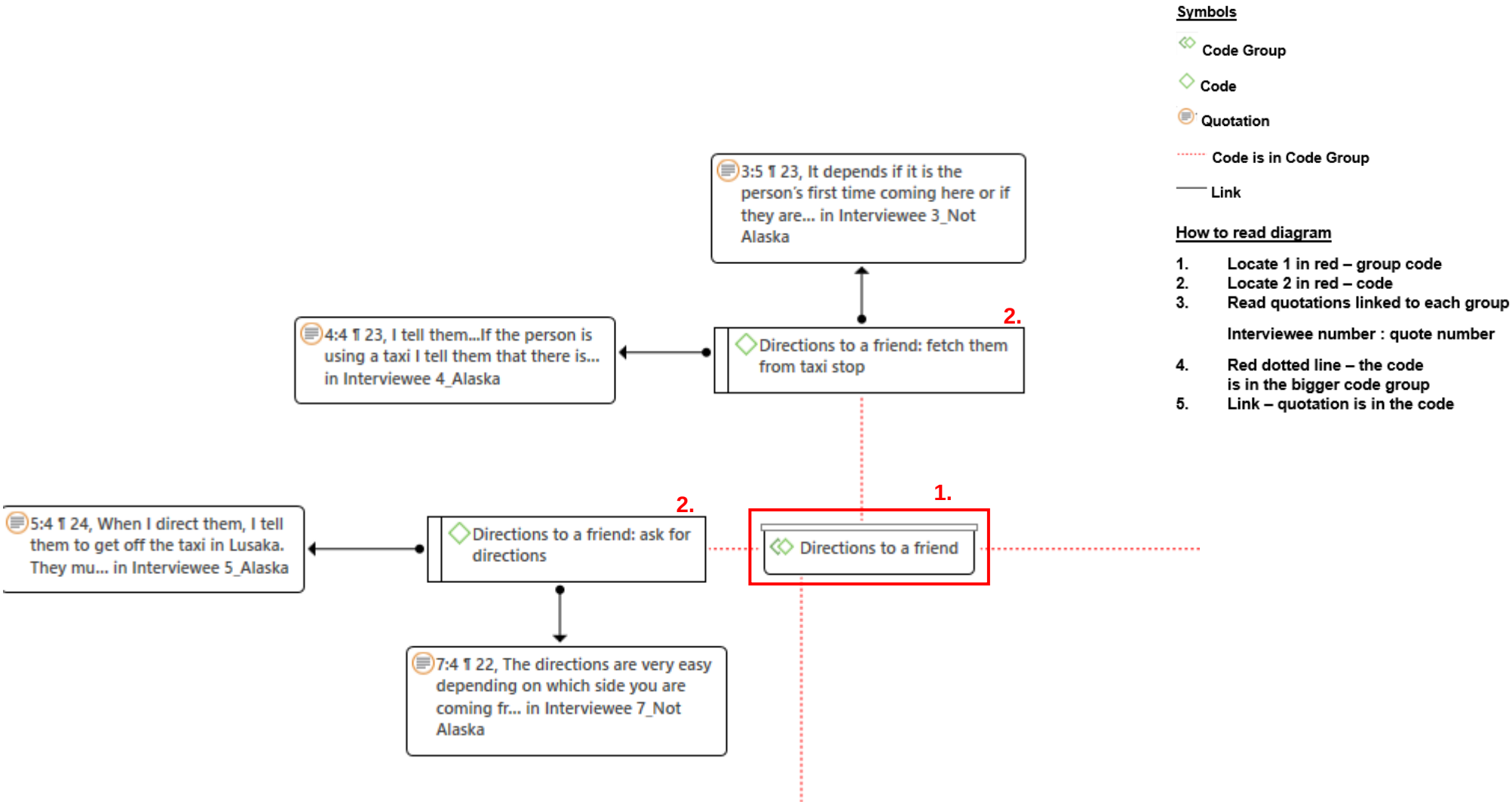
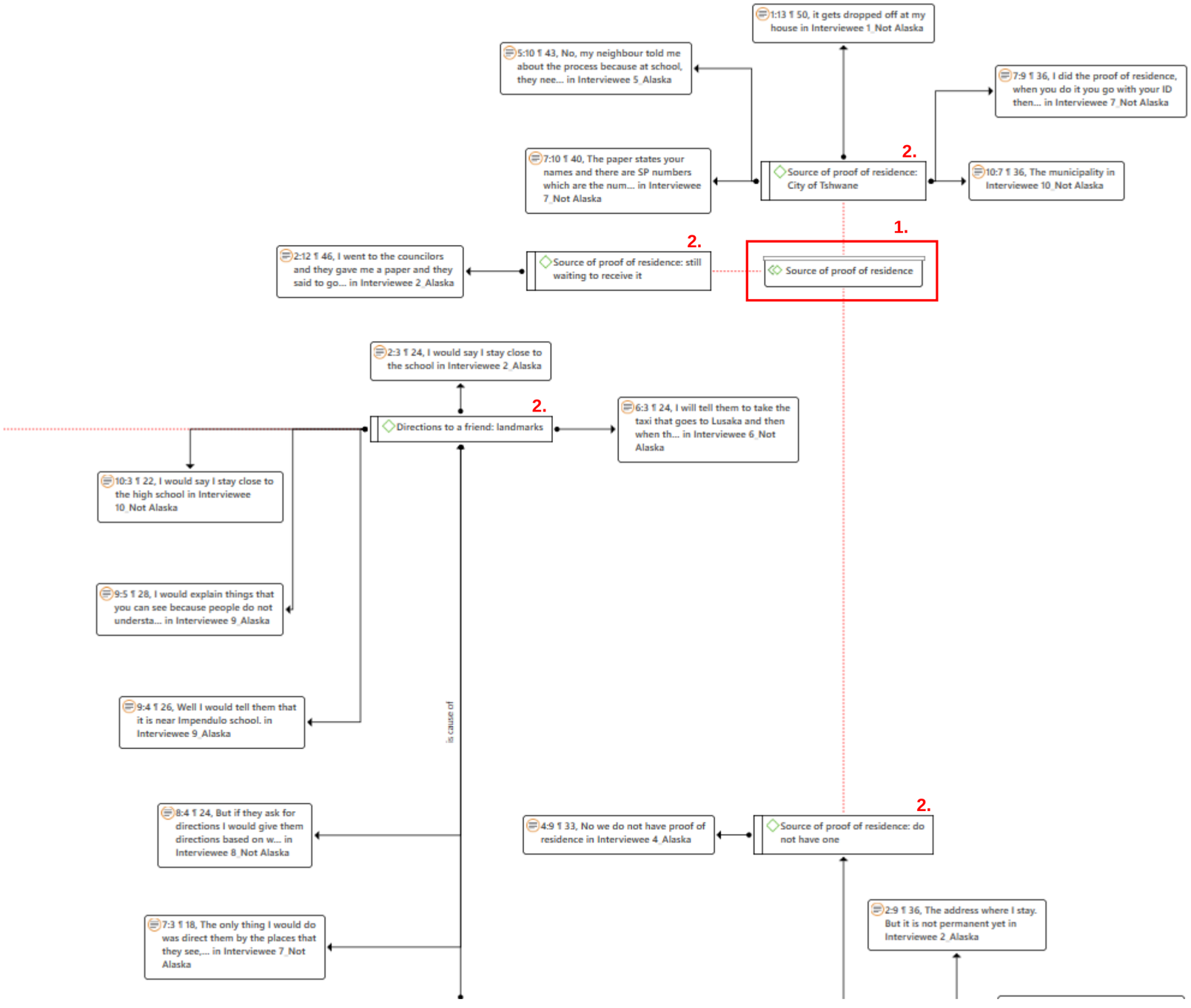


Figure 14: Network of exploring current relationship with addresses - Breakdown 1



Symbols

- Code Group
- Code
- Quotation
- Code is in Code Group
- Link

How to read diagram

1. Locate 1 in red – group code
2. Locate 2 in red – code
3. Read quotations linked to each group

   Interviewee number : quote number
4. Red dotted line – the code is in the bigger code group
5. Link – quotation is in the code

Figure 15: Network of exploring current relationship with addresses - Breakdown 2

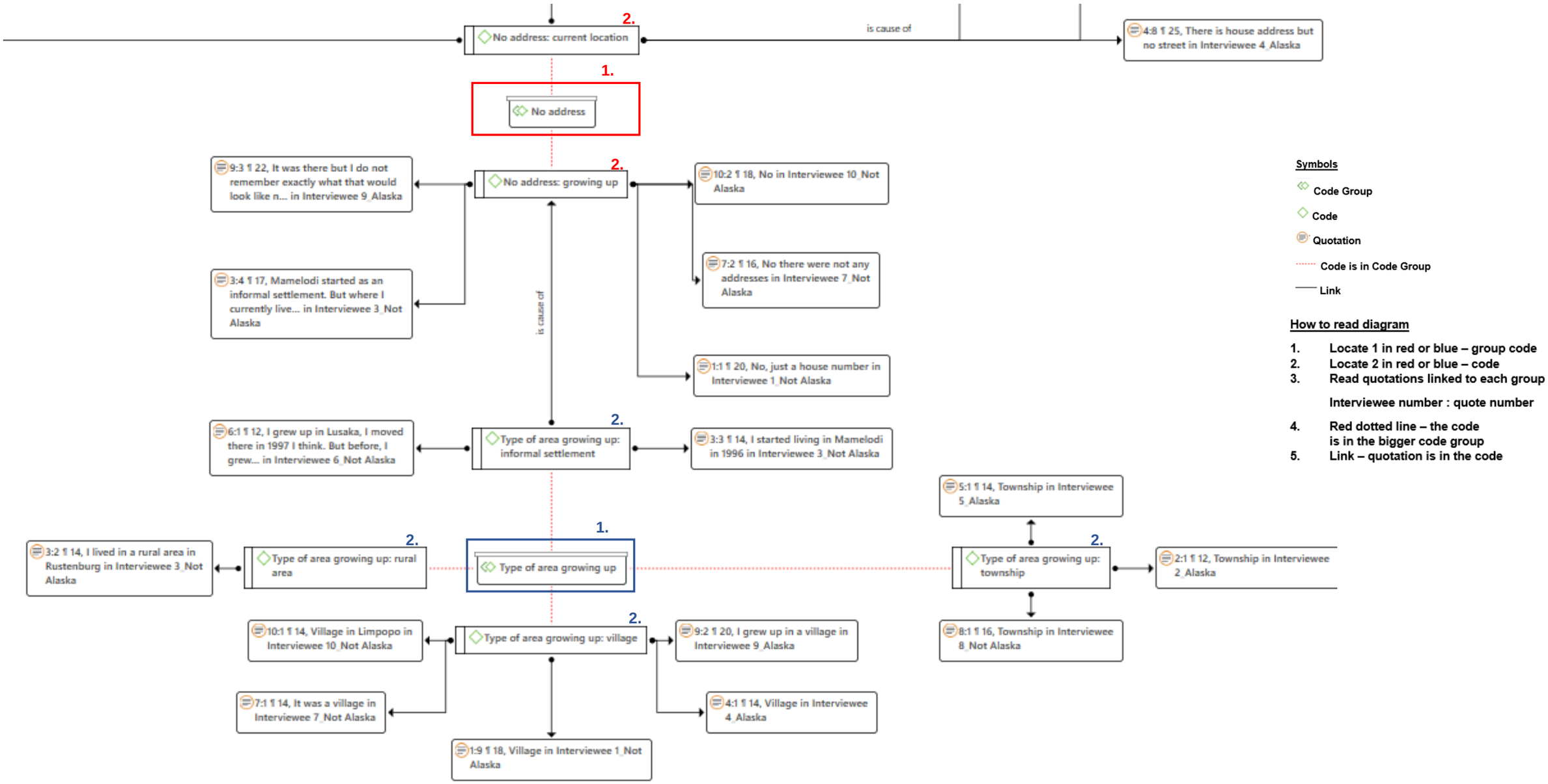


Figure 16: Network of exploring current relationship with addresses - Breakdown 3

Symbols

- Code Group
- Code
- Quotation
- Code is in Code Group
- Link

How to read diagram

1. Locate 1 in red or blue – group code
2. Locate 2 in red or blue – code
3. Read quotations linked to each group

   Interviewee number : quote number

4. Red dotted line – the code is in the bigger code group
5. Link – quotation is in the code

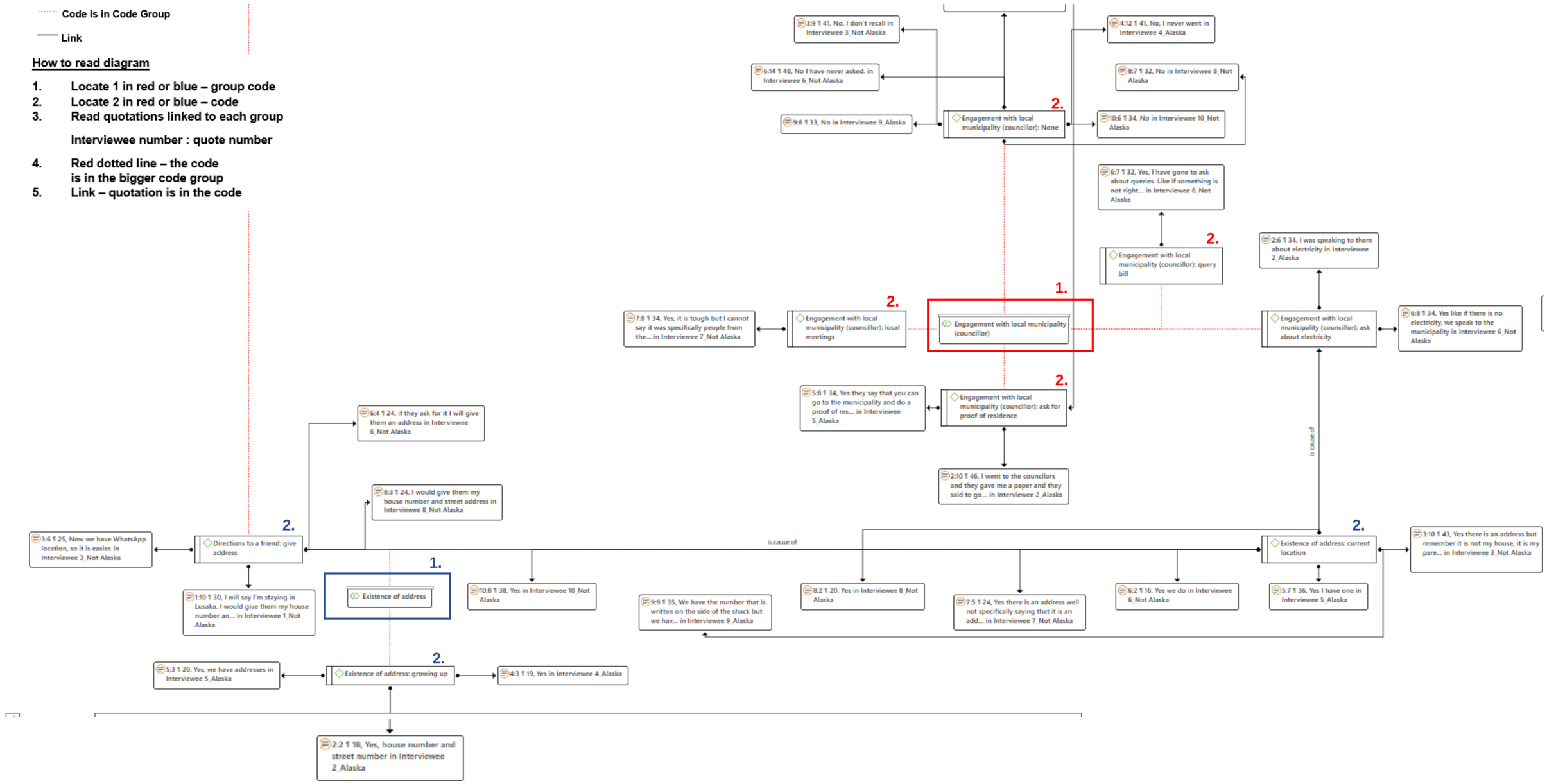


Figure 17: Network of exploring current relationship with addresses - Breakdown 4

3.4. Discussion and Conclusion

After speaking to residents of Alaska and its surrounding areas there are links and relations that can be made between the five areas of interest and their sub-categories.

The first of which is the importance of addresses, with the interviewees responding that they are important as they help people find you, especially in the case of an emergency, job application, as well as in order to open a bank account; these categories are all supported by literature (Coetzee and Cooper, 2007b). The importance that was highlighted by the Universal Postal Union (UPU, 2012) and is reiterated by Interviewee 8, is that it is important to have an addresses so that a child can be enrolled in school. The second area, which links to importance is the ability to open bank and store accounts as per FICA regulations. It is currently unknown where residents of informal settlements get their proof of residence for activities such as opening a bank account, registering a phone and registering to vote (Balkaran, 2016), but the interviewees provided some useful information regarding this topic. Interviewees that live in Alaska stated that they used proof of residence documents from previous formalised residences, which included those of their former employers and the homes of their extended family.

It is clear that the law requires individuals to have addresses (South African Government, 2001; RICA, 2003) and proof of residence, but it is not always easy to get proof of residence that those that live in informal settlements qualify for. Through the interviews conducted in this research, it is evident that municipal councillors in Alaska are not always willing to give community members proof of residence. This then forces members of this community to either resort to fraudulent or illegal activity in order to participate as active members of society, where the inability to be granted a proof of residence denies them of their basic human rights.

The third area is concerned with the quality of life, where the residents of Alaska said that having addresses affects their quality of life (UPU, 2012). Two residents of Alaska said that the quality of life is bad, and one said that it is good as they are excluded from the politics of daily life. The same interviewees who live in Alaska were initially asked what their reason for moving there was, and some responded that they moved there for a better place to live. This however contradicts the sub-category that the quality of life in Alaska is bad, which would mean that regardless of the surrounding circumstances of living in an informal settlements, individuals are willing to move there for proximity and convenience to urban areas. These urban areas provide opportunity for employment growth, but the urban infrastructure is not equipped for this rapid population growth. The urban areas that people move to the most are metropolitan areas which have experienced 60% of South Africa's population growth between 2001 and 2011 (Turok and Borel-Saladin, 2014).

The benefit of giving people addresses was the fourth category which had significant responses, which ranged from there being no benefit to there being plenty of benefits. The benefits which were mentioned resonate with what is currently known about why an address infrastructure and street addressing is necessary (Farvacque-Vitkovic *et al.*, 2005), which is that it can improve people's lives by allowing them access to better services and thus more opportunities. This is important, as addresses can be used to access areas which that were previously inaccessible. Additionally, there were interviewees who stated that there is no benefit to assigning people addresses, while others said that having an address could result in a proof of residence that can be useful or improve the day-to-day life. This suggests that individuals may not necessarily view the importance of having an address and may see having a proof of residence as separate to addresses altogether.

The fifth and final sub-category is exploring the interactions that people have with addresses, specifically in terms of how they would give directions to a friend for a social visit. All of the interviewees responded with informal addresses (SABS, 2009a) which ranged from simple directions using the landmarks, to asking the person who is visiting to meet them at the nearest taxi stop. An example in literature of how wayfinding is done in informal settlements was done by Madubedube, Rautenbach and Coetzee (2018), where they compared left-right directions and cardinal directions. The study showed that participants preferred and performed better when using left-right directions. All the interviewees had addresses growing up, which supports the literature that says that individuals move to informal settlements to be closer to urban areas for better access to jobs and opportunities (SERI, 2018). When it came to the source of proof of residence, the interviewees who lived in Phase 3 and Lusaka said that they get them in the mail; where of those that live in Alaska, one had made efforts to get an affidavit from the councillor but had been unsuccessful due to offices times being limited due to the COVID-19 restrictions. It does however seem that, similar to the Polokwane Local Municipality and the Kouga Local Municipality as well as what is written in FICA (South African Government, 2001), residents of informal settlements are able to ask their councillor for an affidavit proving their residence and this can be used in a formal capacity – although none of the interviewees had attempted this. There are however other alternatives to this letter that are accepted, such as bank statements, employer letters, affidavits, and TV license letters.

The results from the interviews done in Alaska and its surroundings provide valuable insight on the views and thoughts of the value of addresses, even though there were limitations when it came to phone interviews. Some of the interviewees were hesitant to give out their information to a stranger over the phone out of fear of getting scammed, this is common especially in communities where individuals are marginalised. The way that the people who were interviewed view the importance of assigning addresses to those that do not have an

address and linking that to having proof of residence documentation and its uses are different. While the majority of the interviewees recognise the importance of having an address, some do not think that having one would be a solution to problems faced in informal settlements.

The residents of Alaska who were interviewed place a high value or importance on addresses and the quality of their lives as two of the four have made significant efforts to try and get some sort of documentation to prove their place of residence.

Based on the results, there needs to be further exploration into the procedure that people in informal settlements should follow when needing to get some sort of proof of address from the ward councillors and local municipalities. There is currently no official procedure in the City of Tshwane, but there does seem to be a verbal understanding amongst some officials and residents of informal settlements. This would be a solution in the meantime while officials work on ways to assign addresses to those living in informal settlements, a procedure like the one followed in Addressing the Unaddressed (Burton, 2020) where dwellings are geocoded could be the mitigation needed for emergency purposes.

4. Chapter 4 Online Survey to Geospatial Professionals and the General Public in South Africa

4.1. Introduction

This chapter discusses the surveys which were distributed to geospatial professionals and the general public in South Africa, how they were designed and the results.

4.2. Study Design

4.2.1. Overview

The aim of the survey, which was distributed to geoinformatics professionals and the general public, is to gain insight and perception on what the public thinks of addresses and address data in South Africa. In South Africa, GISc Professionals are in people that belong to a professional body (South African Geomatics Council), however, to avoid any confusion, for the sake of this research a geospatial professional is anyone who works in the geospatial field. This study will be conducted through surveys that are beneficial when gathering a big quantity of responses from the desired audience. The survey questions were derived from a combination of existing literature, including the GCRO Quality of Life Survey 2015 and addressing standards of South Africa and local knowledge on the current addresses in South Africa and how its data is stored and dealt with. The participants of the survey were invited through different communication platforms, and this follows the convenience sampling method.

4.2.2. Materials

This section describes the materials used to create the survey, where an outline can be seen in Table 6 and the full survey in Annexure B. It was created using Qualtrics and distributed online through various communication platforms. The questions which were asked probed at the ways in which the public interacts with addresses and address data as a whole.

Table 6: Section titles of survey

Section Title
Demographics
Experience with Addresses - Professionals
Accessing Address Data
Experience with Addresses – General Public
General

4.2.3. Procedure

The survey was distributed using various methods, all of which were online. An anonymous link to the survey was sent to the mailing lists of different geospatial organisations namely, the Geo-Information Society of South Africa (GISSA) and South African Geomatics Institute (SAGI). This link was also shared with the current students of the at the University of Pretoria through the Department of Geography, Geoinformatics and Meteorology's Blackboard Learn page, the Postgraduate Student Association for the Natural and Agricultural Sciences (PSANA) mailing list and the Centre for Geoinformation Science (CGIS) mailing list, which was used for events and means that anyone who was not a part of the university but indicated that they were interested in geoinformatics was contacted. The link was also shared with the public on social media such as Facebook, LinkedIn, and Twitter. Once the participant clicked on the link, a Qualtrics survey opened and consent was asked of each individual before continuing and then the questions began, which took about 10 minutes to complete.

4.2.4. Participants

In order to gain an understanding on what the public thinks of addresses in South Africa as well as how they navigate their general environment, the survey which was distributed online had a total of 234 respondents but 22% of them had to be discarded because they did not complete at least 97% of the survey. The limit was chosen as 97% because this meant that the respondent completed all the questions except for the last question which was open ended – this was noted when discussing the recommendations from this question. The remaining 182 participants were grouped into three categories which made it easier to contextualise the responses. The three categories are i) General Public (65% total – 78% female, 20% male, 2% other), ii) Professionals: work regularly with addresses (21% total – 65% female, 35% male) and iii) Professionals: do not work regularly with addresses (14% total – 50% female, 50% male). These percentages were rounded up to whole numbers to make it easier to read/ understand and so they do not always reflect whole numbers of people when calculating the number of participants from the percentage. Participants who fall into the general public are those that do not work in the geospatial field and those that do work in the geospatial field fall under professionals. Professionals are divided into two groups: those that work regularly with addresses whose responses were that they work with addresses either daily or weekly, and those that do not work regularly with addresses whose responses indicated that they work with addresses monthly, yearly, and never.

The participants education levels are shown in Figure 18, with majority (82%) having a university level education. Those that work in the geospatial field have a higher percentage of university level education with both subcategories having 92% and 96%, respectively. The breakdown of participants which have a university level education can be seen in Figure 19.

80% of professionals who regularly work with addresses have doctor's degrees which is the group with highest qualification while professionals who do not regularly work with addresses seem to have a better distribution between national diploma, honours degree and master's degree.

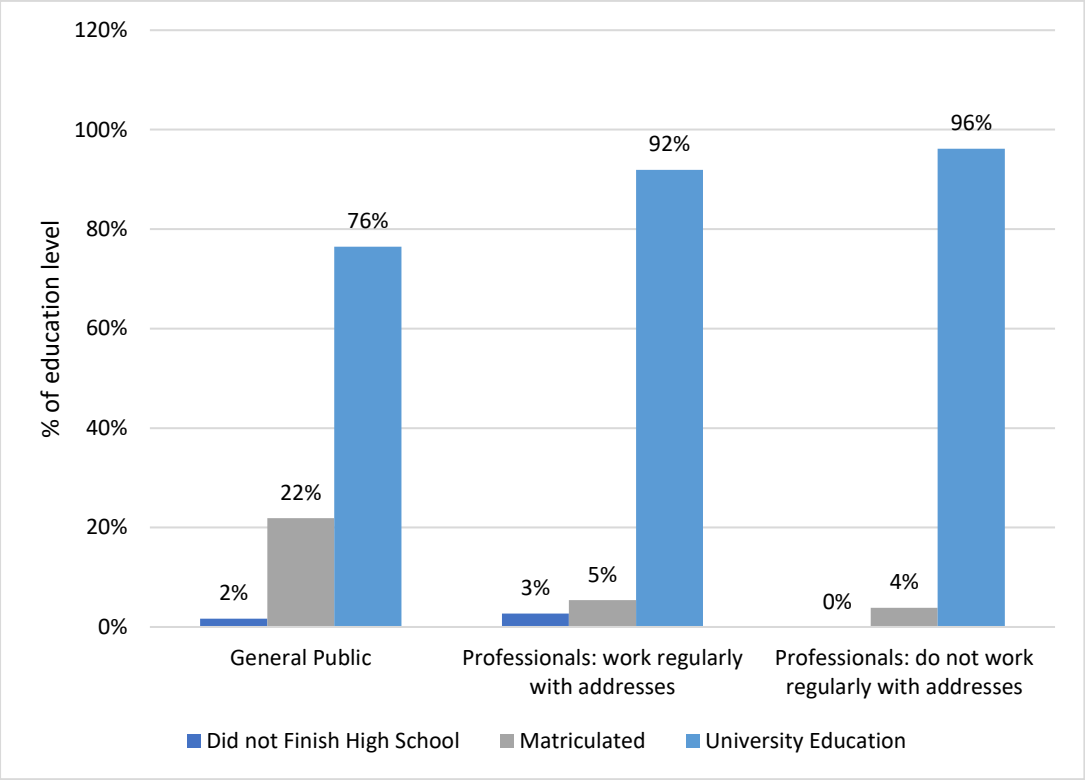


Figure 18:Education levels across the three categories (n=182)

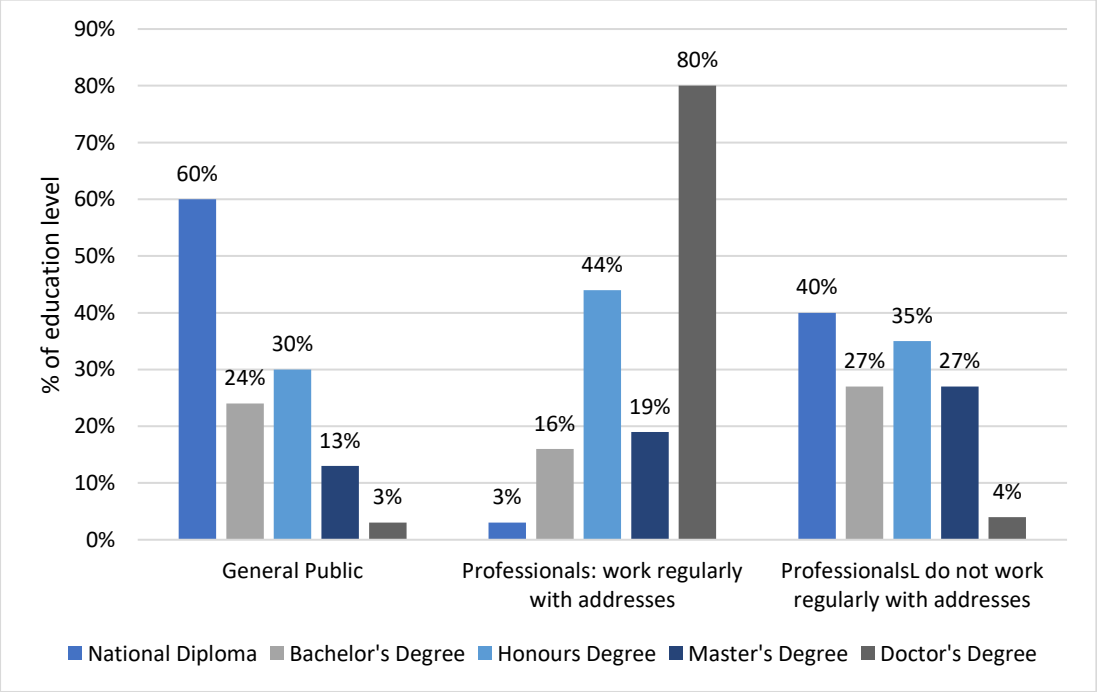


Figure 19: University education level across the three categories broken down (n=150)

4.3. Results

The results presented are responses from the 182 participants of this survey who range from the general public to geospatial professionals who regularly work with addresses. The results that include the responses from the general public are (4.3.1), i) Format of Address, (4.3.2), ii) Navigating to an Address and (4.3.3) iii) Improvements on Addresses and Address Data in South Africa. The results that focus on geospatial professionals include both those that work regularly with addresses and who do not are (4.3.4), i) National Open Dataset for Addresses, (4.3.5), ii) Address Data Sources and (4.3.6), iii) Formats of Address Data.

4.3.1. Format of Address

The format of address consists of two main sections, which are where the participants learnt how to write an address and the format in which participants wrote out an address. When scaled, the places that participants range from preschool to high school and between those two are learning at home/from parents, at primary school, sometime during school or the participants not remembering at all. The participants were presented with a paragraph which contained information about an address (as seen below), and they were asked to write down the address of the location that was mentioned format. The three most common formats in which this text was written can be seen in Table 7.

"Emily who lives at number 3 on a street called Blue Street has trouble writing down her address. The area she lives in is called Acorn Park in Johannesburg, South Africa and she always remembers her postal code which is 9999."

Table 7: Most common formats for text of address

Address Format	Format Details
1	3 Blue Street Acorn Park Johannesburg South Africa 9999
2	3 Blue Street Acorn Park Johannesburg 9999
3	3 Blue Street Acorn Park Johannesburg 9999 South Africa

Figure 20 shows that majority of the general public say that they learnt to write an address in primary school (62%) and the same applies for professions who work regularly with addresses (54%) and professionals who do not work regularly with addresses (60%). More professions who work regularly with addresses responded that they learnt sometime during school (19%) when compared to the other categories. 12% of professionals who do not work regularly with addresses indicated that they were taught how to write an address at home or by their parents, which is more than any of the other categories.

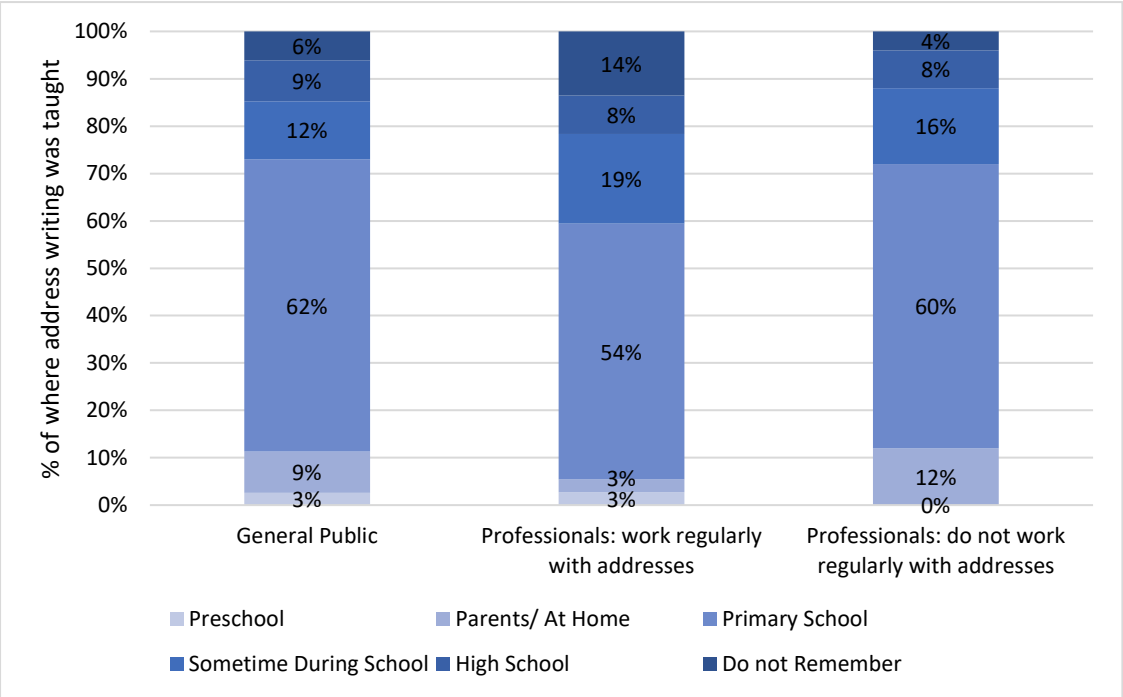


Figure 20: Places participants were taught to write an address (n=182)

The participants were given a paragraph which contained information about an address which read 3, Blue Street, Acorn Park, Johannesburg, South Africa, 9999 and they were asked to write down the address. The responses were grouped into 8 different formats depending on how the respondents wrote the address of the location that they were given and these can be seen in Table 8.

Table 8: Address format and format details

Address Format	Format Details
1	House Number, Street Name, Suburb, City, Country, Postal Code
2	House Number, Street Name, Suburb, City, Postal Code
3	House Number, Street Name, Suburb, City, Postal Code, Country
4	House Number, Street Name, Suburb, Postal Code, City, Country
5	Street Name, House Number, Suburb, City, Country, Postal Code
6	House Number, Street Name, Suburb
7	Suburb, City, Street Name, House Number, Postal Code
8	House Number, Street Name, Suburb, Postal Code, City

Figure 21 shows the formats in which each category chose to write the address with format 1 at a majority of 40% overall and format 2 at a close second with 36% of the overall respondents chose to write the address without the country. When taking a closer look at each category, majority of the general public (42%) wrote the address in format 1, this is different when compared to professionals who regularly work with addresses with majority (41%) of this category writing the address according to format, 2 and professionals who do not regularly work with addresses follow the same majority (42%) as the general public. The second most popular format for each category is as follows, with the general public (35%) and professionals

who do not regularly work with addresses (35%) choosing format 2 and professionals who regularly work with addresses choosing format 1 (32%). The least common formats were formats 4 through to 8 with a total of 8% of the respondents overall writing their address in those formats.

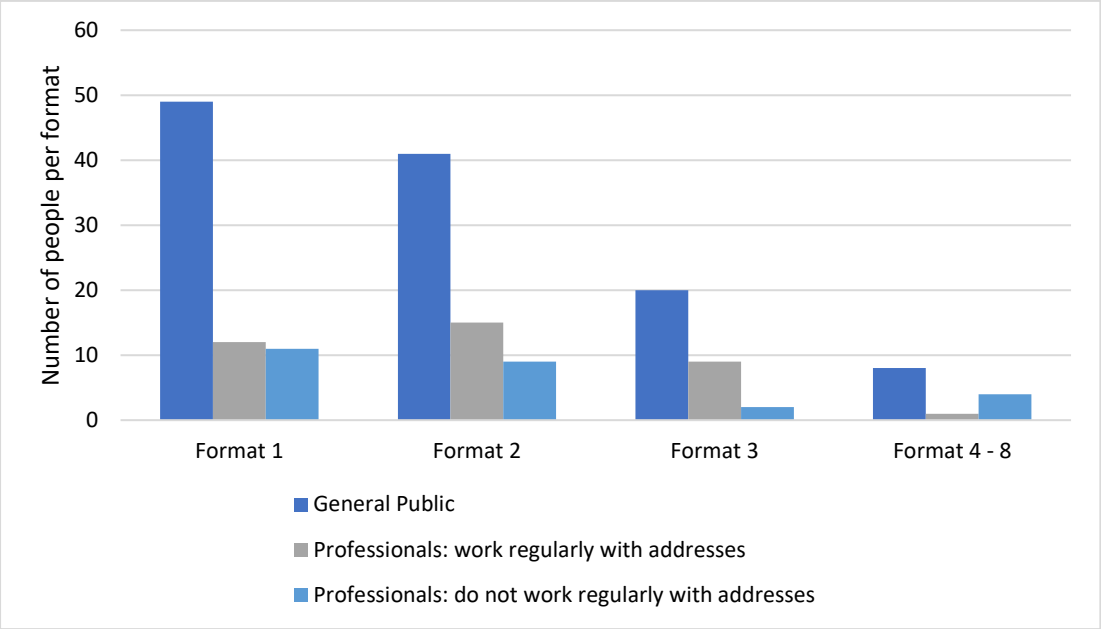


Figure 21: Format in which addresses are written (n=182)

4.3.2. Navigating to an Address

All of the participants were asked to show how often they navigate to an address using GPS devices/applications, paper maps, verbal descriptions/landmarks and from memory. These four ways of navigation were then compared against each other.

The way of navigation which 44% of participants say they always use is a GPS device/application while 40% of the participants said that they often use it. This is a stark contrast to paper maps which 56% of the participants said they never use in addition to 30% who said that they rarely use them. The contrast between GPS devices/applications and paper maps can be seen in Figure 22 which also shows that 56% of the participants often navigate from memory and 45% of them sometimes use verbal descriptions/landmarks.

There seems to be a stronger likelihood that participants will always or often use GPS devices/applications and memory to navigate to an address and they would be less likely to use any verbal descriptions/landmarks and even less likely to use a paper map.

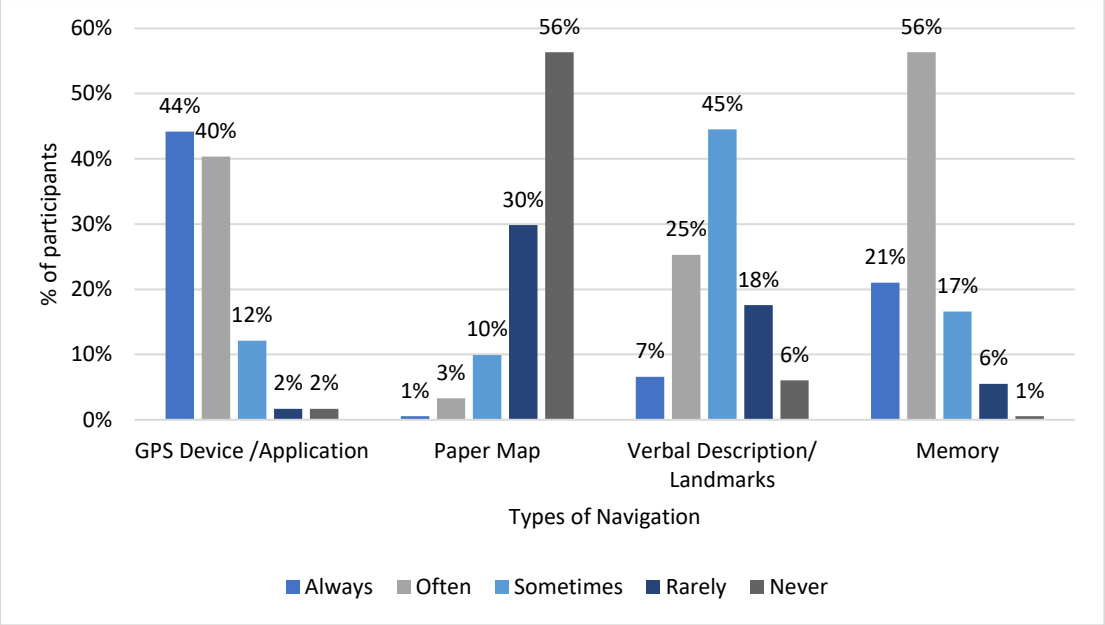


Figure 22: Ways in which participants navigate to an address (n=182)

4.3.3. Improvements on Addresses and Address Data in South Africa

As a way to gauge where all the participants were when it came to addresses and address data in South Africa, they were asked if they would improve one element of existing addresses and address data what would they improve as an open question. The responses in Figure 23 are a word cloud of the grouped responses which were submitted by all the participants.

Of the participants that responded, a total of 18% indicated that they had nothing to improve, have no opinion or that they had not ever thought about addresses in depth before. The majority (23%) of participants said the improvement they would make would fall under the standardisation of addresses and this can be expanded in a few ways. Standardising addresses includes better numbering and naming of streets in complexes, estates, and townships, avoiding similar names in the same town and indicating the demarcation between suburbs. A further 5% of participants went on to say that townships as a whole should be focused on by introducing street names as opposed to having sections which are made up by the residents. Informal settlements were highlighted by 3% of the participants who said that they would provide addresses to those that live in these settlements. While rural areas were singled out by 4% of respondents, who stated that they would assign addresses. A combination of all three (informal settlements, townships and rural areas) was mentioned by 4% of the participants who said they would improve the addresses by assigning them, and also ensuring that these areas are up to date on platforms such as Google Maps.

The maintenance of addresses – namely street names and house numbers – was mentioned by 7% of participants, who specified that they would make them more visible to people driving

past at eye level and not have them on the curb. The suggestion that the entire addressing system be reimaged was mentioned by 3% of participants who said that they would put forward using a proprietary geocoding system to assign “addresses” such as what3words and Google Plus Codes.

Few participants mentioned address data, with 4% saying they would make improvements by making data more accessible, and 3% mentioning introducing a national address database.

With such a wide net of responses, there seems to be an overall theme that addresses should be assigned in areas that do not have them, and those that do exist should be visible and accessible without much trouble.

Figure 23: Word cloud of improvements on addresses and address data in South Africa

4.3.3.1. Current Address Datasets in South Africa

To gain objective insight on what professionals think of the current address datasets in South Africa without introducing concepts such as open data and probing them to think about where they get their data, they were asked their thoughts. The breakdown of these responses can be seen in Figure 24. The professionals who regularly work with addresses responded that they think the address datasets available are fair (44%), while the biggest group of those who do not work with addresses regularly (30%) responded that they think they are good. A further 26% of professionals who do not regularly work with addresses agreed with those that do by supporting the response that the datasets currently available in South Africa are fair. There was almost an even split between good (25%) and poor (22%) in the professionals that

regularly work with addresses. 28% of the respondents that the current address datasets are good also indicated that they often use data provided by other service providers (mostly open source), which indicated that there is likely to be relation between the opinion of the current state of address datasets in South Africa and specific address providers.

Figure 24: Professionals' opinion of the current state of address datasets in South Africa (n=63)

4.3.4. National Open Dataset for Addresses

In order to get an opinion on the importance of a national open dataset for addresses, the professionals (both those that work regularly with addresses and those that do not) were asked to respond. Overall, the response was that it is very important to have a national open dataset for addresses but the participants that are professionals who regularly work with addresses had more polarizing answers when compared to professionals who do not regularly work with addresses, which is supported by Figure 25. In Figure 25 it is shown that 81% of professionals who regularly work with addresses stated that it is very important in comparison to the 73% of professionals who do not regularly work with addresses who also responded, "very important".

More professionals who regularly work with addresses (3%) indicated that a national open dataset was unimportant in comparison to the other group where none of the participants responded with this.

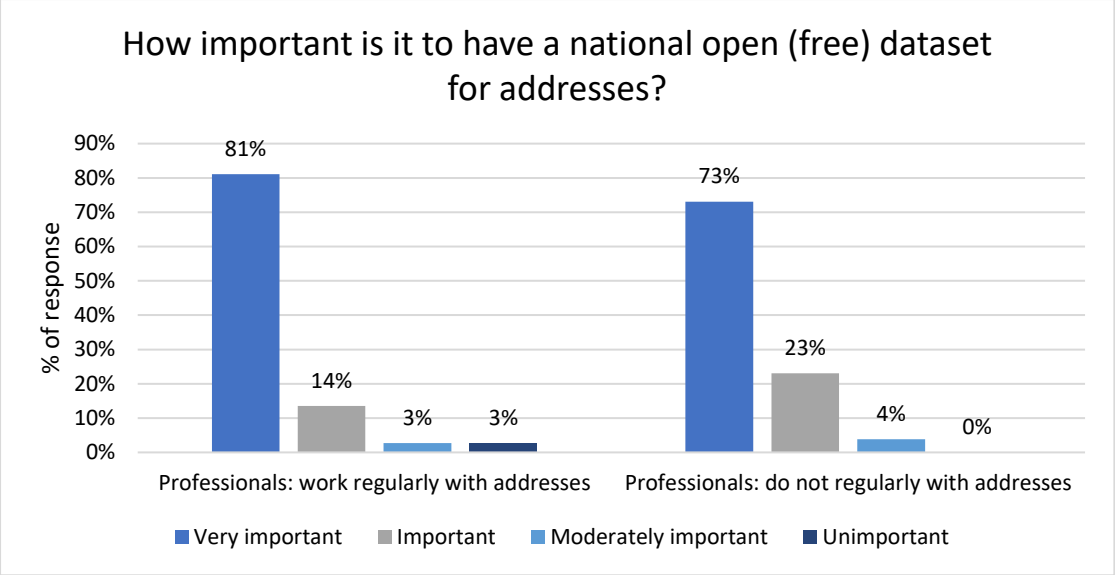


Figure 25: Importance of national open (free) dataset for addresses (n=63)

4.3.5. Address Data Sources

In order to focus in on address data, professionals were asked the frequency at which they use address data sources from government/administrative bodies, the private sector and other service providers such as OpenStreetMap and OpenAddresses.

The frequency at which geospatial professionals use address data provided by government/administrative bodies is not very high, as seen in Figure 26. 30% of professionals who regularly work with addresses responded that they often work with address data provided by government, while 19% said that they always use this source and another 19% responding sometimes. This can be compared to those that do not regularly work with addresses, who responded that 42% of them sometimes work with data provided by these bodies in addition to 38% that responded that they rarely use data from these sources.

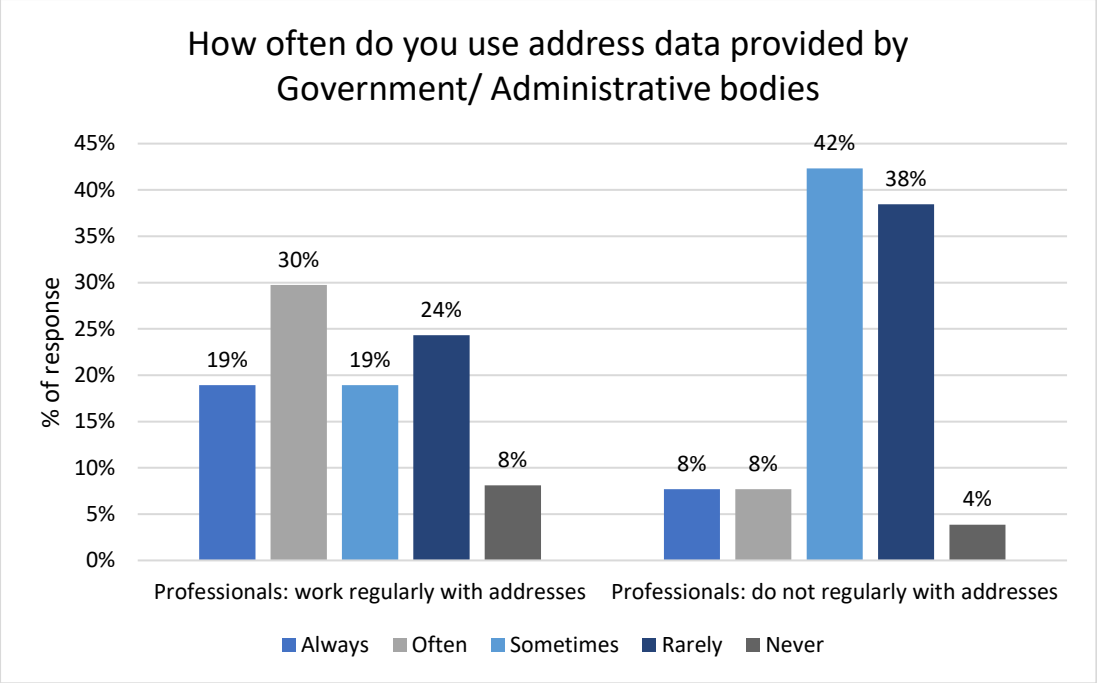


Figure 26: How often professionals use address data provided by government/administrative bodies (n=63)

Address data which is provided by the private sector is the most popular among professionals who regularly work with addresses, as 32% said that they always use data from this source and 41% responded that they often use data from this source. The professionals who do not regularly work with addresses had more moderate responses to this data source as 31% of them responded that they sometimes use it, and a further 23% said that they rarely use this source. It can again be noted that responses from those that work with addresses on a regular basis are more polarising than those that do not, as seen in Figure 27.

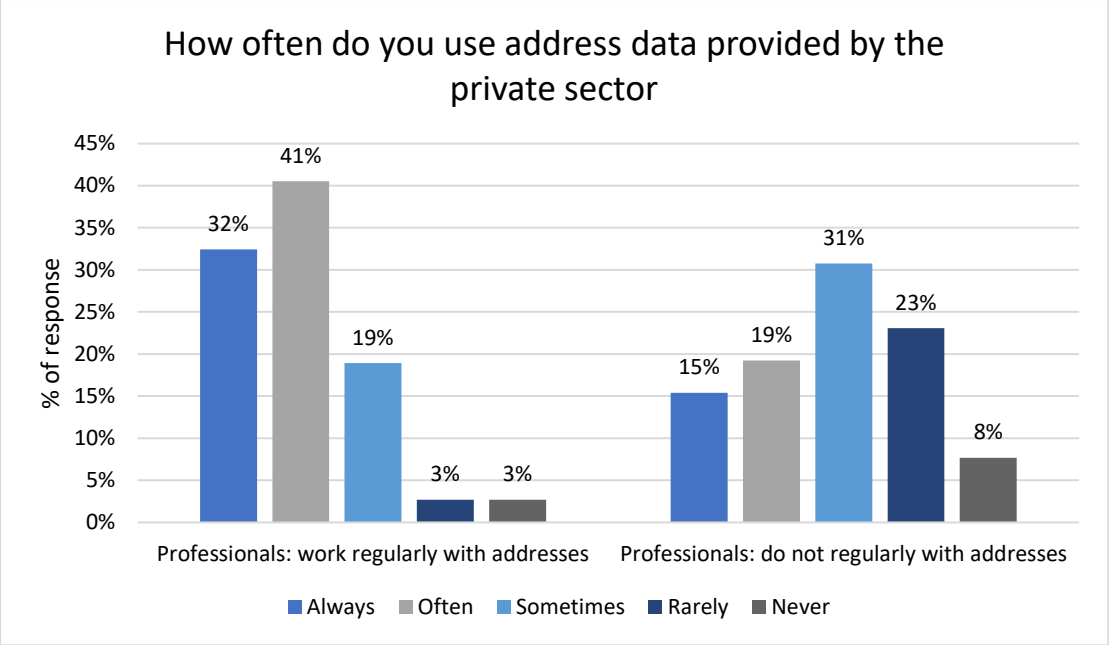


Figure 27: How often professionals use address data provided by the private sector (n=63)

When it comes to address data that is provided by other service providers which, as implied by the examples provided, lean more towards open data, professionals who do not regularly work with addresses responded that 31% of them use this source often and a further 27% saying they rarely use them. The breakdown of these can be seen in Figure 28. These can be directly compared to responses by professionals who regularly work with addresses with 38% responding that they sometimes use this data source and a further 22% and 27% using it always and often, respectively.

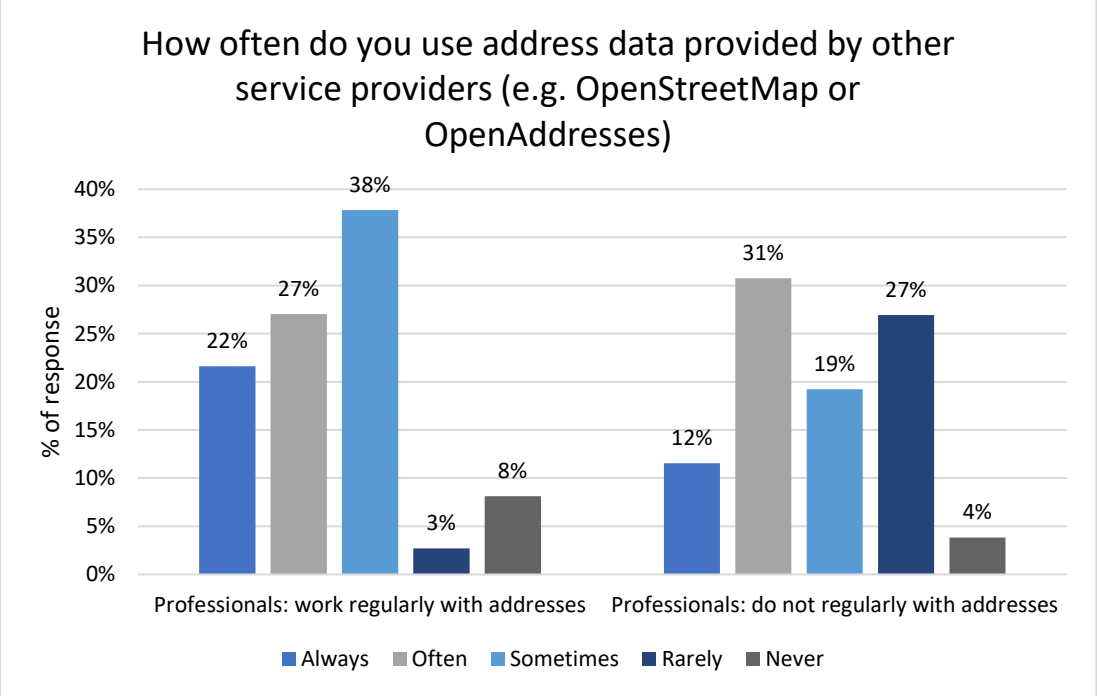


Figure 28: How often professionals use address data provided by other service providers (e.g. OpenStreetMap or OpenAddresses) (n=63)

Professionals that regularly work with addresses always or often rely on address data that they get from government/administrative bodies and the private sector, while those that do not regularly work with addresses sometimes rely on these sectors but would most likely use other service providers.

4.3.6. Formats of Address Data

Geospatial professionals were asked about the different formats that they currently receive and retrieve address data and of those formats, which they prefer by ranking them. They were able to select multiple formats and the most common ones have been highlighted.

4.3.6.1. Current Formats

The current formats that professionals currently receive data are web services, CSV, GeoJSON, Shapefile and Esri Personal Geodatabase which can be seen in Table 9. Of these formats, web services were selected by 21 professionals who regularly work with addresses then followed by Esri Personal Geodatabase (17 professionals who regularly work with addresses). The preferred formats for professionals who do not regularly work with addresses are shapefile (17 selections) and CSV (17 selections).

Table 9: Formats that professionals currently receive address data (n=63)

Format	Web services (e.g. WMS or WFS)[1]	CSV	GeoJSON	Shapefile	Esri Personal Geodatabase
Professionals: work regularly with addresses	21	28	4	26	17
Professionals: do not work regularly with addresses	8	17	2	17	8

The formats in which professionals currently retrieve address data are a downloadable link, USB, hard drive, CD/DVD and other in Table 10. 30 professionals who regularly work with addresses retrieve data via downloadable link – while professionals who do not regularly work with addresses use USBs (11 selections). The “other” option was offered to respondents as an open-ended question and as a result a variety of answers were received.

Table 10: Formats that professionals currently retrieve address data (n=63)

Format	Downloadable Link	USB	Hard Drive	CD/DVD	Other
Professionals: work regularly with addresses (%)	30	12	11	3	13
Professionals: do not work regularly with addresses (%)	21	11	8	1	2

[1] WMS and WFS were given as examples for types of web services even if they cannot be applicable for addresses

4.3.6.2. Preferred Formats

The participants were asked to rank their preferred formats to receive data with 1 being the most preferred and 5 being the least preferred out of the list, each block that is shown in bold sums up to 100%. The preferred formats to receive data in Table 11 are ranked per subcategory, where the break down for professionals who regularly work with addresses is as follows: i) Web services (18%), ii) Shapefile and Esri Personal Geodatabase (19%), iii) CSV (21%) and iv) GeoJSON (19%). For professionals that do not regularly work with addresses, the preferred formats were ranked overall as: i) web services (16%), ii) CSV (14%), iii) GeoJSON (14%), iv) Shapefile (6%) and v) Esri Personal Geodatabase (16%). Both subcategories of professionals prefer to receive their address data through web services.

Table 11: Ranked formats that professionals prefer to receive address data (n=63)

Format and Rank	**Professionals: work regularly with addresses (%)**	**Professionals: do not work regularly with addresses (%)**
Web services (e.g. WMS or WFS)		
1	18	16
2	11	3
3	13	6
4	14	13
5	3	3
CSV		
1	18	9
2	6	14
3	21	5
4	9	8
5	5	5
GeoJSON		
1	2	2
2	3	5
3	8	14
4	19	6
5	27	14
Shapefile		
1	16	11
2	19	10
3	10	11
4	6	6
5	8	3
Esri Personal Geodatabase		
1	6	3
2	19	9
3	8	5
4	10	8
5	16	16

The participants also were asked to rank their preferred formats to retrieve data with 1 being the most preferred and 5 being the least preferred out of the list. The preferred formats to

retrieve data in Table 12 are ranked per subcategory, where the break down for professionals who regularly work with addresses is as follows: i) downloadable link (48%), ii) USB (33%), iii) Hard drive (24%), iv) CD/DVD (38%) and v) Other, which includes email, pdf and excel (40%). For professionals that do not regularly work with addresses the preferred formats were ranked overall as: i) downloadable link (35%), ii) USB (24%), iii) Hard drive (22%), iv) CD/DVD (33%) and v) Other (30%). Both subcategories of professionals prefer to retrieve their address data in the same formats.

Table 12: Ranked formats that professionals prefer to retrieve address data (n=63)

Format and Rank	Professionals: work regularly with addresses (%)	Professionals: do not work regularly with addresses (%)
Downloadable Link		
1	48	35
2	4	5
3	6	2
4	0	0
5	0	0
USB		
1	0	2
2	33	24
3	22	16
4	3	0
5	0	0
Hard Drive		
1	3	0
2	15	10
3	24	22
4	14	6
5	3	3
CD/DVD		
1	0	0
2	2	0
3	3	0
4	38	33
5	16	8
Other		
1	8	5
2	5	3
3	3	2
4	3	1
5	40	30

4.3.6.3. Perception of Level of Effort

Geospatial professionals were asked to rank the level of effort that they think goes into geocoding, assigning addresses and altering addresses to fit a data model/ data cleaning. As seen in Figure 29, geocoding has median level of effort of 70%, assigning addresses is perceived as the least level of effort with a median of 60% level of effort and finally altering addresses to fit a data model/data cleaning has a median of 80% level of effort. This means that professionals view altering addresses as the task that has the most level of effort and assigning addresses is seen as the task with the least amount of effort.

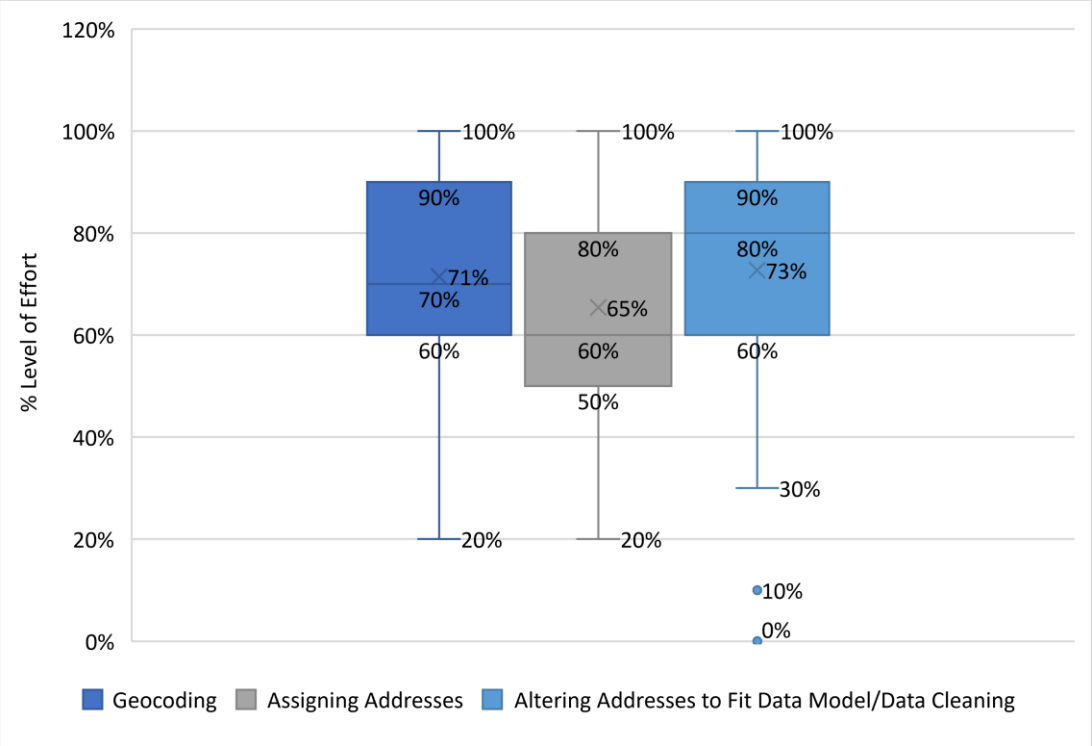


Figure 29: Perception of the level of effort that goes into each task

4.4. Discussion and Conclusion

This chapter consists of an analysis of the general public and geospatial professionals' perceptions on addresses and current address data in South Africa while comparing their responses to current standards and literature.

Respondents were asked when they learnt to write an address, many of whom responded with primary school, however it was not further investigated which type of address they were taught with regards to SANS 1883-1 (SABS, 2009a). They were then given an address to write out, they were given a house number, street name, suburb, city, country, and postal code (3, Blue Street, Acorn Park, Johannesburg, South Africa, 9999). The most commonly used format was format 1 which was the SAPO street address (SABS, 2009a) with a complete building unit identifier, street identifier and SAPO street locality (e.g. 3, Green Street, Waterkloof). The second most common format, number 2 is also a variation of the SAPO street address but in this case the country was omitted, similar to format 3 but the country was placed after the postal code. Formats 4 to 8 did not fit any of the existing formats of addresses in SANS 1883-1.

When it came to navigating to an address, respondents were given an option to select from 4 different methods, namely GPS device/application, paper map, verbal description/landmarks, and memory. They were asked to rate the frequency at which they use each of these methods of navigation; it was found that the most popular methods were GPS device/application and from memory, which supports the notion that address infrastructures are important for mobility (UPU, 2012). A study done by Ishikawa, Fujiwara, Imai, and Okabe (2008) stated that the more individuals use GPS based navigation systems, the more likely they are to view verbal directions/wayfinding differently and in some cases more difficult. This implies that once an individual regularly uses a GPS device/application, they are less likely to use any other navigation method e.g., paper-based maps because of the effectivity and efficiency provided by GPS navigation systems. Address infrastructures can also be seen as important when it comes to using informal addresses, which is navigating using verbal descriptions/landmarks. As the world moves to a mostly digital age, the current address infrastructures need to keep up. Thus, it can be seen in the very strong "never" when it comes to using paper maps.

The results show that majority of the respondents' current view of improving addresses and address data in South Africa is that standardisation needs to happen; this can be applied to other improvements such as assigning addresses in informal settlements, rural areas, and townships. This supports the idea that South Africa is in need of a national address dataset (Cooper, Katumba and Coetzee, 2020) so that everything can be standardised and freely available. According to the Danish Enterprise and Construction Authority (2010) there is

financial benefit to having a free-of-charge scheme for addresses. These benefits include having a shorter distribution chain, which enables the use of addresses in GPS systems, no longer having duplicated data which is a waste of resources, along with confidence from the public that emergency services will be able to get to them efficiently (Danish Enterprise and Construction Authority, 2010). If there is a standardised way of assigning addresses in these areas and complexes and estates, then there would be less confusion for people when they try find specific addresses (Coetzee and Cooper, 2007b). Standardisation would also help keep house numbers and street names visible to drivers. Additionally, standardising addresses could help speed up the process to having data accessible as less data cleaning would need to be done which according to 22% of the professionals in the task, which takes the highest level of effort at 100%. The standardisation of addresses could also make navigating to addresses using the preferred methods of GPS device/application, or from memory, simpler. It is more likely that a location with an address would be on a GPS, while when using memory, street signs and house numbers would be clear in order to help navigation.

Geospatial professionals were asked what they think of current address datasets in South Africa. This would apply to the few government agencies that provide some sort of address database, though none of them are complete and they mostly exist within the private sector, which has their own datasets which individuals need to pay for in order to use them (Coetzee and Cooper, 2007b). Professionals stated that the current address datasets in South Africa are fair, and this is supported by the strong response of a national open dataset for addresses being very important. This shows that there is a need for better and more accessible address data in South Africa. Regardless of the data source that is frequently used, there is a strong lean towards a national open dataset. This national open dataset would need to account for the different formats that professionals use and prefer in order to make it as accessible as possible. This information could be used to expand on what is currently SANS 1883-3 (SABS, 2009b). There is volunteered geographic information project through which address data is collected and stored in a central database, which is accessible to everyone free of charge, called OpenAddresses. However, OpenAddresses is less accurate than a database or dataset that would require payment, as there are positional errors which leads to people depending on more formal datasets. The other factor that makes people less likely to use OpenAddresses is that there is a challenge with the way that addresses are written as the architecture of an address often depends on the national standard, which means it cannot be easily integrated into any system.

The formats which would be ideal for professionals when it comes to the way in which they would like to get data, the most common format was web services (e.g., WMS or WFS) and

they would like this as a downloadable link so when a national address dataset does get created, this is something to take into consideration.

In addition to standardising addresses and making datasets more accessible, there should be a focus on teaching people how to write their addresses properly, as mentioned by participants in the improvements section. In South Africa, writing a formal letter is a part of transactional writing assessment, while this is first taught in the foundation phase (grade R – 3) it only starts being assessed in the intermediate phase (grade 4 – 6); thus, there should be a focus between these grades to make sure everyone understands how to write an address in the correct format regardless of the language (German and Randel, 2013). A maximum of 8 different formats were received when participants were prompted to write an address, and this shows that regardless of what standardisation changes are implemented they will not be as successful as they could be unless people learn how to use them properly – this is also mentioned by a participant in the improvements.

When asked to offer suggestions on how they would improve South African addresses and address data, a few participants indicated that geocoding/grid-based systems should be implemented. While these systems such as what3words aid when there is a lack of addresses in times of emergency and for deliveries, they cannot be used as addresses. Conventional addresses refer to buildings and parcels of land, whereas a system like what3words assigns a code to any 3x3 location on earth. There is a chance of duplication of words where there is a higher density of buildings, thus the effectivity in South African informal settlements is not known (Naidoo, 2021).

It is clear that there is a lot of work that still needs to go into addresses and address data in South Africa, as it is not something that people normally consider but it is vital in ensuring livelihoods. This is evident in addresses being required for basic services such as opening a bank, enrolling a child in school and even applying for a job.

5. Chapter 5 Conclusion

5.1. Overview

The work in this dissertation investigated the perceptions that informal settlement dwellers, the general public and geospatial professionals have concerning addresses and address data. From the dwellers of informal settlements and surroundings, we wanted to understand how these individuals view addresses and whether there is any value that they place on them. From the public we wanted to understand how they use addresses and from geospatial professionals, what they would like to see go into a national address dataset. This final chapter provides an overview of the main results and information on future work that still needs to be addressed in this field.

5.2. Main results from dissertation

Objective 1: Understand addresses worldwide, their value, compare different addressing methods, review existing standards, and addresses in a South African context as well as related work.

The topics that were discussed in this dissertation were also explored and covered in chapter 2. While reviewing literature of addresses and their standards all over the world, it became evident that the topic of addresses is not one that is extensively covered. As a result, a small set of papers provided the cornerstone for the literature review of this research about addresses in South Africa. However, addresses are clearly defined in various literature, address standards locally are clearly stated and internationally, they are being refined. Based on the literature, the value that addresses have for the economy, society and governance cannot be overlooked, as it is the aim motivator because it is so essential for everyone to have an address. The idea of South Africa having a national address dataset is one that is gaining popularity and the benefits of having a national address dataset can be seen in countries like Denmark.

Objective 2: Conduct semi-structured interviews and analyse them in order to understand what the value and importance of addresses is to community members of informal settlements compared to what is currently known.

To achieve this objective, the literature that was explored in objective 1 was mainly Prescott (2015) and UPU (2012) on what value people place on addresses. The main areas where people place value were economic, society and government; these were then dissected in order to see how these areas could be better understood from the perspective of informal settlement residents. The interview questions were set up similar to the GCRO Quality of Life

Survey of 2015 in that they left room for probing should more information come up than expected.

After the interviews were conducted, the recording of these interviews were transcribed and loaded into ATLAS.ti, where qualitative analysis was conducted. First, open coding was performed in order to identify what the themes within the responses were, and once these had been identified a second round of coding occurred. In this second round of coding, grouped codes were created and these added onto the bigger themes of what was found. Network diagrams of each of these themes were then created and if there were any links/relationships between themes based on the responses, these were also added onto the networks.

These themes were then compared to what is currently known about the value, importance and overall uses of addresses, specifically in South Africa (this can be found in chapter 3). Individuals who live in informal settlements do not have addresses, and as a result experience challenges when trying to take part in everyday life. For example, these individuals have trouble enrolling their children in school and even receiving basic services.

Objective 3: Distribute surveys to the general public and analyse them in order to understand their perception of addresses and assess what geospatial professionals deem important when it comes to a national address dataset.

In order to understand what is known about addresses in South Africa at the moment from the perspective of the general public and geospatial professionals a survey was created. This survey was conducted online, in Qualtrics and distributed widely on known networks as well as social media. In the survey, the address infrastructure in South Africa was investigated and any suggestions on improvements that could be made. Geospatial professionals were asked more technical questions which would hopefully inform what a national address database should look like with regards to how they would like to get their data, as well as the formats in which it should come.

The responses which were collected from the surveys were analysed in SPSS in order to understand what the variation of responses was as seen in chapter 4. All respondents were asked to write an address down and the format in which this address was written was compared to SAPO street address, which can be found in SANS 1883-1 (SABS, 2009a). The approach to how and when address writing was taught was also explored, as well as how navigation using these addresses takes place. Majority of the respondents said that they prefer GPS devices/applications, which should further motivate why everyone should have an address, because it makes them a part of society.

Geospatial professionals were asked questions with regards to address datasets in hopes that this would inform what the framework of a national dataset would be. The formats in which they would like to receive their data and how they would like to retrieve their data was explored. The datasets that they currently use were also explored in order to understand the preferences which were selected. They indicated that they prefer receiving their data via web services (e.g. WMS or WFS) as a downloadable link, while they currently use various formats including web services, GeoJSON, Esri Personal Geodatabase, CSV and Shapefile. The level of effort that goes into geocoding was also something that was highlighted with 70% of respondents saying that 70% and more level of effort currently goes into geocoding. This is something that should be considered when it comes to creating a national dataset for addresses, as it needs to be as efficient as possible for those that use it.

Objective 4: Based on findings, draw conclusions, and make recommendations on the value that addresses have in informal settlements, what the public understands about addresses and what geospatial professionals would like to see in a national address dataset.

Both chapter 3 and chapter 4 include discussions and conclusions for their respective topics. The residents of informal settlements and surrounding areas do think that there is value and importance in addresses although the reasons do not always align. For example, those that live in surrounding areas would motivate that addresses are needed in informal settlements so that their own lives are not inconvenienced, in comparison to those that live in informal settlements who would say that their lives would be improved. The prospect of geocoding locations in informal settlements similar to Addressing the Unaddressed or using what3words should be explored. The official procedure that informal settlement residents should follow in order to get an affidavit for proof of residence should also be explored as it does seem that there is a system in place in some areas, but nothing is official.

When it comes to addresses and an address dataset, the public sees it important that addresses appear in navigation applications such as Google Maps so that it is easier to get from point A to point B. This would further motivate why there is a need for an address infrastructure that is standardised, and for the standardisation be put into practice in real life. To inform exactly what kind of standardising needs to happen, the responses from professionals when it comes to datasets as well as SANS 1883-3 should be explored.

5.3. Recommendations for further research

The following areas or topics are recommendations for future research efforts:

Ways in which informal settlements can be geocoded or given grid-based codes should be explored. This could be a similar study as Addressing the Unaddressed (Burton, 2020). These geocodes, however, should not be used as official addresses but as a way to mitigate the isolation that comes with not having an address. This should happen concurrent to exploring the official ways in which addresses in informal settlements can be assigned, or official ways in which the residents of these settlements can get official documentation. The relationship between addresses and geocodes or grid-based systems can also be investigated through the lens of memory. For future research, it would be interesting to see if people remember grid-based systems like what3words easier and better than they do an address and then further, an address that they visit repeatedly.

As South Africa does not currently have a national address dataset, it is proposed that the infrastructure of a national address dataset be explored. This would be a framework of what this infrastructure would look like, who would be the custodians, how professionals and the public would retrieve data from this dataset and finally the implementation of this national address dataset.

South Africa has extensive address and addressing standards, but they are not always implemented. Understanding the shortfalls of the implementation of these address standards is something that needs to be explored.

This dissertation aimed to provide an overview of the value of addresses and address data for various groups namely those in informal settlements, general society and among experts so it is recommended that each of these topics be explored in more depth in future masters dissertations.

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Annexure A – Ethical Approval

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Natural and Agricultural Sciences
Ethics Committee

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

13 July 2020

ETHICS SUBMISSION: LETTER OF APPROVAL - AMENDMENT

Dr V Rautenbach
Department of Geography Geoinformatics and Meteorology
Faculty of Natural and Agricultural Science
University of Pretoria

Reference number: NAS128/2019
Project title: Producing spatial knowledge with the community to empower them

Dear Dr V Rautenbach,

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 (NAS128/2019) 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.

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

25 January 2021

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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 KG Duodu
Chairperson: NAS Ethics Committee

Annexure B – Survey

Start of Block: Welcome

Q31
Dear participant,

This survey aims to understand the ordinary citizen's perception and experiences with addresses which are the most common way of describing a location. This survey also aims to understand how people interact with addresses and overall address data in South Africa. Please answer all questions relative to your residential address.
The responses of this survey will be anonymous. Your name will not appear on the questionnaire and the answers will be treated as strictly confidential. You cannot be identified based on the answers you give. Note: that consent cannot be withdrawn once the questionnaire is submitted as there is no way to trace the particular questionnaire that has been filled in.
Your participation in this study is very important to us. You may, however, choose not to participate and you may also stop participating at any time without any negative consequences. Please answer the questions in the questionnaire as completely and honestly as possible. This should not take more than 15 minutes of your time. The results of the survey may be published in the media and/or an academic journal without identifying any of the participants individually. We will provide you with a summary of our findings on request.

Please click the forward arrow signs at the lower right corner of the screen to continue.

End of Block: Welcome

Start of Block: Demographics

Q4 Age

_____

Q5 Gender

- Female (1)
- Male (2)
- Other (7)

Q6 Highest Qualification

▼ I Did Not Finish High School (1) ... Doctor's Degree (9)

Q7 What type of area did you grow up in?

▼ Informal Settlement (1) ... Other (5)

Display This Question:

If What type of area did you grow up in? = Other

Q31 Please specify the type of area you grew up in

_____

Q32 What type of area do you currently live in?

▼ Informal Settlement (1) ... Other (5)

Display This Question:

If What type of area do you currently live in? = Other

Q32 Please specify the type of area you currently live in

_____

Q8 Were you ever taught how to write an address? (e.g. when writing a letter)

- Yes (1)
- No (2)

Display This Question:

If Were you ever taught how to write an address? (e.g. when writing a letter) = Yes

Q9 How and when were you taught how to write an address

_____

_____

_____

_____

_____

Q10 Write down the address of this location:

Emily who lives at number 3 on a street called Blue Street has trouble writing down her address. The area she lives in is called Acorn Park in Johannesburg, South Africa and she always remembers her postal code which is 9999.

_____

Q11 Do you work in the Geospatial field?

- Yes (1)
- No (2)

End of Block: Demographics

Start of Block: Experience With Addresses - Professionals

Q24 What is your job title?

_____

Q26 How regularly do you use addresses in your job?

- Daily (1)
- Weekly (2)
- Monthly (3)
- Yearly (4)
- Never (5)

Q21 How often do you give out your residential address? (e.g. deliveries)

- ○ Daily (1)
- ○ Weekly (2)
- ○ Monthly (3)
- ○ Yearly (4)
- ○ Never (5)

Q22 People find me with ease using my address...

- ○ Definitely (1)
- ○ Probably (2)
- ○ Possibly (3)
- ○ Probably Not (4)
- ○ Never (5)

Q23 How often do you use each of these to navigate to an address?

	Always (1)	Often (2)	Sometmes (3)	Rarely (4)	Never (5)
GPS Device/ Application (1)	○	○	○	○	○
Paper Map (2)	○	○	○	○	○
Verbal Descriptions/ Landmarks (3)	○	○	○	○	○
Memory (4)	○	○	○	○	○

Q27 I think current address datasets available in South Africa are...

- ○ Excellent (1)
- ○ Good (2)
- ○ Fair (3)
- ○ Poor (4)
- ○ Very Poor (5)
- ○ I don't know (6)

Q28 Rate your perception of the level of effort that goes into completing the following tasks:

	0 10 20 30 40 50 60 70 80 90 100
Geocoding ()	
Assigning Addresses ()	
Altering Addresses to fit Data Model/ Data Cleaning ()	

Q29 Can you tell us about your least favourite part about working with addresses

_____

End of Block: Experience With Addresses - Professionals

Start of Block: Accessing Address Data

Q30 How important is it to have a national open (free) dataset for addresses?

- Very Important (1)
- Important (2)
- Moderately important (3)
- Slightly important (4)
- Unimportant (5)

Q31 How often do you use address data provided by...

	Always (1)	Often (2)	Sometimes (3)	Rarely (4)	Never (5)
Government/ Administrative bodies (1)					
Private Sector (2)					
Other (e.g. OpenStreetMap or OpenAddresses) (3)					

Q32 Select all the formats you currently of receive address data in:

- [ ] Web services (e.g. WMS or WFS) (1)
- [ ] CSV (2)
- [ ] GeoJSON (3)
- [ ] Shapefile (4)
- [ ] Esri Personal Geodatabase (5)

Q34 Drag to rank the formats in which you prefer to retrieve address data

_____ Web services (e.g. WMS or WFS) (1)
_____ CSV (2)
_____ GeoJSON (3)
_____ Shapefile (4)
_____ Esri Personal Geodatabase (5)

Q33 Select all the formats you currently retrieve address data in:

- [ ] Downloadable Link (1)
- [ ] USB (2)
- [ ] Hard Drive (3)
- [ ] CD/ DVD (5)
- [ ] Other (4) _____

Q34 Drag to rank the ways in which you prefer to retrieve address data

_____ Downloadable Link (1)
_____ USB (2)
_____ Hard Drive (3)
_____ CD/ DVD (5)
_____ Other (4)

End of Block: Accessing Address Data

Start of Block: Experience With Addresses - General Public

Q33 What industry do you work in?

▼ Student (20) ... Unemployed (21)

Q15 How regularly do you use addresses in your job?

- Daily (1)
- Weekly (2)
- Monthly (3)
- Yearly (4)
- Never (5)

Q17 How often do you give out your residential address? (e.g. deliveries)

- Daily (1)
- Weekly (2)
- Monthly (3)
- Yearly (4)
- Never (5)

Q18 People find me with ease using my address...

- ○ Definitely (1)
- ○ Probably (2)
- ○ Possibly (3)
- ○ Probably Not (4)
- ○ Definitely Not (5)

Q19 How often do you use each of these to navigate to an address?

	Always (1)	Often (2)	Sometmes (3)	Rarely (4)	Never (5)
GPS Device/ Application (1)	○	○	○	○	○
Paper Map (2)	○	○	○	○	○
Verbal Descriptions/ Landmarks (3)	○	○	○	○	○
Memory (4)	○	○	○	○	○

End of Block: Experience With Addresses - General Public

Start of Block: General

Q35 If you could improve **one** element about addresses and address data in South Africa, what would it be?

_____

End of Block: General