Improving Service Delivery to Informal Settlements through Data Management

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Improving Service Delivery to Informal Settlements through Data Management

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Abstract

While the South African Bill of Rights establishes the provision of services to all residents, over 1.5 million households have limited or no electricity, refuse removal, water, and sanitation structures. This project aimed to assist in improving service delivery to informal settlements in Stellenbosch, South Africa, by assessing the municipality's communication and data collection system. Informational interviews with organisations working on data management and service delivery, and engagements with residents of the informal settlement Mountain View, it was determined that the service request process needs to establish feedback loops, interdepartmental communication requires restructuring, and new technologies could improve communication with residents and increasing government transparency.

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Executive Summary

The need for service provision to informal settlements is increasing due to the rise in informal settlement populations throughout South Africa as well as other developing countries. It is difficult for municipalities to identify the needs of the communities because many of the settlements operate outside of traditional municipal planning policies. In South Africa, over 1.5 million households exist within informal settlements, where facilities including housing, electricity, refuse removal, water, and sanitation are underdeveloped or non-existent. With these numbers service conditions within informal settlements are difficult to record, maintain, or improve.

The goal of this project was to identify communication platforms and data management solutions to improve the service delivery process to informal settlements under the jurisdiction of Stellenbosch Municipality. To accomplish this, the current process of data collection and service provision carried out by Stellenbosch Municipality was analyzed. Alternative modes of data collection used by outside organisations were analyzed in order to compile the most effective strategies and make recommendations to the municipality.

Three overarching ideas about the current communication system were identified. The system does not allow for constant, direct contact between informal settlement residents and the municipal office. There is no consistent feedback once a request is issued due to gaps in interdepartmental communication. The current method of identifying existing services is inconsistent and difficult. These common themes contribute to social divisions, lack of trust with the municipality, and feelings of being silenced among the informal settlement residents.

Enumerations and community profiling are popular forms of data collection among municipalities, non-governmental organisations, and private companies. Enumerations are more time intensive and focused on quantitative demographic data, while community profiling is a quick tool to gather basic information focused on community engagement and qualitative data. GPS tagging of structures and increased community involvement in data collection practices are new methods used by intervening organisations to promote partnership and ownership within the community. Community profiling to supplement data collected through enumeration were recommended for the Stellenbosch Informal Settlement Management Unit (ISMU). Enumerations provide the demographic data required while community profiling can be used to

supplement the information gained by enumerations. This will keep the data collection process more time efficient while keeping the community feeling empowered.

In order for the community members to clearly identify services when reporting a problem, a numbering system was developed that could be tagged onto each tap, skip, electrical pole, and ablution facility. This numbering system would be used to efficiently report service requests to the municipality through the use of a suggested WhatsApp messaging system. Additional guidelines for sending service requests through WhatsApp were proposed to allow for a more organised process. A list of best practices was created to encourage the respectful and efficient use of the system. Facebook and Twitter should be supplements to WhatsApp as additional platforms for general updates from the municipality. To accommodate people without smartphones, the use of SMS short code service request system was suggested.

The above processes, along with an interdepartmental communication platform, will create feedback loops within the service request communication chain. Slack was recommended as an interdepartmental communication platform to replace email and make the process more reliable and organised. Busybot is an additional program embedded into Slack that will generate lists of service tasks automatically. This will aid in tracking service requests and providing periodic feedback to all parties. This platform would have at least two representatives from each relevant department.

In addition to immediate actions, there are long term improvements to be made in order to improve service delivery within the current system. Our long term suggestions include: organisations of a centralized call center for service requests, implementation of a centralized database that connects all municipal departments, integration of a professionally-made service request mobile application and web page, and amend zoning and planning bylaws to consider free WIFI near informal settlements, and establish an efficient communication and idea sharing line with the Cape Town municipality.

Authorship

Brandon Clark, Natalie Fabrizio, Muhammad Ali Shah, and Julia Veitch all contributed to the research, writing and editing of this report. The following breakdown is a quick link of how the report was brought together.

Brandon Clark contributed to the introduction, background, methodology, and results and recommendations chapters. In the background chapter, Brandon organized the section "Stellenbosch Municipality's compliance with South African housing legislation" and authored the final paragraph of "Examples of effective citizen: state relationships." In the methods chapter, Brandon co-authored the section objective 1 with Natalie and co-authored and edited objective 3 with Muhammad. In the results and recommendations chapter, Brandon authored suggestions, organized the structure and order of the paragraphs, and created flow charts and screenshots. He also organized the appendices.

Natalie Fabrizio contributed to the introduction, background, methodology, and results and recommendations chapters. Natalie authored the section under objective 4 of the methods. Additionally Natalie authored the section of thematic analysis under objective 2. Natalie additionally contributed by writing the section titled "Stellenbosch Municipality: responsibilities and services provided" of the background and provided relevant citations relating to that section. Additionally Natalie worked with Brandon to author Objective 1 in the methods. Natalie developed topic and closing sentences, made final edits to structure and grammar when compiling the paper.

Muhammad Ali Shah contributed to the introduction, background, methodology, and results and recommendations chapters. In the background, Muhammad authored the section titled "Serving the community: primary actors involved" and "Analysis of effective citizen/organisation relationships". In the methods chapter, Muhammad added information regarding objective 1 and 2. He also co-authored the section under objective 3 with Brandon and organized the overall methods section. Muhammad also edited the results and recommendations chapter and specifically authored the section under data collection methods.

Julia Veitch contributed to the introduction, background, methodology, and results and recommendations chapters. More specifically Julia contributed by co-authoring methods under objective 1. Julia contributed to the paper by writing the section titled "Current data management practices in Stellenbosch" of the background and provided relevant citations for aforementioned section. Julia also worked on objective 2 and authored sections regarding data analysis. Additionally Julia authored sections regarding objective 3. Julia made final edits to grammar and structure of the paper.

Introduction

The need for service provision to informal settlements is an increasingly global issue as urbanization rises in developing countries (Winayanti and Lang, 2004). Many settlements develop and operate outside of traditional municipal planning policies (Chakraborty, Wilson, Sarraf & Jana, 2015). Due to these informalities, it is difficult for municipalities to identify the needs of these rapidly appearing communities and establish timely and appropriate responses (Chakraborty, Wilson, Sarraf & Jana, 2015). In South Africa, over 1.5 million households exist within informal settlements, where facilities including housing, electricity, refuse removal, water, and sanitation are underdeveloped or non-existent (Housing Development Agency, 2001; SEPLG, 2014). Consequently, the service conditions within informal settlements are difficult to record, maintain, or improve.

The South African Bill of Rights establishes that all people within South Africa have the right to basic human needs (SEPLG, 2014). Given this, Stellenbosch Municipality is mandated to provide services to the established 21 informal settlements in the vast 831 km^2 area under its jurisdiction. These services specifically include providing residents with housing, toilets, water taps, electricity, and garbage skips, as well as deliver maintenance of these services. Each communal service must adhere to the national government guidelines, which specify the minimum number of people per each specific service. Maintaining this data is difficult as people constantly move in and out of informal settlements.

With the constant changes in population of the informal settlements in Stellenbosch, it is hard to maintain demographic data for municipal use. Without this updated information, the municipality is unable to maintain compliance with the national guidelines. There is also a gap in communication in regards to basic service provision due to disorganized communication between the municipality and residents. Throughout the service delivery process there is limited feedback from the municipality which leaves residents confused and frustrated. This broken communication interferes with the efficiency of service provision and management of informal settlements.

Although difficulties arise in the management of informal settlements, the national government is also trying to improve quality of life by implementing new housing programs throughout the country. For example, the "Breaking New Grounds" initiative intends to improve the rental housing market and municipal engineering services by providing additional facilities for schools and developing alternative housing solutions (Stellenbosch Municipality, 2011).

Governing bodies in both South Africa and the United States have established service request collection and management structures in order to promote efficient delivery of services to both formal and informal residencies. The cities of Cape Town, South Africa and Worcester, Massachusetts have highly developed service request websites that are the main organization system for all service requests throughout their city. Worcester also has a designated call center with five workers who handle phone requests 24-hours–a-day on weekdays. All requests are entered into a database that automatically sends notifications to the appropriate department (Worcester Customer Service Systems, 2016).

To maintain updated data for varying organisations, The Community Organization Resource Center (CORC) conducts community driven profiles and enumerations. The purpose of these data collection strategies is to collect relevant data that will aid in community growth and development. The CORC enumerations are a community initiated and run census which result in the production of a social and demographic profile (CORC, 2011). The community profiling and enumeration approach helps to identify the needs of the people, improve feedback and give the people a sense of empowerment. Alternative ways to manage data for Stellenbosch Municipality include an online demographics database and GPS tagging. The municipality has been searching for new strategies and platforms to improve responses to service delivery requests. This revised approach to resident engagement is driven by an increasing awareness of the importance of partnership, as noted by Johru Robyn, Manager of Informal Settlements, "Now we don't go to the community to talk to the community. Now we go to the community to speak with them" (2011).

This project involved an analysis of the current processes of data collection and service provision employed by Stellenbosch Municipality. Case studies were conducted on Worcester Polytechnic Institute (WPI), Worcester Department of Public Works and the City of Cape Town to gather examples for specific service delivery recommendations. Alternate methods of data collection were evaluated through expert interviews conducted with members from governmental, private and non-governmental organisations (NGOs). All collected data was analyzed and coded in google sheets to identify major themes and formalize recommendations. Recommendations on communication platforms were presented at a community gathering with residents of the Mountain View settlement to gather final feedback and solidify results.

Stellenbosch Municipality's compliance with South African housing legislation

As South Africa's national government continues to advance standards in service delivery and housing requirements, Stellenbosch Municipality must continually reassess its existing provisions. In section 26 of the South African Bill of Rights, everyone is guaranteed the right to adequate housing and access to basic services such as water, electricity, sanitation, and waste removal (SEPLG, 2014). Due to this housing clause, the government must take reasonable legislative measures to achieve this right (Stellenbosch Municipality, 2016). In 1994, the Housing Policy and Strategy was created to reconcile a national housing situation divided between well serviced formal housing and disregarded informal housing. It also instituted new systems to ensure that steps were being made to minimize the large percentage of citizens without housing (Stellenbosch Municipality, 2016). Due to the success of the 1994 housing policy, the Comprehensive Housing Plan for the Development of Sustainable Human Settlements (known as Breaking New Ground) was created in 2004. The goal of the Breaking New Ground plan was to: incorporate rental housing, provide consistent municipal engineering services, create additional facilities for schools, create business opportunities for informal settlement members, and combine different housing options (e.g. single-stand units to double story units). The Comprehensive Housing Plan now works to accelerate housing delivery and use housing service delivery as a job-creation strategy. It also diversifies housing developments, uses housing development to break down barriers between social classes, and develops maintainable human settlements (Stellenbosch Municipality, 2011). With the implementation of this new legislation, Stellenbosch Municipality must work towards maintaining national standards.

In 2005, the federal government created a set of guidelines to help municipalities decide specific indicators to determine an informal settlement as having adequate housing (Department of Housing, 2005). This set of guidelines, mentioned in the Bill of Rights, is presented as a baseline that municipalities should build off and tailor to their own situations. The federal government suggests that the conception of adequate housing be a constant dialogue between settlements, municipalities, and the federal government. The guidelines mention suggestions for adequate provision of basic services. Examples of the national guidelines include: one tap should be available per 25 – 50 dwellings and the maximum distance from a dwelling to a standpipe should be 200 meters. Stellenbosch Municipality surveys informal settlements to ensure its

residents are appropriately provided with essential services in alignment with national guidelines. See Appendix A for a full list of suggested national guidelines.

Current services and communication structure of Stellenbosch Municipality

The Stellenbosch Municipality is the governing body over Stellenbosch, Franschhoek, Pniel, and surrounding areas in the Western Cape (IDP, 2010). Figure 1.1 outlines the jurisdiction of the municipality, highlighting the location of municipal buildings and two informal settlements. The responsibilities of the municipality include passing by-laws about any of the services they are responsible for, approving budgets and development plans, collecting service fees for water, electricity, and libraries, as well as charging fines to individuals who break municipal laws (Stellenbosch, 2013). These responsibilities are set in place to ensure the welfare of citizens and hold officials accountable to provide services to the people.

Fig 1.1 Map of Stellenbosch's Municipal Region and Location of Two Informal Settlements, Langrug in the Top Right and Mountain View in the Bottom Left (Kritzinger, 2016)

With a diverse population of 155,733 (Statistics South Africa, 2011), spanning across a landmass of 831 km^2 (Stellenbosch Municipality Integrated Development Plan, 2010), tracking service needs and existing services is an increasingly difficult task that warrants constant upkeep, expansion, and improvements. First, understanding this diversity of language is an important factor during the development of an improved communication platform because people are more

forthcoming with information when communicating in their native language (Lumkani Executive, Informal Interview, 2016). There are 11 different languages spoken in South Africa (Statistics South Africa, 2011). Afrikaans, English, and isiXhosa are the most common languages used in Stellenbosch and the surrounding areas. This understanding of languages is also relevant in making sure that proposed improvements to the municipality's data collection system are cohesive and sustainable. A second factor to understand within this diverse population, is the significant range in income levels (see Figure 1.2). One quarter of the population exists on little to no income and another quarter of the population earns an annual household income of over R300,000, the equivalent of 21,500 USD (Statistics South Africa, 2011). This difference in income results in differences in housing conditions and lifestyles. Some of the residents live in formal multi-room structures with plumbing and electricity, others live in informal settlements either in state provided temporary housing (known as *Wendy* houses), while others live in self-assembled shacks with no access to sanitation or electricity (see Figure 1.3). This diversity in factors such as income and housing demonstrates the difficulties that the municipality faces when providing services.
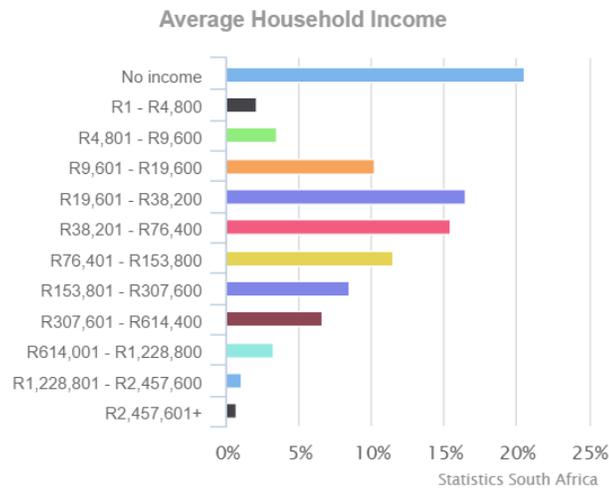

Figure 1.2 Graph of Household Income in Stellenbosch (Statistics South Africa, 2011)

Figure 1.3 Comparison of housing structures: From left to right are images of a self-assembled shack, state provided Wendy house, and a formal multi-room house.

In order to improve living conditions for all of its Stellenbosch residents, the municipality established an Integrated Development Plan (IDP) in 2007. The projected plan was to create over 20,000 housing units by 2017 and transition the over 7,000 informal households into formal structures. Since the implementation of this plan, the number of people living in informal housing in Stellenbosch decreased from 17.7% to 3.5% (see Figure 1.4, A and B). Currently only 4.6% of Stellenbosch residents are living in non-formal housing. Although there have been improvements in the form of infrastructure, these benefits do not necessarily take into account the "poorest of the poor" in the greater Stellenbosch area, such as many residents of informal settlements (Stellenbosch Municipality Integrated Development Plan, 2010).

Population Group	Formal	Informal	Traditional	Other	Total
African	36.1	48.2	11.5	4.3	100.0
Coloured	84.5	11.3	4.0	0.2	100.0
Asian	100.0	0.0	0.0	0.0	100.0
White	96.4	2.6	1.0	0.0	100.0
Total	78.2	17.7	3.7	0.4	100.0

Figure 1.4A: 2006 Housing type breakdown in Stellenbosch by demographic racial classification (Stellenbosch Municipality Integrated Development Plan, 2007)

Population group	Formal	Informal	Traditional	Other
White	99.5	0.5	0.0	0.0
African	96.5	2.2	0.0	1.3
Coloured	93.8	4.8	0.7	0.7
Asian	68.6	31.4	0.0	0.0
Total	95.4	3.5	0.4	0.7

Figure 1.4B: Most Current Housing type breakdown in Stellenbosch by demographic racial classification (Stellenbosch Municipality Integrated Development Plan, 2010)

The 2007 IDP addressed possible improvements in provision of services to informal settlements in order to comply with the guidelines of the Federal Department of Housing. Using this strategy, the municipality organized funding to retrofit structures for electrical energy efficiency and identify areas of water and electricity scarcity. The municipality additionally mandated water conservation, implemented water conservation technologies, and upgraded conventional waste disposal in targeted areas. As shown in Figure 1.5, a majority (75%) of Stellenbosch residents now receive refuse removal services from the municipality. Most residents have flush toilets (99%) and an upward trend in improvements is predicted for the past few years (Stellenbosch Municipality Integrated Development Plan, 2010). Since the IDP was implemented there have been improvements to the service delivery process, but not enough to completely align with the national guidelines.

Even with trends in service delivery improvements, there remain residents who do not receive reliable refuse removal, electricity, or sanitation services. For example, 13.5% of residents still use communal disposal, while 1.5% of people report not having any form of refuse removal (Stellenbosch Municipality Integrated Development Plan, 2010). In certain cases of refuse removal, remnants of garbage left behind can be hazardous to children, animals, and the community over all. There are households who have no sanitary facilities in many of the more rural areas. As seen in Figure 1.6, there are residents who do not have access to flush facilities, as well as the poorest population who may not have been included in this census (Stellenbosch Municipality Integrated Development Plan, 2010). Residents without flush facilities use the bucket method, or chemical toilets, which are not mentioned in Figure 1.6. These chemical toilets are the most common toilet facility provided by the municipality. Municipal efforts towards alignment with national guidelines have resulted in less people left without access to basic services, but has yet to supply basic services to all people.

Population group	Municipality once a week	Municipality less often	Communal	Own	None
Asian	100.0	0.0	0.0	0.0	0.0
African	90.0	0.0	8.5	0.0	1.5
White	90.0	0.0	0.0	10.0	0.0
Coloured	95.0	0.0	5.0	0.0	0.0
Total	75.0	0.0	13.5	10.0	1.5

Figure 1.5: Refuse removal in Stellenbosch by racial classification (Stellenbosch Municipality Integrated Development Plan, 2010)

Population group	Flush	Pit	Bucket	None
African	100.0	0.0	0.0	0.0
Coloured	98.3	0.0	1.7	0.0
Asian	100.0	0.0	0.0	0.0
White	100.0	0.0	0.0	0.0
Total	99.1	0.0	0.9	0.0

Figure 1.6: Sanitation and accessibility to a toilet (Stellenbosch Municipality Integrated Development Plan, 2010)

When all income classes are considered and all services are compared, the statistics on services provided by Stellenbosch Municipality do not adequately serve all residents. Figure 1.7 is a compilation of basic services in Stellenbosch compared with the provided services in other areas of the Cape Winelands District. Although the percentage of people receiving refuse removal is highest in Stellenbosch, only 87% of residents are receiving this service (SEPLG, 2014). The housing statistic (75.2% of people receiving housing) differs from Figure 1.2 in that it includes some of the poorer residents of Stellenbosch, who live in the informal settlements or other housing conditions. Services provided by Stellenbosch are ranked below average in water and housing services, around average in sanitation and energy services, and above average in refuse removal services. Taking the poorer communities into consideration consequently lowers the percentage of the population that is receiving proper housing infrastructure. Although many residents of Stellenbosch live in formal housing, there are still people living in informal structures such as houses built with limited resources and material, or in no housing at all (Šliužas, 2004).

Regional area	Water 2011	Water 2013	Sanitation 2011	Sanitation 2013	Energy 2011	Energy 2013	Refuse Removal 2011	Refuse Removal 2013	Housing 2011	Housing 2013
Cape Winelands	97.2%	97.1%	90.9%	90.8%	92.8%	92.6%	80.0%	79.9%	82.9%	82.6%
Witzenberg	98.5%	98.4%	91.6%	91.6%	93.3%	92.6%	69.8%	69.9%	87.0%	86.7%
Drakenstein	98.6%	98.6%	93.6%	93.5%	95.0%	94.9%	69.8%	69.9%	85.8%	85.5%
Stellenbosch	94.8%	94.7%	90.7%	90.6%	92.9%	92.8%	87.0%	87.0%	75.6%	75.2%
Breede Valley	96.5%	96.4%	88.2%	88.1%	88.4%	88.2%	75.2%	75.2%	78.7%	78.3%
Langeberg	97.8%	97.8%	89.0%	88.8%	88.4%	94.0%	71.6%	71.7%	91.2%	91.0%

Source: Quantec 2014

Figure 1.7: Access to basic services broken down regionally within Cape Winelands District (SEPLG, 2014)

Primary actors involved in servicing informal settlements

      The primary actors involved in the Stellenbosch communication chain are the municipal departments, ward councilors, and community members. This chain of actors is assisted by third party actors including NGOs, research institutes, and private contractors (Figure 1.8). To successfully develop a service delivery communication platform, it is imperative to understand the role of each of these actors and their relation to each other.
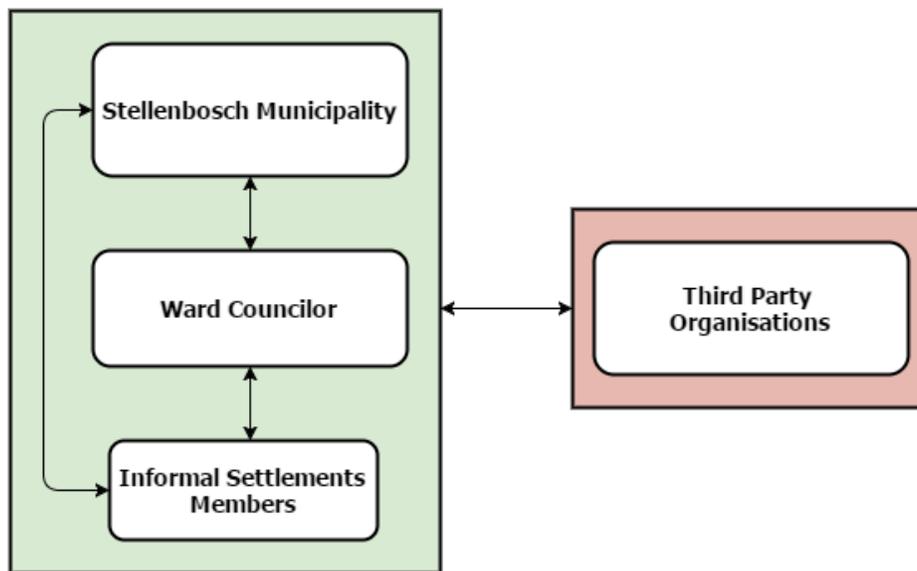

Figure 1.8 Actors involved in informal settlement infrastructure project in Stellenbosch and their relationships

      Within the Stellenbosch Municipality, the Human Settlements & Property Management department overlooks all matters related to formal and informal housing. A subdivision of this department, known as the Informal Settlement Management Unit (ISMU), was established to manage the delivery of basic services and upgrading of structures in informal settlements (Stellenbosch Municipality, 2016). There are currently nine people working in ISMU. The department is under the supervision of the manager of the informal settlements management unit and the project coordinator. The department employs two field workers who spend time in the communities, gather demographic information/requests from community members, and pass relevant information on to the manager and project coordinator. The full time staff is supported by three interns who manually enter collected data on excel spreadsheets, compile summary reports, attend to the front desk at the office and assist field workers in data collection. The full

structure of the ISMU in relation to the municipality is illustrated in Figure 1.8. While the ISMU acts as the point of contact for informal settlement residents, the unit is supported by the Engineering Services Department in installing services in informal settlements. The Information and Communications Technology (ICT) department also supports the ISMU by providing communication portals such as the municipality website. Figure 1.9 further details the ISMU and its relation with other municipal departments involved in service delivery.
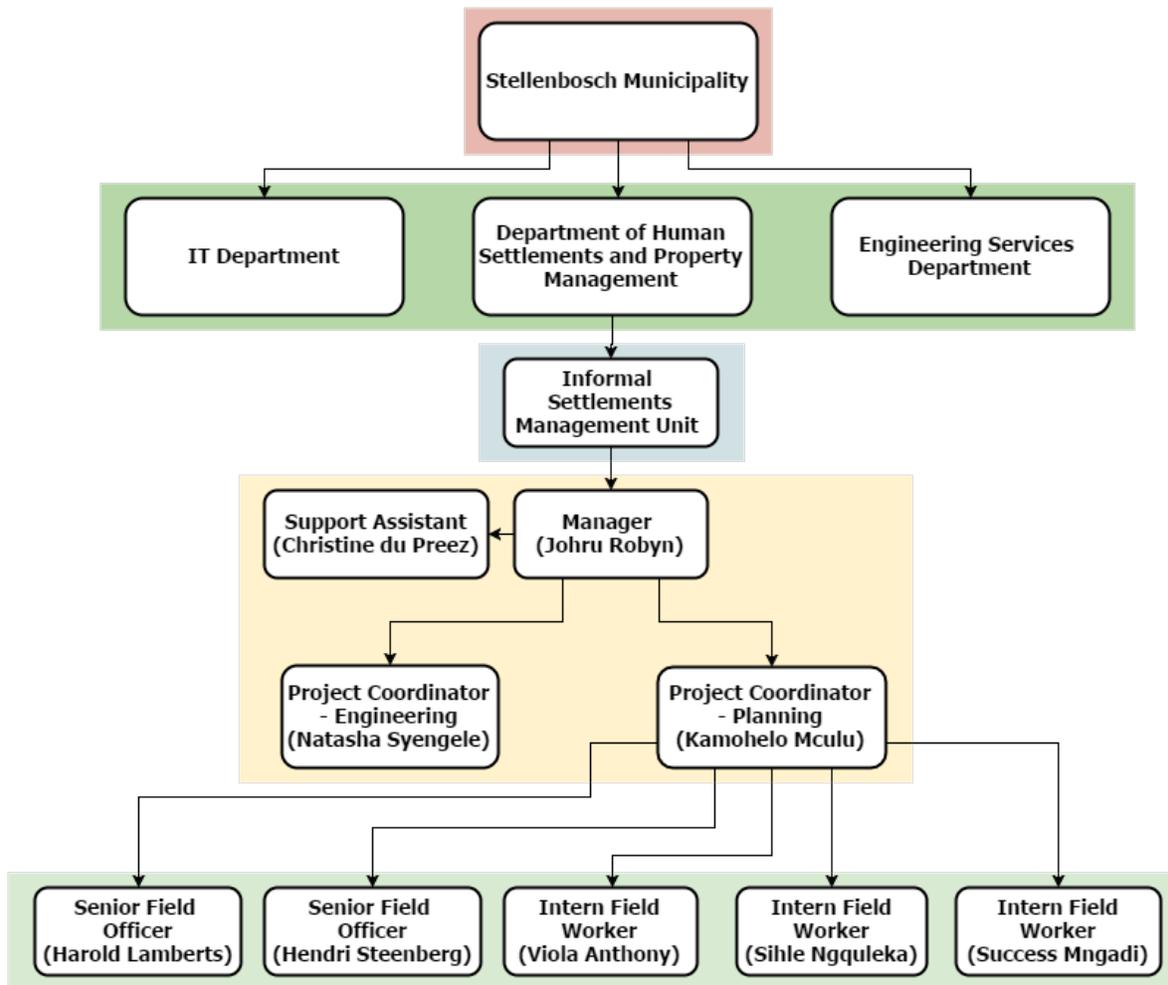

Figure 1.9 Hierarchy of Informal Settlement Related Departments in Stellenbosch Municipality

The second primary actor in the communication chain is the ward councilor, who is an elected official within the government. In Stellenbosch, the ward councilors each represent 22 geographically defined wards (Municipal Demarcation Board, 2014). Each of these wards

consists of an individual ward councilor supported by a subcommittee to oversee their informal settlements, as well as maintain communication between the municipality and the community members (Newcastle Advertiser, 2016). As representatives of their constituents ward councilors act as a liaison between the community and the municipality, however they act independently from the municipal departments. Ward councilors are tasked with holding regular committee meetings, as well as public meetings. These meetings are required to make sure that ward constituents are aware of the workings of the council by making records and reports available to the public (Newcastle Advertiser, 2016). The proper integration of the ward councilor into the services communication chain could be a vital outlet for the ISMU.

Residents of informal settlements including community leaders and general members act as the grass root actors. Section 152(1) (e) of the South African Constitution (1992) states that municipalities should involve communities and community organization in matters of local governments, hereby making community involvement in matters of service delivery and data collection mandatory. Within an informal settlement, community leaders play an important role as liaisons between the community and the outside organizations. In 2013 for example, Alfred Ratana of Langrug, acted as a community representative and explained the upgrading process taking place in the informal settlement to visiting delegates of five cities (Hildebrand & MacPherson, 2013). Alfred Ratana additionally spearheaded the enumeration process in Langrug with the collaboration of CORC and Stellenbosch Municipality (Fieuw, 2013). Although he was not a municipal official, Alfred played an important role in representing his community.

Non-governmental organizations (NGOs) are another important group in the chain of communication. As third party actors, NGOs impact this system by aiding government institutions and creating important partnerships to aid in service delivery. In some instances NGOs act as the implementing partners for service delivery projects sponsored by government and third party funding institutions. Andrea Bolnick supports this idea in her report "Informal Settlement Upgrading" by asserting that, in a formal housing delivery or service delivery projects, the government usually provides subsidies, whereas private sector or NGOs act as the implementing agents assisting the government in carrying out uniform service delivery. The South African Slum Dwellers International Alliance (SDI) is a past partner of Stellenbosch, which focuses on projects by and for the poor and includes partnerships with Community Organization Resource Center (CORC), Federation of Urban and Rural Poor (FEDUP), Informal

Settlement Network (I.S.N) and uTshani Fund (South African SDI Alliance, 2016). Another example is the Sustainability Institute which has also worked closely with Stellenbosch Municipality to finalize their 2017 Housing Strategy dealing with the relocation and upgrading of Informal Settlements (Hendler & Swilling, 2008). Apart from NGOs, research institutes also play an important role in evaluating service delivery methods from a third party perspective. The Santa Fe Institute (SFI) (based in New Mexico, USA) established a partnership with SDI to research improved data collection techniques that empower community members to collect data by themselves (Santa Fe Institute, 2016). Through collaboration with open source software developers, SFI works to evaluate measures used for data collection and mapping to assist in coordinating service delivery (e.g. Android phone applications with GPS coordinates) (CORC Annual Report, 2013). With the support of third party organizations, municipalities are able to build stronger connections with constituents, as well as utilize increased technical and research skills for efficient service delivery.

Analysis of effective citizen-organisations relationships

The strength of relationships between primary actors directly impacts the success of service provision. Data collection strategies and service delivery strategies that have proven to be sustainable have successfully connected all the major actors mentioned above. The University of Cape Town (UCT) used graphical information systems to upgrade two informal settlements in Cape Town (Abbott, 2003). The goal of the project was to provide informal settlement leaders with geographic maps of data collected in their community in order to give them a larger role in decision making. These decisions included where and how certain upgrades in their settlement should be carried out (Abbott, 2003). This project relied on their feedback and communication, and consequently empowered the local actors. Managing data in a user friendly, visually engaging, map platform made it easier for residents to be confident when discussing plans with the municipality. This successful method enhanced communication and cooperation between the third party actor (UCT) and the residents of the informal settlements (Abbott, 2003) in order to improve data management and service delivery.

Another example of a successful project that promoted the active involvement of citizens is the Branding Slums project in Rio de Janeiro, Brazil (Torres, 2012). After a need was identified by the local municipality, the project was taken up by the Museum of Favela, an NGO

comprising of members of informal settlements. The goal of the project was to rebrand the image of slums/informal settlements in Rio de Janeiro for successful integration into urban areas. Most importantly, the project involved training informal settlement residents to conduct tourism and increase their own local business potential by marketing the experience of informal settlement residents in various exhibitions (Torres, 2012). This project yielded useful results because it was able to effectively connect together the local municipality, community residents and Museum of Favela. Due to effective communication between the primary actors, the project was tailored to the needs of community members, mobilized them to take action, and took into account municipal resources.

Effective cooperation between primary actors can aid in the ease of conducting a project. SDI Alliance along with the collaboration of United Cities and Local Government of Africa (UCLG-A), recently implemented a "Know Your City" global database in parts of Africa and Asia (SDI, 2015). This database includes data regarding settlement history, population and a description of basic services available. Data is collected by community members who are mobilized by NGO representatives and then mapped in a central database that is publicly accessible online (SDI, 2015). The goal of this database was to promote proactivity within informal settlements by making community's data readily available to the residents. Doing so empowers the community to negotiate development projects which cater to their specific needs (CORC Annual Report, 2015).

However, additional literature suggests that in the South African political landscape, complex and varied conceptions of political entities' role in service delivery can make citizens either communicate more or less to governing bodies (Bulled, 2015). This highlights the need for municipalities to advertise their function as a partner with citizens to prevent inconsistent communication (Krishna, 2003). A study conducted in the Dzimauli neighborhood of the Vhembe District in Limpopo Province, South Africa explored citizen engagement in state water provisions (Bulled, 2015). Since mandating adequate water availability in the Bill of Rights (SEPLG, 2014), the South African government made pushes towards equality in a way that "promoted a 'culture of entitlement' whereby individuals and communities opt to wait for government action rather than make efforts to improve local situations" (Grootes 2014). This culture has caused citizens to respond to water insecurity in a multitude of ways, some communicating more to governing bodies than others. Some citizens frequently go to governing

bodies to request better access to water because they believe in the government's responsibility to provide adequate water availability to all people in South Africa. Some citizens take responsibility into their own hands to find better access to water because they see no other effective option but to take ownership of problems. Some citizens hide their service needs from governing bodies due to a sense of shame given "limited familiarity and experience engaging with the civic sector" (Bulled, 2015). Other citizens believe traditional local governance should handle water access instead of municipalities due to a unique, historically formed, South African sense of citizenship. These examples show that the current political landscape combined with various cultural, racial, and historical influences in South Africa largely causes communities to not see citizen: state relationships as a partnership. Many citizens do not see the possibility of equal input from both sides taken into account during municipality projects. Literature suggests that when municipalities start projects in a community, they must try to understand varied opinions, and the history and conceptions of municipalities that back these opinions, to better facilitate solutions that are community driven with community satisfaction in mind (Krishna, 2003).

This project was designed to assist in improving service delivery to residents of informal settlements in Stellenbosch. In order to enhance the current management of services, the following objectives were developed to address systems of data management:

1) Identified modes of data collection and data interpretation from outside organizations.
2) Analyzed current processes of data collection and service provision carried out by Stellenbosch Municipality.
3) Proposed standardized service delivery platforms that can connect all stakeholders related to service delivery in informal settlements.

Objective 1: Identified modes of data collection and data interpretation from outside organizations.

To evaluate current data collection processes, semi-structured interviews were conducted with officials from NGOs and for-profit organizations. The goal of interviewing different types of organizations was to obtain different data collection and management strategies that might result due to differences in organizational structures and goals.

Semi-structured interviews with NGOs

Due to active involvement in data collection efforts, such as enumeration reports in Stellenbosch (CORC Annual Report 2015) and research on effective data collection using phone applications (CORC Annual Report, 2013), NGOs provide an ideal third party perspective on suggestions for the data collection system. A representative from CORC was interviewed to gather their expertise in data collection and management. In addition to the representative, Mr. Aditya Kumar, who worked for CORC in 2014 as the Deputy Director and Technical Coordinator (Talking Heads, 2014), was interviewed. The interview with Mr. Kumar centered on past efforts of CORC related to data collection and management in informal settlements. Both past and present strategies were discussed, outlining improvements the organization has undergone in their data collection strategies. These interviews complemented discussions with more government focused organisations by providing a different perspective on the service delivery process. A full list of interview questions can be found in Appendix B.1.

Semi-structured interviews with for-profit organizations

Representatives from Profile Mobile Mapping (PMM) GIS Solutions, an organization that focuses on developing data collection platforms on mobile applications, was interviewed (Appendix B.1). PMM had been contracted by the Stellenbosch ISMU to transfer their data collection questionnaire onto a handheld device and conduct demographic data collection in informal settlements. Due to contract time limitation PMM employed a more direct procedure than CORC, which relied on automated processes to feed data into the database while capturing necessary demographic information.

Two interviews were also conducted with representatives from Lumkani, a social enterprise that focuses on distributing fire detectors to informal settlements (Appendix B.1). Lumkani conducts data collection to gauge experiences regarding their fire detector devices, as well as improve their product and its distribution model. One interview focused on understanding communication with community members when collecting data, and the other focused on understanding the data management system used to capture data from the field workers. The variables involved in Lumkani's data collection are specific to fire incidents as compared to detailed demographics conducted by other organisations.

The benefits and shortcomings of each data collection and management approach were assessed and reviewed by analyzing interview notes and listening to the voice recordings. This analysis made it possible to identify viable practices used from each organization and formulate an applicable data collection approach for the Stellenbosch Municipality.

Objective 2: Analyzed the current process of providing services and the challenges of service delivery

After analyzing data collection practices, the specific methods of service delivery in Stellenbosch were evaluated by interviewing primary stakeholders. The primary stakeholders involved were the residents of informal settlements (receivers of services) and the Stellenbosch Municipality (provider of services).

Understanding the process of service delivery required gathering both qualitative and quantitative data from multiple stakeholders. The project was conducted in the informal settlement of Mountain View, located in Jamestown, in order to delve into underlying issues and identify broad themes in the community. The time spent in one community helped make

community members comfortable enough to speak about such topics. In order to distinguish the current process for requesting services and addressing needs in detail, the current flow of information was mapped from the residents of Mountain View to the municipality and vice versa.

In order to enhance the service delivery system and bolster two-way communication it was important to gauge the suggestions of both the municipality and the community. Over the course of seven days (within a six week period) spent in the Mountain View, 90 residents were spoken to. The residents provided the team and the municipal officials with a more personalized story behind daily life. Relationships were also built with many of the residents. Over 20 semi-structured interviews were conducted, from which a set of common themes was compiled. The methodological process for the interviews was as follows:

1. The interviews were recorded and handwritten notes were taken.
2. The information gathered from municipal officials was assessed in order to conduct a thematic analysis of all responses.
3. Using a uniquely developed coding system, a content analysis was conducted of all the collected interview transcripts. These codes identified common themes related to the process of service delivery (see Appendix B.6-2).
4. Common trends were determined related to data management by quantifying the data and assessing the frequency of codes (See Figure 2.1).
5. After the interviews were conducted, all transcripts, audio recordings, and notes were uploaded to an online password protected shared folder accessible only to team members, and all written work was filed in its designated folder.

Name	# people in section	Toilet	Toilet on property	Toilet Maintenance	Expected Toilet Mainte	# people	Taps	
John Johannes		chemical		2 days		2		
Jameel		chemical		2 days				
Marianna		chemical		1 day			1	
Velma		chemical		1 day				
JoAnn		chemical		2 days				
Monica		bucket		0 days		6		
Denise		chemical		2 days		2	1	
Nomsa		chemical		2 days		1		1
Charmaine		Chemical		0 days	3x			
Analine		Chemical		3 days		3+	1	
Charlene		chemical		3 days		4	2	
Lydia		chemical		1 day		4		
Anna Daniels		chemical		2 days		4		1
Christina		chemical		2 days		5		1
EPWP Workers (8 roughly)		chemical	no	3 days		7		2
Benny Lenord		chemical						1
Sonia		chemical		2 days		1		1
Carmen		chemical	no	2 days		3		1
focus group (9 people)		chemical	6 households use 1 T	1 day				1
Kara Maraman		chemical	yes	3 days		3+		1
Enrico		chemical	no	3 days		5		1

Figure 2.1: Snapshot of coding analysis of Mountain View interviews

Interviews with Stellenbosch Municipality officials

Six semi-structured interviews were conducted with municipal officials working in the Informal Settlement Management Unit, Engineering Services and Information and Communications Technology. These interviews yielded responses that provided a range of insights on the processes of receiving and managing requests, carrying out the service, and feedback after completion of request. This method of interview allowed for in-depth clarification on the intentions of the municipality and their current data management system.

Within the ISMU, Kamohelo Mculu (Senior Project Manager), Harold Lambert (Field Worker), and two of the interns, Viola Anthony and Success Mngadi, were interviewed. The goal of the interview with Mr. Mculu was to understand how the ISMU processes service requests (Appendix B.2). That information was supplemented by interviewing Mr. Lambert (Appendix B.3) to get a sense for the responsibilities of the field workers. Mr. Lambert's tasks range from answering service requests to performing data collection and writing disaster reports. Ms. Anthony and Mr. Mngadi support the ISMU in a variety of roles including, manning the front desk, addressing phone calls from informal settlements and managing collected data. Through a

list of questions (Appendix B.2), the perspective of Ms. Anthony and Mr. Mngadi on the direct dealings of the ISMU with informal settlement residents was gained.

From the Engineering Services water and sewage department, Tracy Wehr was interviewed. Through a list of questions (Appendix B.4), information was gained regarding the challenges faced when installing taps and ablution facilities, as well as the policies of communication between Engineering Services and the ISMU. To further comprehend the interdepartmental communication within the municipality, Brian Mkaza, Manager of Information and Communications Technology, was interviewed. In the conversation with Mr. Mkaza, information was gathered regarding the responsibilities of his department in establishing interdepartmental communication, the current system of individual databases within each department, and his future goals to centralize the data management system (Appendix B.5).

Interviews with Mountain View community leaders and community members

Community interactions in Mountain View included unstructured conversations followed by semi-structured interviews with community leaders and the residents of the settlement. During unstructured conversations, community members were given the chance to provide opinions and extra information, and deeper relationships were formed. Detailed experiences were gathered about the movement of residents into Mountain View, services provided in the community, and the daily interactions between the people. The semi-structured interviews were a continuation of the conversation approach and resulted in three main topic categories: current methods and processes that residents have for communicating needs to the municipality, the opinions of the people on the current service delivery structure, and suggestions for improvement (Appendix B.6-1).

An informal strategy was implemented in order to interact with the community, as well as gather necessary information from all primary actors. Residents located at varying distances from taps in each section were sampled by drawing a radius line outward from centralized taps and interviewing the households that fell on that line (see Figure 2.2). This ensured that an adequate range of opinions and suggestions related to the service delivery process was collected.
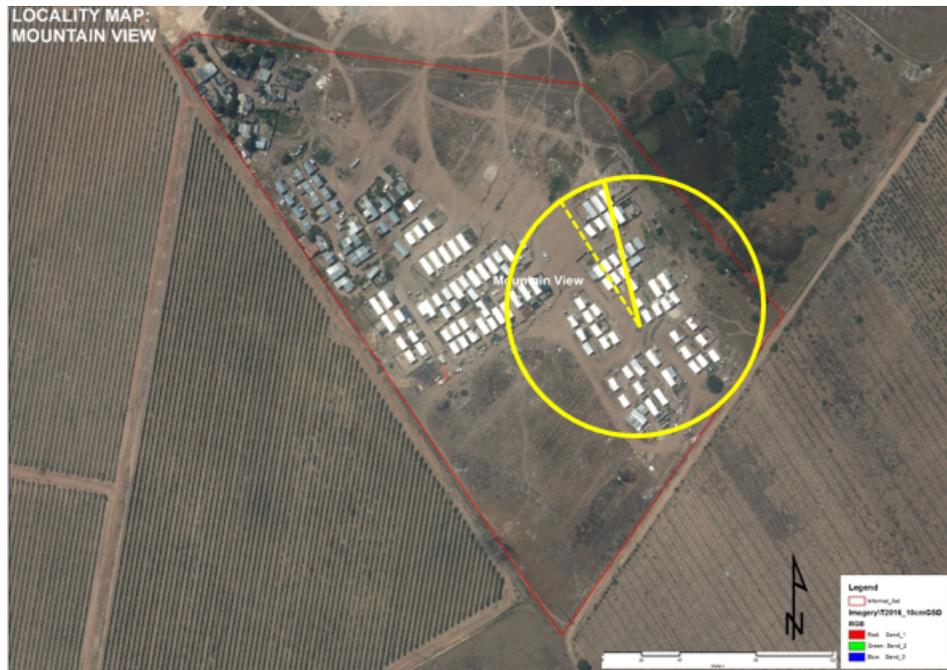
Figure 2.2 Radius Line Interview Strategy

In order for community leaders to prepare information for the time of the interview, Mr. Lambert notified them prior to the scheduled interview date. Mountain View interviews were conducted in pairs to make the process time effective. Through meetings with community members within their homes and around the settlement, observations and recordings were taken regarding the state of existing services in each section. With approval from each participant, all interviews were recorded, and the information was analyzed using the previously mentioned analytical process.

Objective 3: Proposed a standardized service delivery platform to connect all stakeholders related to service delivery in informal settlements

The proposed service delivery platform was assembled through a thematic analysis from interviews, case studies of other service delivery models, and a final gathering in the community of Mountain View in Jamestown.

Thematic analysis of community interviews

      After interviewing each community member interview in Mountain View, a debrief was done in order to take down all important information. It was important to recap fieldwork and write down all observations right away. The purpose of this was to understand the history of the specific section, the story behind the household, the household's satisfaction with the municipality, and to record the bonds built with the people. Demographic data collected included which services were available to each resident such as toilets, taps, skips, and sanitation, the number of days that the toilets and skips were cleaned, number of people in the household, mode of communication with municipality, and a list of suggestions mentioned by each person about improvements that could be made.

Case studies of organisations that provide services

      Case studies were conducted on Worcester Polytechnic Institute (USA), Worcester Department of Public Works & Parks (USA), and the City of Cape Town (RSA), in order to gather best practices that were included in final recommendations. These organizations offered different models of data management related to service delivery as they were established in and serve different contexts. They are also managed under different financial and political institutional constraints. Case studies were comprised of semi-structured interviews with representatives from each organization. The interviews touched on two major components: the communication flow in each of these organizations and the system employed to collect, manage and disperse service requests.

Worcester Polytechnic Institute (WPI)

      WPI provided an example of a service delivery organization that caters to around 2000 students (Worcester Polytechnic Institute, 2016). These students live on campus and are dependent on the university for housing. Amy Beth, Senior Associate Director of Residential Operations, was contacted via email. In this position Ms. Beth acts as the liaison for facilities (Residential Services WPI, 2016) and overseas residential occupancy. A predetermined list of questions (Appendix B.7) addressed the communication flow of a service request and explained the system used for recording such requests. The WPI Facilities office was also contacted via email. This office is responsible for carrying out the service delivery requests forwarded by

Residential Services. Through another semi-structured interview with WPI Facilities (Appendix B.8), an understanding of the system for recording service delivery requests by their office was gained.

Worcester Department of Public Works & Parks (DPW)

The City of Worcester provided information on a government data collection and management system that catered to a similar scale of residents as Stellenbosch Municipality. This process consisted of two semi-structured interviews with representatives of the DPW. An individual who handles service requests to the DPW was contacted in order to get an overview of the communication flow and how they processed service delivery requests. An interview with predetermined questions elucidated the types of service deliveries handled, resources available (i.e., monetary, technological and human), as well as the feedback protocol that is used to make residents aware of the status of their request (see Appendix B.9). The second interview was with Janet Benoit, an IT department official, credited with developing the software, to further understand the database used by the DPW. She was asked to determine the technicalities of the software including: the resources needed to run the software, the user capacity per time, any graphical information system (GIS) mapping that is used by the system, and any maintenance process that is undertaken over time (Appendix B.10).

City of Cape Town

A third case study on the city of Cape Town was done because it has 204 informal settlements and created the first informal settlement management unit in South Africa (City of Cape Town, 2013). One semi-structured interview was conducted with Susan Groenewald, who is involved in the planning department within the informal settlements department (Appendix B.11 and B.12). The goal of this interview was to get a sense of the resources utilized by Cape Town municipality when addressing service delivery and their service request platform. The communication flow within the department and the mediums of communication were mapped. This interview also provided an example of different sets of approaches that are used to mobilize community when making service delivery sustainable. Information was gained regarding resources needed to support their service request platform, the availability of GIS mapping to ease service delivery, and any limitations of the system that affects service delivery.

A semi-structured interview was also conducted with the Professional Town and Regional Planner for the Western Cape Government, David Alli. Since Mr. Alli oversees housing implementations in all of the Western Cape, including Cape Town and Stellenbosch, the aim was to obtain information regarding strategies for managing large areas (Appendix B.13).

Analyzed findings from interviews and community gathering

After data was recorded and the current system analyzed, an assessment was made regarding which approach would be most applicable for the Stellenbosch Municipality. The possible benefits that communities get out of each model was assessed. With the information collected from the interviews with the municipality and the community leaders, direct benefits gained from models were prioritized. The process of service delivery was analyzed, starting from when the request arrived, how the service request was addressed, how requests were prioritized, and how long it took to address the issue.

In order to gain a final round of feedback from the community, a gathering was held attended by all stakeholders (municipality staff and community representatives) which allowed everyone to be on the same page regarding the proposed approach for service delivery improvements. This gathering was held at the Weber Gedenk NGK Primary School just outside of the Mountain View community, in order for residents to be provided with direct results from the collected data. After a brief introduction, an open forum was held to discuss the potential pros and cons of the proposed approaches. Posters were created that described the importance of communication with the municipality, the goal of completing a feedback communication loop during service delivery, and how multiple communication applications could be beneficial. These posters kept people's ideas on topic and provided outlets for further questions about results. A post-it note suggestion board was set up in order to gather community feedback to give additional data to the municipality. The gathering was limited to two hours in order to keep everyone's attention. Food and drinks were provided as a means of thank you for their hospitality and attendance. Using gathered information, the proposed approach was further validated and changes to address feedback received were made.

Data Collection Methods

Varied approaches to data collection: enumerations, community profiling, GPS tagging, and community engagement

Interviews with organisations revealed a difference in opinions and strategies pertaining to data collection with each of the organizations interviewed. One common method of data collection is enumeration. An enumeration is a detailed census of the community obtaining demographic, economic, and service provision data. Organisations conduct enumerations in different ways, however for the same outcome/purpose. PMM uses a digitised survey allowing for quicker data collection and management. PMM's data is managed on private servers that clients can purchase a subscription to access. Other organisations continue to use paper-based surveys, which results in a much slower process requiring additional time to input data into an electronic format. Given that such census surveys require time and investment, organizations like CORC refrain from enumerations in all communities. CORC limits enumerations to communities where requests have been made to move forward with their development. Enumeration survey teams are comprised of community members, trained partners from ISN and technical support staff from CORC. This process affords the community members with agency as they develop skills to conduct the surveys, learn about their own community, and control what is done with the data following the completion of the enumeration. Although this enumeration approach is time consuming, it ensures that the community actively participates and sees value in collecting data.

Community profiling is another data collection strategy employed by CORC to maintain a community oriented and community run process. This method is designed to acquire a greater understanding of the history, physical environment, demographics, and goals of the residents. Selected community members are asked to participate in a focus group led by CORC field staff. This selection method limits the number of residents involved, which limits the information collected to the knowledge and perceptions of participants. Basic services including water taps, ablution facilities, and electricity poles are counted and GPS mapped out. ISN is a key contributor that suggested people build relations and understand each other. Community profiling is a quick process that can be completed within three hours to half a day.

An additional data collection strategy used by Lumkani is the combination of GPS tagging and demographic surveys to gather relevant information. This approach provides

constant feedback and updates through two-way SMS communication with community members. PMM uses GPS tagging as well which provides exact location of the infrastructures being surveyed.

Representatives from most of the outside organisations interviewed had used community members to help collect data and implement their own local projects. The common idea among the organisations is that this method allows for better community ownership of the project at hand. CORC deploys community profiling and enumerations to instill equal partnership between the community members and their organization. When the community is able to take ownership and move forward with their data collection, the system has a much greater chance of sustainability and promotes community proactivity in the long-run.

PMM fosters community engagement and motivates community members through monetary compensation. This keeps data collection more standardised in terms of processes and outcomes, making it a shorter process with more quantitative data. This method could also persuade data collectors to focus on filling forms rather than ensuring the authenticity of data collected. Conversely, Lumkani hires community members to help in the data collection and implementation of their devices by compensating people with airtime. One downfall with compensation methods is that it may set a precedent for other communities. This limits community engagement without compensation due to the expectations of the people.

The City of Cape Town uses a more structured community engagement process by employing community members on short term contracts. These contracts can range from a number of jobs including data collection to maintaining basic services in settlements. The employment system is rotational in order to ensure that everybody has an equal chance of getting employed.

Suggestions for data collection: Community profiling through radius line focus groups to supplement data collected with enumerations

Currently, enumerations, the approach for collecting a quantitative assessment of service provision, provide the demographic data required by the ISMU, however the process takes too long to complete and often has incomplete information. Community profiling, the approach for qualitative data collection through conversations, can be used to supplement the information gained by enumerations. Focus group discussions can be carried out in order to make the process

time effective. However, representatives in the focus groups should be chosen via the radius line method in each section. Choosing people at a variety of distances away from services in each section would ensure that all sections within the settlement and the widest spread of opinions possible are represented. Additionally, the radius line method facilitates choosing people in an unbiased manner. Focus groups should have a maximum of 15 participants excluding members from the municipality. If a settlement with a lot more sections (e.g. Kayamandi) has to be profiled, multiple focus groups should be conducted. Topics such as history of settlement, leadership structure, access to basic services, community relations and goals of the community should be covered in the focus group. Followed by the focus group, basic services can be mapped out on an aerial map and consolidated in the office providing quantitative data (see Figure 3.1). Information gathered through community profiling is not the only goal. Additionally, the process of the data collection itself is just as important. Focus groups should give residents the opportunity to establish a partnership with the municipality, converse with the municipality on equal ground, make their own opinions and situations heard adequately, and plan additions for their community together with the municipality.
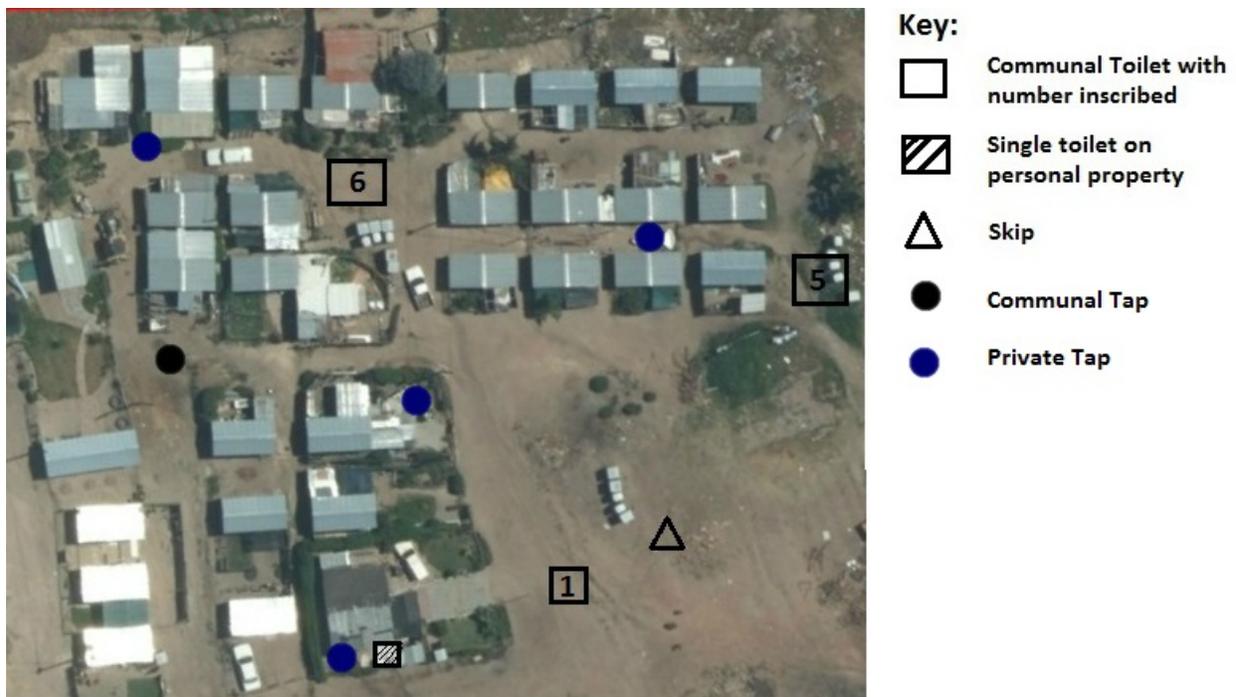

Figure 3.1 Aerial map of services in section B of Mountain View

Community profiling can serve as an introductory meeting between the municipality and community residents where residents have not been extensively exposed to the actions of the municipality. Communities who are already involved with the Stellenbosch municipality can use this opportunity to update their previous data. After the consolidation of data from community profiling, all findings should be reported back to the community. This feedback will encourage proactive participation by community members. Giving data back to the community will also increase awareness regarding the importance of data collection. This will aid in a smooth enumeration process where residents are much more willing to provide data and actively participate as enumerators.

Communication and Service Delivery Methods

Informal settlement residents should have an individualised service request system because of disorganisation and inconsistent mindsets in Mountain View

Municipal officials indicated a confliction with implementation of an individualised service request system compared to a communal system. A communal system would require one person to gather community support for a service request and have a representative send the request to the municipality. This system would regulate unreasonable requests through a community leader, and a request backed by many people would have more impact on the municipality. However, an individualised system would allow for any person to submit a direct service request to the municipality offices without having to get representation or organise community support. Due to social disorganisation and inconsistent proactivity in informal settlements, a communal system would be difficult to organise and would prevent many residents' voices from being heard. Therefore, an individualised system would be a more effective option if implemented correctly because it would give people a voice.

One indicator of disorganisation is the varied histories and allegiances in sections of Mountain View. Mountain View is a small informal settlement in Jamestown. It is divided into four sections with A being the first settlement to form in the area, and the newer sections being B, C, and D. The newer sections are comprised of people who were relocated from their original homes within the last five years. One woman explained that tension sometimes lies between the different sections due to the different histories within sections. She informed that leaders often

communicate within themselves which creates a further divide between sections. This woman also speculated that people from different sections have a hard time trusting each as they did not grow up together. A majority of the people interviewed agreed that meetings between sections are not frequent enough (see Figure 3.2) and some inclined that they would like to have more regular meetings. Due to varied allegiances among sections, organising a communication structure between all members of the community has been difficult in the past.

Count of Community Meeting Opinions
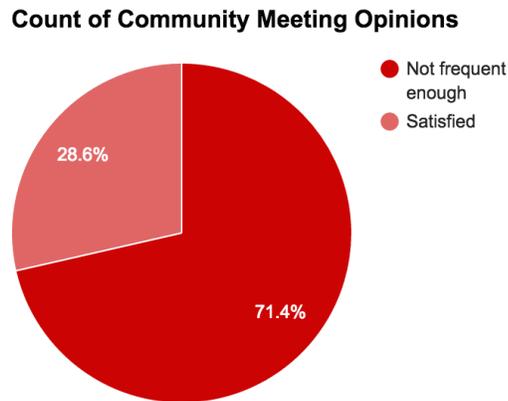
Figure 3.2 Satisfaction of the community in regards to community meetings

Another indicator of disorganization is the varied relationships with community leaders. Although there are community leaders in each section, there are not always good relations between the people and the leader. One woman chooses not to report problems to the community leader of section A because of controversy surrounding the election of that leader. When community members disagree with the chosen leadership, they elect different leaders on the side or even self-appoint. When this controversy occurs, some residents wait to report problems until they sees Mr. Harold. In contrast, there are people in the community who do go to the community leader for help and advice without any hesitation. This inconsistency in relationships with community leaders is further argument for an individualised request system. It is possible that if leaders are made the central representative of communication with the municipality, they might not attend to the needs of every resident equally.

Along with the social divides, there are inconsistencies in the mindsets of people regarding who is responsible for the maintenance of services. These discrepancies throughout Mountain View would make it difficult to gather support behind a communal service request

system. A resident in section A mentioned that she decided to insert her own tap on her property because sharing the tap became too difficult. Another resident explained that constant difficulties with the communal toilets motivated her to move a toilet onto her own property. She now cleans her toilet a few times a week on her own to ensure sanitation and safety for her children. Although she did "steal" the toilet and move it onto her property, she has taken responsibility for it. On the other hand, a section C resident suggested that there are people in the community that expect the municipality to fix all of their problems. These people are the ones who intentionally break the doors to their structures or vandalise toilets. An elder in section B confirmed this speculation, saying that many people have no intention to find work. With no work to keep them occupied, some residents get by with stealing from others in the community.

Although a majority of the community had access to phones they do not always take action to contact the municipality with problems because of the inconsistencies in their mindsets regarding maintenance responsibilities. Figure 3.3 indicates the proportion of residents interviewed who reported having a smartphone or access to a smartphone. In one interview, a woman complained that a tap had been broken for a week, but had never contacted anyone about it. Sometimes in this community there is the expectation that someone else will be the one to contact the municipality and take action. This is largely due to the current communal representation structure, where community leaders are seen as more capable to take action than the general public. This mindset would be better circumvented in an individualised system because one person would be able to take action and contact the municipality. Hopefully over time the entire community will experience their own voice being heard and see the value in being more individually proactive.
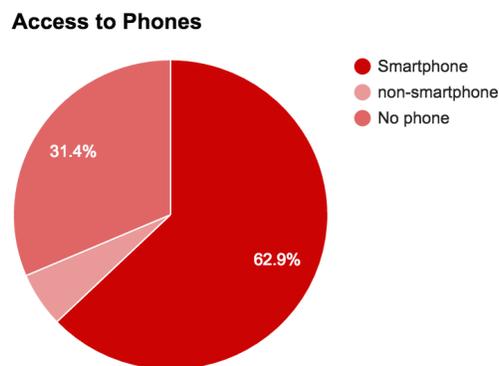

Figure 3.3 Access to Phones in Mountain View

Interviews with municipal officials revealed that current service requests follow a long route of communication. This exacerbates the disorganization and proactivity gap within informal settlements. Figure 3.4 outlines the current flow of service request communication in Stellenbosch Municipality. Field workers are designated to address issues within communities while physically present in their assigned community. They handle requests in person which creates a time consuming process. This paper-based application increases completion time and loses efficiency in reporting service requests because they need to be approved by relevant authority before action can be taken. Requests can be submitted by anyone in an informal settlement, but the singular requests are not always listened to right away. Human error is a factor in this process because the field worker has to take notes about each request and organise them on the spot. The long route of communication needs to be shortened to increase efficiency and allow residents to see their request being recorded.
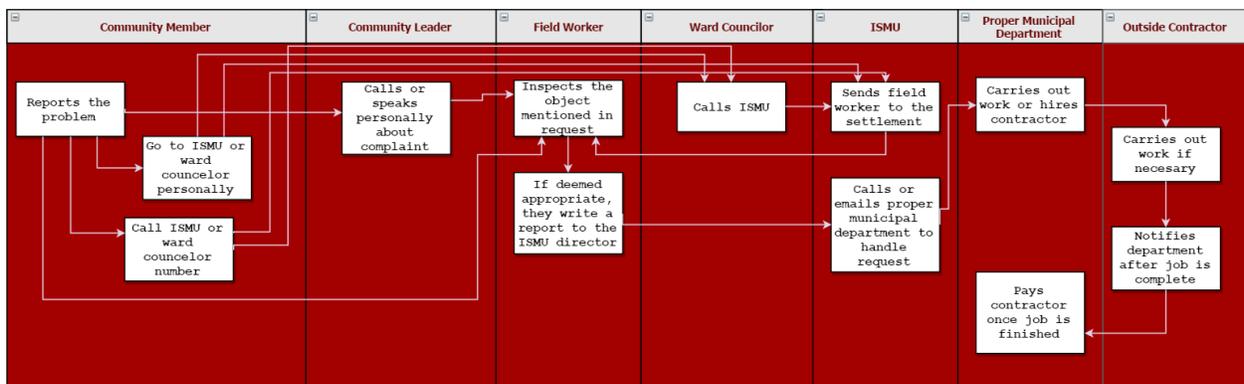

Figure 3.4 Flow of service request communication in Stellenbosch

Service request and delivery can be improved by implementing an individualised request structure that directly connects residents to the informal settlements office. Our interviews, summarised in the previous section, showed that communication among the community can be difficult. Community members expressed reservations about talking to middle men, such as the ward councilor, because they feel that their concerns will not reach the municipality. Finding a way to unite a community around making service requests together is a big undertaking with a lot of social implications.

Stellenbosch Municipality has the emergency contact numbers in place to promote direct communication, but the people do not know how to utilise those resources. Both Worcester and

Cape Town municipalities have established direct lines of communication with their constituents. An individualised system allows for leaders to report requests themselves, but they are on the same level as all other community members. This individualised request system should be supplemented by a community group messaging system. The purpose would be to inform the entire community that a request was sent in for a communal service. This will limit the possibility of an overabundance of messages clogging the municipality office about one problem.

Formal settlement residents in Stellenbosch follow similar procedures when reporting municipal service requests. However, formal housing is on privately owned land which allows them freedom to amend their property at will. When these residents have a problem related to their own infrastructure (e.g. plumbing problems in the house, broken toilet, broken lights) he or she calls a private service provider to fix the problem because the municipality does not have jurisdiction over the private land. When a formal resident recognises a problem related to a public system on their property, he/she would call the same emergency municipal number that the informal residents are told to call.

Suggestions for Individualised Service Request System: WhatsApp Group and Call Rerouting

Residents of informal settlements in Cape Town directly send messages via WhatsApp to their designated group chat to inform municipality officials of service requests while keeping other community members in the loop. This ensures that the system is not clogged by the same request being placed by multiple individuals. This is also a familiar platform for the citizens of South Africa.

Having WhatsApp groups organised by Stellenbosch Municipality can be combined with a number from the office that residents can message individually. To avoid clogging a full community group, each section of an informal settlement should have their own group. This is also due to WhatsApp only being able to support 256 people in one group. With this proposed system, when residents have a problem about a communal service they have the ability to send a request themselves to their WhatsApp group. If a request is about an individual issue, such as a housing problem, then the resident can send a message to the municipality number in an individual chat. This system enables people to make their requests directly known to the

municipality while updating their section in the process. A set of guidelines have been formulated in order to moderate the system and limit abuse and can be found in Appendix C.

WhatsApp was chosen over other communication programs because it enables people to relay information quickly with timely feedback. It is a user friendly communication app already being used by many Mountain View residents. In terms of functionality, WhatsApp has the ability to share a pinned GPS map location, PDF file, and pictures in the form of a message. South African cellular companies offer special data packages making a WhatsApp message as cheap as 0.06 Rand, which is cheaper than SMS.

Possible drawbacks are that requests have to be manually uploaded to a service project tracking database and it is limited to people with smartphones. The groups also need regular monitoring by the municipality and are prone to manipulation and overuse by community members. However, guidelines for how Stellenbosch Municipality should monitor WhatsApp can be found in Appendix D. These drawbacks could be addressed in the future with a professional service request mobile application.

Observations and interviews in the Mountain View community revealed that the current municipal phone system does not follow a protocol to ensure that resident's requests are heard reliably. Residents in all four sections indicated that they did not know who to go to for help or inquiries, even though laminated sheets with emergency/utility contact numbers on them have been distributed. These numbers include the numbers for water, electricity, traffic, roads and storm water, refuse, environment, and other emergency contacts. While it is noteworthy that 37.5% of people call these numbers directly for assistance, Figure 3.9 shows that almost 70% have access to phones in their homes. The majority of people, including almost half of those with home phone availability, choose to travel to the informal settlements office to speak in person (31.3%), wait for a field worker (18.8%), or talk to community leaders (9.4%) (see Figure 3.5). One reason only 37.5% utilise phone calls is because when the official designated to the informal settlements phone is not around, the call goes to voicemail instead of another phone in the office. In an interview with the IT department, it was noted that there is no automatic call rerouting from the main phone to any other phone in the department when the main phone is not answered. This forces community members go to the office directly and file a request. The downfall to this method is the community member loses time to travel to the office. Due to these consistent

difficulties, a rerouting system should be implemented to make sure that a call would always be answered.
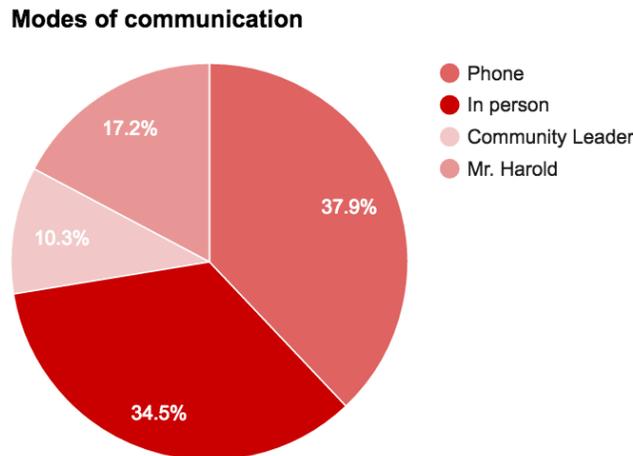
Modes of communication

Figure 3.5 Frequency of different modes of communication to the municipality

Informal settlements should have supplemental communication platforms available
Suggestions: Municipal website improvements and utilization of Facebook and SMS
communication

Adding alternative platforms to supplement the WhatsApp service request system will make service delivery easier. Apart from providing different options, the platforms employed should be able to directly relay information without the need of a middle man. The City of Cape Town currently acts on this policy by using WhatsApp groups, website service request page, short code SMS system, Facebook page, and field visits. These multiple approaches have the ability to capture a variation of data and caters to residents of different age groups and preferences.

The municipal website and Facebook page are service request platforms dependent on Internet connectivity and access to technological devices. The website service request system provides a much more detailed platform where Cape Town residents can specify their request through a fillable form (see Figure 3.6). The information from the form feeds automatically into a database that reduces the need for manual data entry. When a request is created, the user receives a request number that can then be entered at any time to track the progress made on the

original request. The final tab includes a website feedback page where residents can write suggestions for improving the website's functionality. The website has a cellphone version making it easily accessible across multiple types of devices.

Figure 3.6 Screenshot of Cape Town's Service Request page

The Worcester service request web page is similar to Cape Town's, but includes a series of specialised questions for each type of request (see Figure 3.7). This specialised format makes service requests much simpler for the requester. An example of the specialised prompt is for a missing street sign request, which includes questions such as "Is the base and pole still located at the location?"

Figure 3.7 Screenshot of Worcester's Service Request Website

The Stellenbosch web page only includes four text boxes for name, email, subject, and personal message (see Figure 3.8). This simple format results in a singular receiver from the Stellenbosch communication department having to organise many types of messages, from licenses and registrations, to emergencies and municipal service requests, which slows response times for other services.
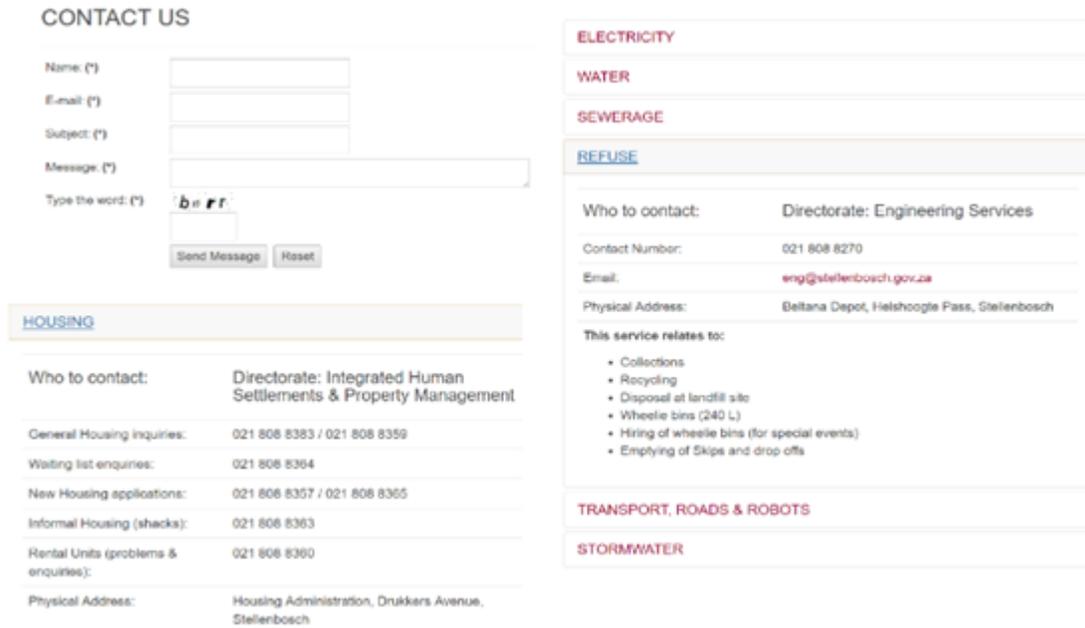
Figure 3.8 Screenshot of Stellenbosch's Municipal Services and "Contact Us" pages

On the other hand, SMS provides an opportunity for citizens without smartphones to request a service via a specific short code number. SMS requests are automatically stored in a central database and an automatic acknowledgement is sent to the resident. This approach is used by the City of Cape Town and the Worcester DPW (USA) where residents can send requests to different departments within the municipality based on the format of the SMS. Additional requests can be made by texting an SMS number to inquire about traffic and road closures. For residents who prefer in person interaction and have limited access to communication tools, Cape Town also employs weekly field visits to each of the informal settlements in its domain.

While short code SMS does not have any PDF or location sending features, it is a simple option for Stellenbosch that would better accommodate people who own older phones than smartphones. There would be a dedicated six-digit number advertised that any community member could text, and it allows for messages to be directly integrated into an online survey database. SMS messaging costs more than WhatsApp, which might discourage overuse and abuse of the communication line. The municipality is able to send mass texts through this platform to update large groups. Guidelines on how to monitor SMS can be found in Appendix D.

Social media provides another familiar environment for residents to report problems and read public announcements. The City of Worcester has the "AlertWorcester" program that sends out mass alerts to residents. When there are emergencies in the community such as road closures, icy roads, and phone poles in the road, alerts are sent out on Facebook and Twitter to inform people immediately. These platforms are utilised in service delivery communication to update residents on tentative completion times and further follow up procedures so that the request can be tracked. The City of Worcester has an additional tab on its Facebook page called SeeClickFix. SeeClickFix allows users to drop location pins on an integrated Google map and report issues that require the municipality's attention. The pins are further color coded based on open, processing and closed requests.

A preliminary Facebook page was made for the Stellenbosch ISMU in addition to the existing page for the entire Stellenbosch Municipality (Figure 3.9). Facebook is manageable by multiple admins, who have the ability to edit, post, and censor the page to control information shared with the public. Cell C provides free access to Facebook for anyone with a Cell C data plan, decreasing cost for use in informal settlements. This method uses up data, which could be pricey for community members not on a Cell C plan. There can also include a bank of preloaded PDF housing application documents for community members to download and utilise. For the effectiveness of this page to be maximised, municipal office policy will need to allow those in charge of the Facebook page to access it during work hours.

Figure 3.9 Facebook Examples of a General Update and Community Event

Direct messages to the Facebook page will be a conversation with multiple admins having the ability to reply to a single message. SeeClickFix can be integrated on the Facebook

page and users can request services by dropping pins on the google map with a brief description message. Guidelines for how to monitor Facebook can be found in Appendix D.

Stellenbosch Municipality should implement feedback loops to keep all parties well informed on project status

Feedback in the service delivery process was emphasised within each data management system. Feedback is important to ensure that the community and service deliverers are well informed once a service request is made. In the WPI SchoolDude system, automatic emails are sent to all the parties in the communication chain whenever an update is entered by contractors (see Figure 3.10). Weekly reports are also sent through the database to the complex coordinators to update them on all work orders in progress. This minimises the chance of a service request getting lost or delayed due to regular follow-ups. In the Worcester, each requester is sent an ID that can be used to track the progress of their service request (see Figure 3.11). When the service is complete, the requestor receives an email verifying completion. One feedback method used in Cape Town is a follow up WhatsApp message to the community from the project manager in that area (see Figure 3.12). Each of these systems have regulated management and feedback which creates a continuous loop of information flow.
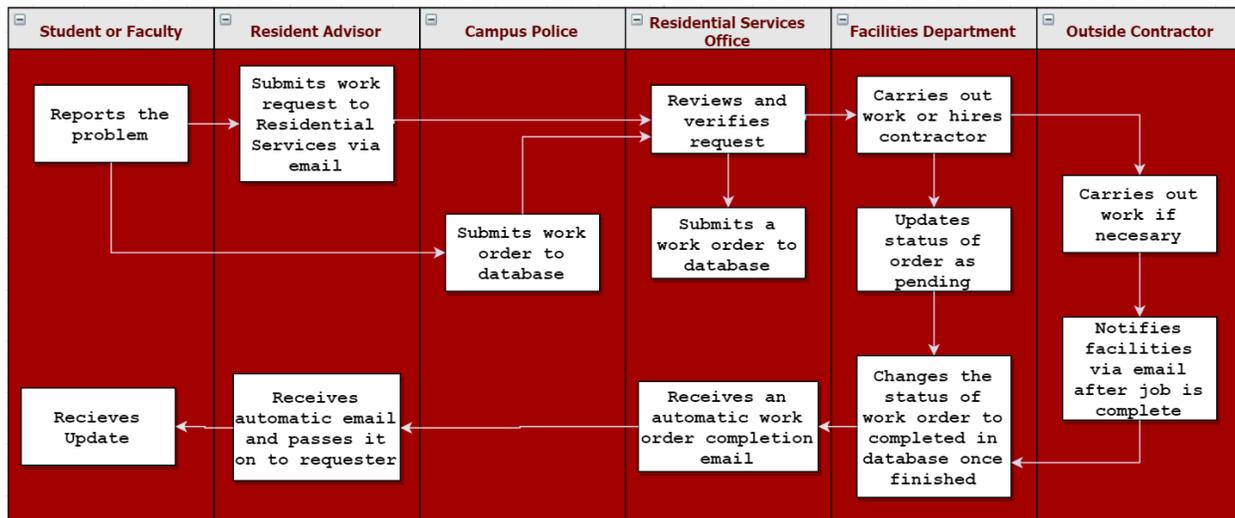
Figure 3.10 Diagram of communication flow regarding service requests at WPI
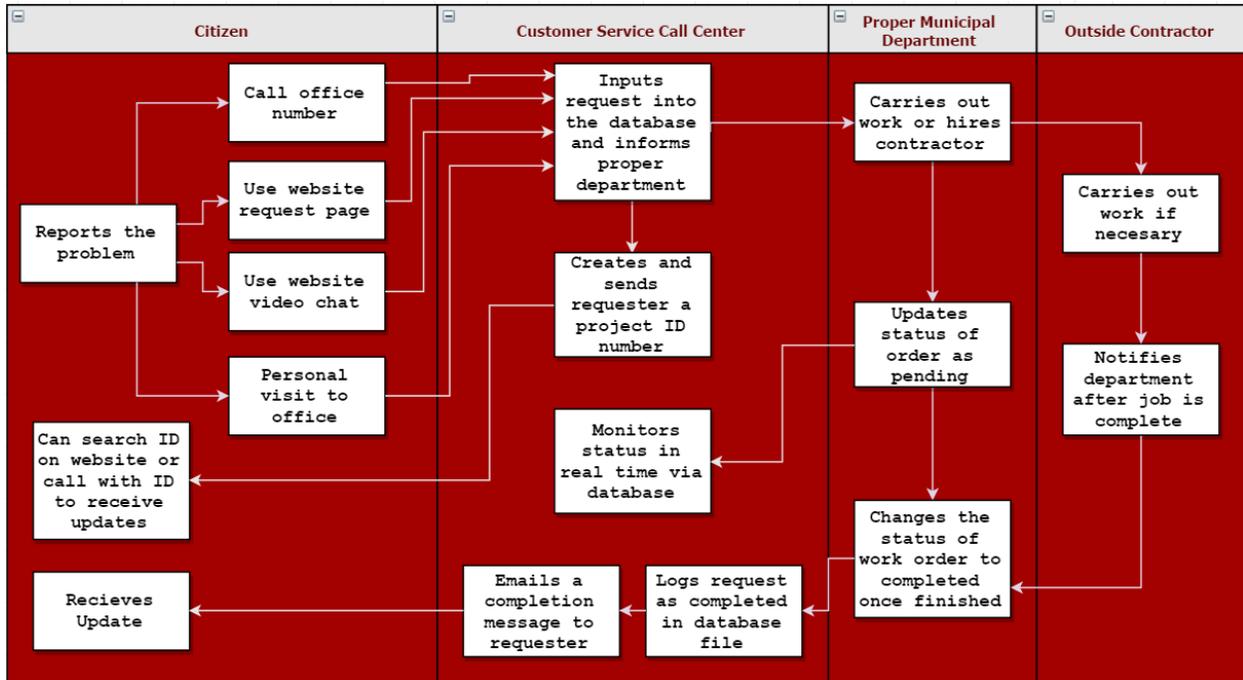
Figure 3.11 Diagram of communication flow regarding service requests in the City of Worcester, MA
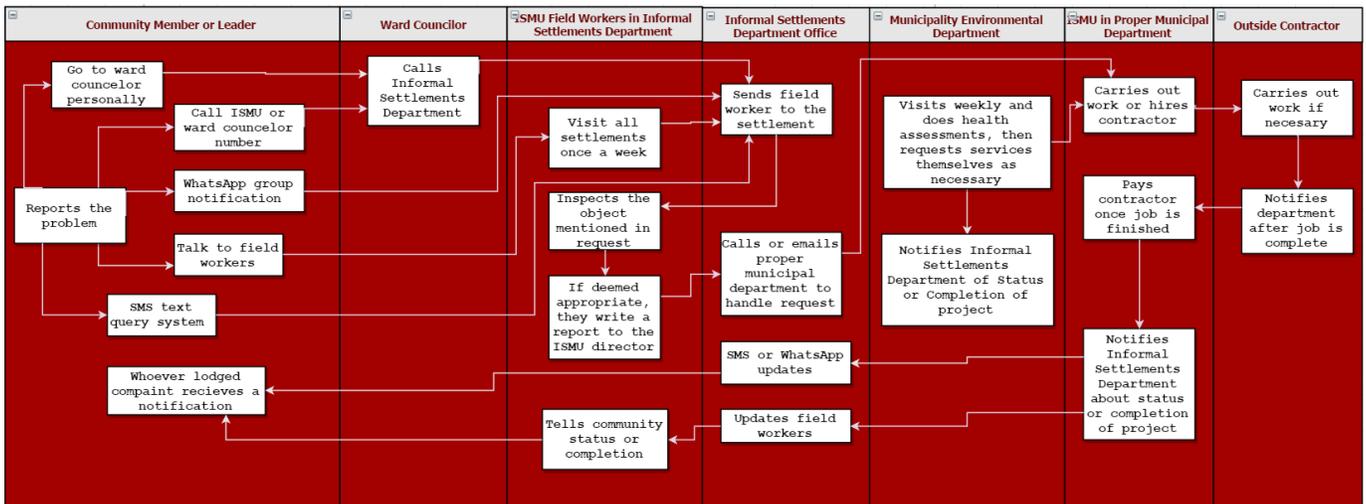
Figure 3.12 Diagram of communication flow regarding service requests in the City of Cape Town

In contrast, there is no feedback loop in Stellenbosch's communication chain to provide updates on progress of service requests. Once the service request is forwarded to a related department (e.g. Engineering Services) there is no specified system of interdepartmental communication to relay progress back to field workers who lodge the complaint (see Figure 3.4).
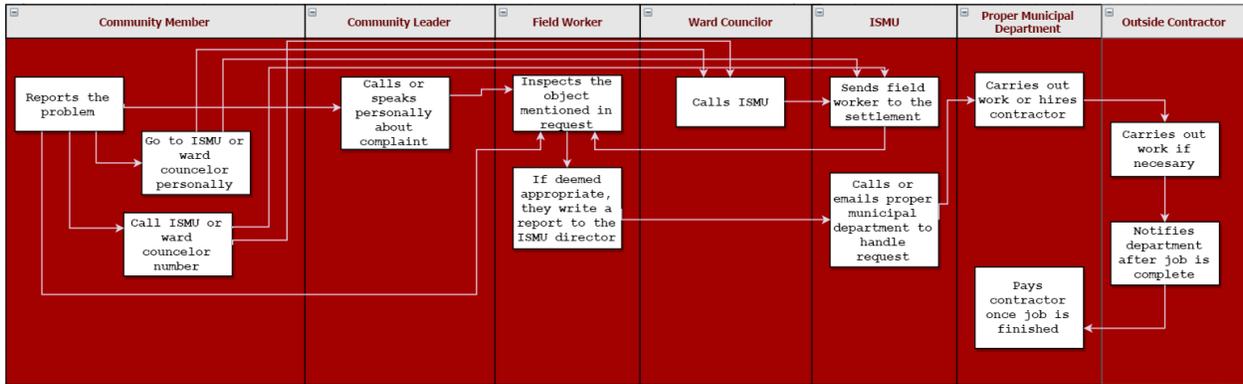
Figure 3.4 Flow of service request communication in Stellenbosch

Data gathered in Mountain View showed that people do not know about national standards for service delivery. Therefore, feedback is necessary to keep communities frequently updated about how well serviced they are in comparison with national guidelines. Figure 3.13 illustrates the ratio of working taps to national standards in each section of the community. Two of the sections (A and B) are in compliance with national standards, while the other two (C and D) are not. An efficient feedback loop with national guideline comparisons would prevent unwarranted service requests being entered.
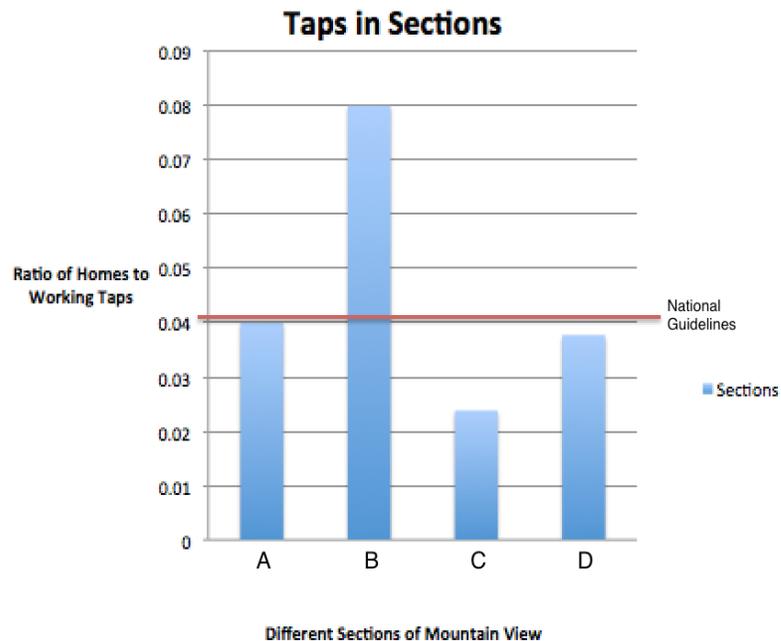
Figure 3.13 Comparison of Different Taps Found in Mountain View

The incompletion of feedback loops have caused some members of Mountain View to see the municipality as unreliable. One example was the request for installation of a floodlight in Section B. A request for a floodlight was submitted to the municipality seven years ago (as of 2016). Since the initial submission through Mr. Harold, residents have not heard back from the municipality about the progress, causing frustration within the community. Another example of limited feedback is that section A is the only area that still does not have electricity. Although section A residents reported to the municipality their need for electricity, they have not received services. It was acknowledged that the people do not have electricity, but feedback was unable to be provided. Furthermore, a resident in section C questioned why they were moved and why the municipality had yet to install more taps and toilets, but he never got any feedback. He mentioned being upset with the conditions of the community and is distrustful that the municipality would act on his complaints.

Inconsistent feedback led to multiple mistaken promises and misunderstandings, which increased mistrust towards the municipality. A resident in section D mentioned that she was previously told her that toilets would be soon delivered to Mountain View from another location. The following week, there were no toilets brought to the settlement still and there was no follow up. A feedback system would promote trust between residents and the municipality by allowing misconstrued municipal statements to be clarified after further developments on a project were made.

Suggestions to improve feedback: Service identification system, municipal feedback protocol, and Slack™ interdepartmental communication platform

One challenge to organizing feedback for the upkeep of services is that it is often a difficult and slow process for the municipality to identify which services are broken in informal settlements. The head engineer in the Stellenbosch Municipality's water department mentioned that settlement residents either don't identify broken services such as taps, or they only mention a rough location based on what the service is close to. During site inspections to examine these requests, she said that it could take a few hours in a large settlement to find the actual broken service. She and the informal settlements project manager suggested that having a simple numbering and labeling system attached to each service would make the process of identifying broken services much easier. The proposed numbering system is in Appendix E.

Another major interruption in Stellenbosch's communication chain is the lack of feedback to the informal settlement management unit after a service requests are forwarded to other departments. If the ISMU is not updated from other departments, such as engineering, regarding pending projects, then the ISMU is not able to provide feedback and updates to settlements. This could be solved in part by an efficient, user friendly interdepartmental communication platform that follows the request from the ISMU to the relevant department for the service, the contractor implementing the service, and back. This should also include a task management system available to every relevant department that would keep service requests from being forgotten and cast aside after a while if the request takes a long time to finish. Whenever a chain of communication is used to contact the final contractor that is implementing a service, that same exact chain should be followed back to the person who requested a service when giving updates. This feedback loop should at least include the department who contacted the contractor, the IS department, the WhatsApp communal group aware of the request, and the specific requester themselves.

We propose that a new interdepartmental communication platform be made through the program Slack as a supplement to email. Project manager, Kamohelo Mculu, identified email as a platform that is too slow, unreliable, and disorganised to efficiently facilitate sharing project updates between departments. Slack is a program that can increase productivity in a professional office setting. Thousands of top companies and organizations, including 77% of the Fortune 100 (Smith, 2016), use Slack in their daily business. After careful consideration, our group chose Slack over competing programs such as Bitrix24, Hipchat, Workplace, Skype for Business, and GovDelivery because it is the most user friendly, has the best information search system, and easily integrates hundreds of other useful applications into its user interface. The channel structure allows for many different group chats to be easily organised. Slack also has a simple notification system to update when messages are posted. It has native versions on every type of operating system, like Apple's, Microsoft's, or Android's, and can be desktop or mobile. It is run by an innovative company, and its app will most likely improve the fastest in the future.

The implementation of this platform should involve at least two representatives from each relevant department: Informal Settlements, Water, Electrical, Refuse, Sanitation, Storm water, etc. There should be updates whenever any important decisions with a contractor are made. These would include when a quote and a deal is made, when problems occur or changes in

a deal occur, when a contractor arrives in a settlement to begin a project, status updates on the build/repair process every few days, and when a project is completed. Each service request that is decided as legitimate to act upon should be logged as a pending project in the appropriate channel of slack by using busybot, an app embedded in the Slack group. One just needs to write "@busybot [title of request]" in the slack channel, and it will be listed on the list of tasks automatically (see Figures 3.14 and 3.15).
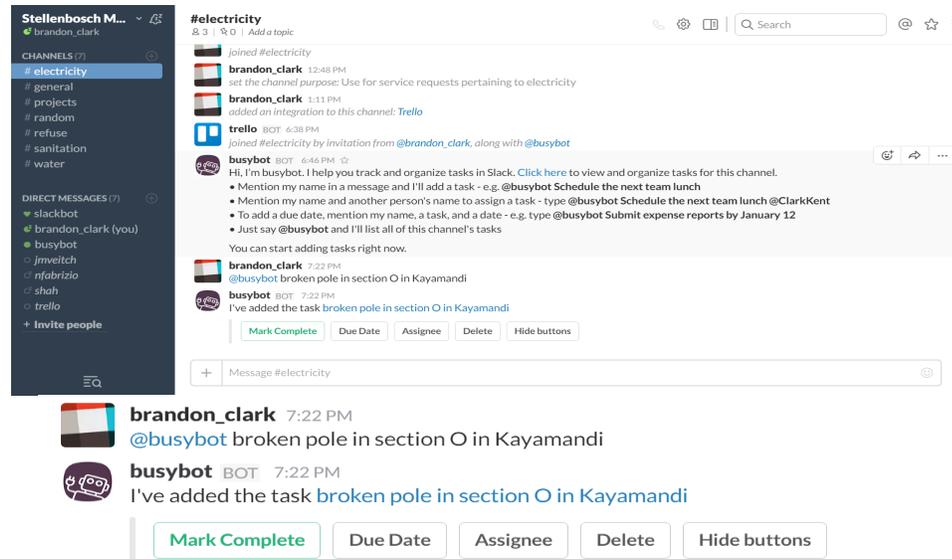
Figure 3.14 Slack page and example of creating a Busybot task
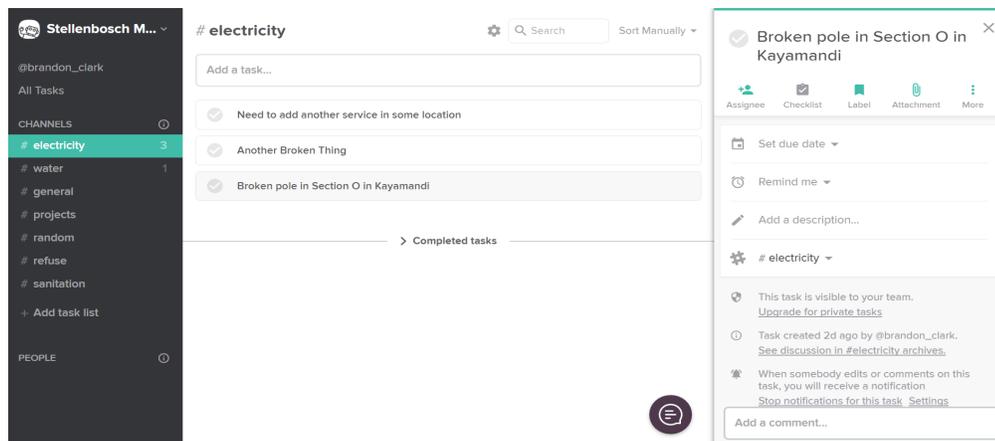
Figure 3.15 Busybot main age and list of service request tasks created in Slack

The department that is contracting or acting on the request should be the one providing the updates to the applicable channel. Each update should be logged on busybot as well as Slack.

Busybot should be checked periodically by each department to ensure that pending projects are not forgotten and finished projects are closed out. A project closed out will automatically be notified on the appropriate slack channel. Questions from any department representative about the status of projects can also be made to the appropriate channel.

Slack is compatible with google docs, all Microsoft programs such as Word and Excel, PDFs, and other programs. Documents under these formats can be sent through Slack, and are catalogued automatically. Slack will begin as a service request, interdepartmental communication platform. Once the municipality is accustomed to Slack, the service request channels should be made private to only representatives mentioned above. Other municipality members can be added to the slack group, and further private channels related to other aspects of municipality communication can be created. It is important for the service request channels to not be invaded or pushed aside by an influx of other municipality members and groups.

Long Term Communication and Service Delivery Improvements

It is acknowledged that the replication of these methods in other informal settlements is too time consuming for municipal officials to carry out. However, a similar process must be replicated in other settlements. In order to ensure replicability, recommendations are the following:

1. Field workers maintain communication with the community
2. Have a set schedule of arrivals
3. Give feedback to the people

Future technological outlook for Stellenbosch Municipality involves the company, Esri South Africa. Esri had been contracted by the municipality to create a cross-departmental database that will be updated and accessed by any municipal entity. This centralised system will generate automated tickets, as seen in the Worcester government, as well as a built-in feedback system, such as the system at WPI. A potential way of recording data into this central database would be through service requests inputted via mobile application. A full list of interview questions for Esri can be found in Appendix B.14.

Our proposed centralised communication platform acts as a temporary system to be shared between all departments. With this in place, all departments would gradually become

familiar with the importance of interdepartmental communication and timely feedback before the full Esri South Africa program is developed and implemented.

The Esri database should be centralised to allow for automatic data sharing within government sectors and departments

One important facets found in the case studies on WPI Residential Services, Worcester DPW, and the City of Cape Town was the use of a centralised database. Each of these organizations has structured their service delivery and processing of resident requests around their database. WPI uses a data management system called SchoolDude that is a subscription based, user friendly data management system and the Worcester DPW uses a customised data management system that was designed in house. Each of these data management systems are organised, easily searchable, constantly updated, have defined communication paths, and provide feedback throughout the process.

At WPI, a singular person is designated to oversee requests sent into the system. Yvette Rutledge, the administrative assistant in the facilities department, sees the requests and delegates tasks to a team of people. In this system, the related department (e.g. facilities) is able to edit the progress of the service request and the system automatically sends updates. In the same way, the City of Cape Town designates people to upkeep the service request system. The central database is accessible by all departments in order to keep everyone informed. The input of data in this system is made simple through the *Trimble* device that automatically inputs collected data into the system when it is connected to WIFI. The informal settlements management unit in Cape Town has a representative in each department, to ensure that all the departments are on the same page when making decisions regarding service delivery in the informal settlements.

The proposed database to be shared between all departments is a GIS platform that maps out all municipal services in Stellenbosch. Both representatives from Esri and the Stellenbosch IT department mentioned implementation of a database that could connect all departments. However, each department in the Stellenbosch Municipality uses their own software and saves files locally. Officials from both the ISMU and Engineering Services showed their separate databases. The ISMU has a database of maps that mark locations and identify information of housing structures, the boundaries of settlement sections, and summary information for entire informal settlements. The electrical department has mapped electrical lines, pole locations,

substations, and generators. The water department has mapped formal taps, some informal taps, reservoirs, pipes, water mains, and sewage systems. Currently there is no open access between the databases of each department. A long term idea within the municipality is to implement one cloud-based GIS map that contains every department's mapped information. Every office could implement appropriate services while knowing about existing services in both formal and informal areas. A service request database should be supplemental to the main database and include the following:

1. Access by every relevant department
2. History of past requests searchable by log date, completion date, departments involved, and keywords
3. Automatically send requests to relevant departments.
   a. Request tagging system that can attach a department tag onto a request.
4. Request ID number system
   a. Requester should receive an ID number that is attached to the logged request. If the requester searches that ID number on the Stellenbosch website or service request app, the status of the request should be visible.
5. Automatic status updates and request status history
   a. Departments working on the request should be able to add updates about request status. These notes should be seen by everyone on the system as a running list when a request is opened.
   b. Departments working on the request should be able to close the request when it is finished. This close out should be seen by everyone who has access to the system.
   c. These updates might be able to be sent to the requester automatically as well if the requester's contact information is attached to the request status program.
6. GIS compatibility
   a. Pending requests should be seen as pins on a GIS map. When selected, a description, service category, and status of the request should be available.

Furthermore, to foster more community engagement and streamline municipal responsibilities, Esri should consider making some aspects of their centralised data program open. Open data programs, like Open Street Map and Wikimapia, provide valuable real time data that municipalities like Stellenbosch could utilise for efficient service delivery (Chakraborty,

Wilson, Sarraf & Jana, 2015). Open Street Map and Wikimapia are open data web applications that allow any internet user to sign up and add streets, buildings, infrastructure, and general map information on a GPS-style map with a user-friendly interface. This map, including any real time changes, is freely available for reference to any person that goes to their website. An application like this uses the location services function on smartphones to direct users to their immediate area. If Esri could make informal settlements' service information on their GIS database open, then informal settlements would have the chance to add information about where taps, toilets, and skips are located. This would promote communities to engage with municipal information and learn more about what is available around them. Secondly, this could cut down time that the informal settlements office has to spend recording community information in person, freeing up time for other responsibilities.

Stellenbosch Municipality should add a centralised call center to better accommodate influxes of phone requests

The implementation of a central database requires internal infrastructure and communication across departments. In order for their large system to work, other organisations have designated people to oversee incoming requests. At the Worcester DPW the database is described as the "central hub of information." This central location is where all service requests start and where dispatching originates. The setup of this organization had the existing infrastructure to build upon and implement a multi-faceted database. All departments are able to access the data in the system and related parties are able to update the progress of the request.

In contrasts, the current "control room" within the Stellenbosch Municipality, is where general calls are rerouted by operators to the relevant department. If the point person at the designated department is not around, the phone call dies and no request information is recorded. The control room's responsibilities could be expanded to a centralised call center for service requests. When they receive a request, they should be able to enter all necessary request details into a system that people in the ISMU have access to. The call would always lead to stored information even if the point people in other departments are not around. There should also be an option for an automated voicemail system that redirects callers based on their preferences. If someone requests that a real person help them with their direction, then an operator would enter the call and direct them. Appendix D details phone call monitoring.

A mobile service request app would better monitor service requests

Esri South Africa has the ability to develop a service request database and mobile application. When fully functional, the Esri system should replace the WhatsApp service request system. The use of WhatsApp will allow residents to voice service requests with a familiar application. This system helps the ISMU to organise data and maintain an online list of service requests. Using this temporary format requires the municipality to set up specified roles and responsibilities in the office. A future service request application should have the following:

1. Fillable form fields for the category.
2. Long answer text box for a description of the request.
3. Embedded GPS map to pinpoint the location of the request.
4. Section to upload a picture or document to verify request.
5. Fillable fields for the name, email, phone number, and house number of the requester.
6. Generation of a unique request ID number for the requester to save and track.
7. Ability to automatically enter sent requests into the centralised database.
8. A history of past requests with the most updated status of each.

Each of these sections should be required. It should be impossible to submit the request until these sections are completed.

Stellenbosch Municipality should implement Wifi Hotspots near informal settlements to allow access to internet service request systems

The IT department plans to reinstate Stellenbosch's free WIFI initiative of 2012. Local politicians, such as ward councilors and the mayor, want to cater to the desires of communities but some people do not see the value of internet when they are unable to acquire basic necessities. Current zoning and planning bylaws slow the implementation of free WIFI to informal settlements. These bylaws indicate the priority of setting up WIFI in public infrastructure such as schools, libraries, and ward offices.

It should be promoted that free WIFI enhances settlements' ability to voice needs and send information about current services to the municipality, improving the implementation of physical services in the long run. Zoning and planning bylaws should be reanalyzed to consider

the merit of free WIFI in a central location in an informal settlement.

A line of communication could be established between the ISMUs in Cape Town and Stellenbosch to facilitate idea sharing

To maintain constant improvement in Stellenbosch's systems, some sort of communication should be formed between the ISMU in Stellenbosch Municipality and its counterpart in the City of Cape Town. The aim of this should be to further cooperation and the exchange of ideas via an active line of communication between representatives of both offices. Since both offices strive to achieve the same national guidelines in different settings, the exchange of strategies can help both offices in achieving its objectives. Involved officials from both municipalities could communicate via Slack, an email alias, or regularly scheduled meetings.

Appendices

Appendix A: Applicable National Guidelines for Adequate Housing

1. Water
   a. "In the case of communal standpipes serving dwelling houses, the following criteria should be satisfied (payment arrangements may influence these considerations):
      -one tap required per 25-50 dwellings;
      -maximum number of people served per water point: 300;
      -maximum number of people served per tap: 150;
      -maximum walking distance from a dwelling to standpipe: 200 m
2. Sanitation:
   a. There must be community participation to have a positive end result with sanitation. Communities must participate in decision-making about what should be done and how.
   b. Government has an obligation to create an enabling environment through which all South Africans can gain access to basic sanitation services.
   c. The main components of a hygiene-promotion and education strategy in a project including:
      1. motivation and community mobilization
      2. Communication and community participation
      3. user education
      4. skills training and knowledge transfer
      5. development of messages
      6. presentation of messages
      7. Maintenance of good practice
   d. The choice of a sanitation system by a community will be influenced by several factors:
   e. The system should not be beyond the technological ability of the community based on operation and maintenance are concerned.
      1. The system should not be beyond the community's ability to meet the capital as well as the maintenance costs
      2. The system should operate well despite misuse by inexperienced users.
      3. In a developing area the system should require as little maintenance as possible.
      4. The system chosen should take into account the training that can be given to the community, from an operating and maintenance point of view.
      5. The community should be involved to the fullest extent possible in the choice of an appropriate system.
      6. To foster a spirit of real involvement and ownership, the community should be trained to do as much as possible of the development work themselves.

7. Local customs should be carefully considered.

3.Refuse Removal
    a. Waste Management Collection can be done by the local authority, a conventional contractor, or an emerging entrepreneur. Several factors therefore need to be considered when selecting the appropriate waste management approach for a particular community, all of which will influence the waste handling and disposal options. Factors:
        1. Affordability: capital and operational costs; level of income within the community; grants or subsidies available
            a. Accessibility: road infrastructure and conditions.
            b. Level of education: literacy and awareness of the community to understand the principles of waste management.
            c. On-site storage facilities: availability and suitability; composition and volume of the waste.
            d. Potential benefits: clean and healthy environment; and job creation and upliftment.
            e. Available facilities and infrastructure: appropriate vehicles and available expertise.
            f. Distance to disposal site: transfer facility requirements.
            g. Pollution potential: blocked sewers and storm water canals and illegal dumping and littering.
4.Electricity and Energy
      b. Outside contractors are used for electrical installations proposed by municipalities
      c. Suggested electrical load densities are dependent on if a settlement is defined by population as high density, medium density, low density, or rural
      d. Poles must be organised in a way that allows for equal energy distribution to all houses in a project area
      e. All new networks must conform to the standard voltage of 230 V ± 10%
5.Roads and Transportation Access
      i. Roads should be designed with a width and condition that allows for emergency vehicle access to all areas that contain houses
      ii. Roads should allow for access from as many directions as possible, preferably in a grid network
      iii. Transportation should incorporate vehicle-only roads, mixed traffic roads, and pedestrian-only roads in areas most appropriate for vehicle traffic density

Appendix B: Interview Questions

B.1: Interview Questions for NGOs

1. Consent Statement

    We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to informal settlements. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

    Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.

    ● Do we have your permission to voice record this interview?
    ● Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

    This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. What sort of data collection techniques are currently used by your organization?
    a. Are community members involved in the data collection?
    b. Who receives the requests?
    c. What sort of record is maintained to store information?

3. Were you involved with any direct communication/dealings with informal settlements   in Stellenbosch? What was your preferred method of contact and who was your focal contact person in the community?

4. If there was anything to change what would it be?

5. What are the underlying factors for the need of improvement in data management/communication system in Stellenbosch? In your opinion, what sort of relationship do the municipality officials have with members of the informal settlements?

5. What techniques are used to improve the data collection process?
    a. Partnership with research institutes for new ways to collect data? Sante Fe Institute?

5. What technology do you use/prefer to reach out to informal settlement members?
7. What is the most common way that people get in touch with you?
8. What resources do you need to upkeep this system?
    a. How many people work here?
    b. How many people are on at the same time?
    c. How many services do you provide and what type of service are they?

B.2 Interview Questions for Stellenbosch Project Coordinator Kamohelo Mculu, Field Intern Viola Anthony, and Field Intern Success Mngadi

1. Consent Statement
   We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to informal settlements. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?
   Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.
   - Do we have your permission to voice record this interview?
   - Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.
   This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. Process Topics
   a. Where is service request data from residents stored?
   b. Does data that comes in from online forms and telephone calls all go into one database? If so:
      i. What variables are included in the database?
      ii. Who updates the database? Is it automatic?
      iii. Does it send notifications to certain offices automatically?
      iv. How are requests routinely monitored to see if they are being addressed and cleared?
   c. How does your directorate address complaints sent in from residents?
   d. Through what modes of communication do you receive complaints?
   e. Who manages the service email that residents send information to?
   f. How do you prioritize which services to carry out?
   g. To whom do you pass information along after initial reception?
   h. How do you make final decisions about service delivery?
   i. Is there anyone else that you would recommend for us to talk to about these topics?

3. Challenges of service delivery
   a. What difficulties do you have collecting, managing, and acting on complaints?
      i. What difficulties are attributed to requester error?
      ii. What difficulties are attributed to difficulties with the current data management system?
   b. How long does it take, on average, from service request reception to service implementation?
   c. What steps do you currently take to make sure community input drives your processes?
      i. Do you notify communities about approximate completion times?
      ii. Do you maintain contact throughout the process of service delivery?

4. Closing Ethics Remarks
   a. Do you have any questions for us?
   b. Are you still comfortable with us using this information and the voice recording for our study?

B.3 Interview Questions for Stellenbosch Senior Field Officer Harold Lamberts
1. Consent Statement

We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to informal settlements. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.

- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

2. Process Topics
    a. Where is service request data from residents stored?
    b. Does data that comes in from online forms and telephone calls all go into one database?
    c. How does your directorate address complaints sent in from residents?
    d. Through what modes of communication do you receive complaints?
    e. Who manages the service email that residents send information to?
    f. How do you prioritize which services to carry out?
    g. To whom do you pass information along after initial reception?
    h. How do you make final decisions about service delivery?
    i. Is there anyone else that you would recommend for us to talk to about these topics?
3. Challenges of Communication:
    a. Can you map out the process of how you approach Informal Settlements?
        i. Breaking the Ice?
        ii. Data Collection?
        iii. Updates/Periodic Communication?
    b. What challenges do you face when you try to approach an Informal Settlement?
    c. What challenges do you face collecting, managing, and acting on service delivery complaints?
        i. What difficulties are attributed to requester error?
        ii. What difficulties are attributed to difficulties with the current data management system?
    d. How do community members receive feedback on service requests reported by them?
        i. Do you notify communities about approximate completion times?
        ii. Do you maintain contact throughout the process of service delivery?
    e. What is the role of the Ward Councilor in the communication chain? Any challenges associated with that?
    f. What steps has the municipality currently taken to improve trust?
    g. What improvements would you propose to improve communication between the Municipality and Informal Settlements
3. Closing Ethics Remarks
    a. Do you have any questions for us?
    b. Are you still comfortable with us using this information and the voice recording for our study?

B.4 Interview Questions for Engineering Services Stellenbosch Municipality
1. Consent Statement

We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.
- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

1. What are the main responsibilities of the Engineering Services Dept.?
2. What resources do you need to upkeep the database/service delivery system?
    a. How many people work in the dept. ?
3. How do you process service requests for informal settlements?
    a. How do you receive requests?
    b. Who receives the requests and how is that request further passed on?
4. How is feedback relayed back to Informal Settlements Management Unit and community members?
    a. How long does it usually take to relay any sort of feedback?
    b. At what instances during the service request process is feedback relayed?
5. Do you perform routine maintenance of facilities installed?
    a. Do you perform site visits/inspections in informal settlements?
6. What are the most popular complaints that you get for service delivery from informal settlements?
7. What is the most common way that informal settlement members get in touch with you?
8. Do you contract work to outside service providers or employees within the Engineering Service Dept.?
9. How do you perform inter-departmental communication specifically with the informal settlements department?
    a. Is there a shared database where service request/ data collected is stored?
    b. What improvements can be made to the current structure?
11. What challenges do you face in fulfilling your responsibilities?
    a. Challenges in the office?
    b. Challenges on ground?
12. Closing Ethics Remarks
    a. Do you have any questions for us?
    b. Are you still comfortable with us using this information and the voice recording for our study?

B.5 Interview Questions for IT Services Stellenbosch Municipality
1. Consent Statement

We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to informal settlements from an IT perspective. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.

- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. What are the main responsibilities of IT services?
   a. In the context of data management and service delivery for informal settlements?
3. What resources are needed to upkeep the daily operations of the dept.?
   a. No. of people working?
   b. Hardware/Technical requirements?
4. Are there any specifications on how data is stored and shared in regards to an IT policy?
   a. Interdepartmental data sharing?
   b. Public release of data collected?
5. Is there any shared database maintained by IT services for data collection and service delivery of informal settlements?
6. How do you decide the content/webpages of the website?
   a. Any input from other departments and community members?
   b. Is the website well utilized by citizens?
7. Do you receive any feedback/service request on the website from community members?
   a. How is that information stored and passed further?
   b. Is there any capacity to send images for requests?
   c. Can the request/feedback be tagged with the user's location based on IP address?
8. Closing Ethics Remarks
   c. Do you have any questions for us?
   d. Are you still comfortable with us using this information and the voice recording for our study?

B.6-1: Interview Questions for Mountain View Residents
1. Consent Statement

We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of making service requests and challenges that might be involved with municipal service delivery to your community. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.

- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. Process Topics
   a. What do people typically complain about or display needs for? (ie. indicators such as taps or toilets)
   b. How does information typically flow from citizens to the municipality in terms of responsible people and methods of communication?
      i. Do most complaints go through you (the community leader) or any other representative, or do people call or email the municipality themselves?
      ii. Do processes change for problems, or are all problems addressed in the same manner?
   c. How long does it typically take the municipality to respond to requests?
   d. What sort of internal management you have without help from the municipality?
      i. How do you address needs when the municipality does not address them?
      ii. Does someone keep track of pending requests and ongoing projects in the community?

3. Opinion and Community Prioritization Topics
   a. How well does Stellenbosch's current data collection system help and hinder community needs from being adequately heard and efficiently addressed?
   b. What they see are the biggest challenges about the process of voicing and addressing service requests?
   c. How community members may sidestep the system, take extra steps to make sure their voice gets heard, or give up when the current flow of information is inadequate.
   d. Suggestions for possible changes or improvements to service delivery and communication.

4. Closing Ethics Remarks
   a. Do you have any questions for us?
   b. Are you still comfortable with us using this information and the voice recording for our study?

B.6-2 Codes Used to on Mountain View Interviews

1. Interviewee's name, section, and corresponding community leader
2. Type of toilet used (flush, chemical, or neither)
3. Toilet on property? (yes or no)
4. Toilet maintenance frequency (0, 1, 2, or 3 days per week)
5. Number of people in household
6. Number of all nearby communal taps, working nearby communal taps, and taps on property
7. Number of nearby skips
8. Community meeting frequency opinions (satisfied or not frequent enough)
9. Satisfied with communication to municipality? (yes or no)
10. Modes of communication to municipality
11. Phone access in household (smartphone, non-smartphone, no availability)

B.7: Interview Questions for Residential Service Officials of Worcester Polytechnic Institute
1. Consent Statement

We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.

- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. How do you process service requests?
    a. How do you receive requests?
    b. Who receives the requests?
    c. What platform/software is used for storing service requests
3. If there was anything to change what would it be?
4. What are the most popular service delivery requests that you get?
5. What is the most common method that you use to accomplish this?
6. What technology do you use/prefer to reach out for service?
    a. Is there platform cell phone friendly?
7. What is the most common way that people get in touch with you?
8. What resources do you need to upkeep this system?
    a. How many people work here?
    b. How many people are on at the same time?
    c. How many services do you provide and what type of service are they?

B.8: Interview Questions for Facility Officials of Worcester Polytechnic Institute
1. Consent Statement

   We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

   Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.
- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

   This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. How do you process service requests?
    a. How do you receive requests?
    b. Who receives the requests?
3. If there was anything to change what would it be?
4. What are the most popular complaints that you get?
5. What is the most common method that you use to accomplish this?
6. What technology do you use/prefer to reach out for service?
7. What is the most common way that people get in touch with you?
8. What resources do you need to upkeep this system?
    a. How many people work here?
    b. How many people are on at the same time?
    c. How many services do you provide and what type of service are they?

B.9: Interview Questions for DPW Customer Service Officials
1. Consent Statement
   We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to city residents. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?
   Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.
   - Do we have your permission to voice record this interview?
   - Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.
   This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.
2. How does your system work?
3. If there was anything to change what would it be?
4. What types of services do you provide?
   a. What is the most popular service request that you get?
   b. Who addresses the service requests?
5. What is the most common method that you use to accomplish this service?
6. What technology do you use/prefer to reach out for service?
7. What is the most popular way that people get in touch with you?
8. What resources do you need to upkeep this system?
   a. How many people work to organize service requests?
   b. Where is your main base?

B.10: Interview Questions for Janet Benoit in Worcester IT department

1. Consent Statement

    We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to city residents. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

    Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.

    ● Do we have your permission to voice record this interview?
    ● Do we have your permission to use your answers in our study?

    At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

    This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. What equipment is needed to operate the database?
    a. What sort of hardware equipment is needed?
    b. What sort of internet/intranet connection is needed for the uninterrupted operation of the database?
3. How much time/resources was required to create the database?
4. Is there any GIS/photo tagging ability of the software?
    a. How was that developed and integrates into the database?
5. Closing Ethics Remarks
    a. Do you have any questions for us?
    b. Are you still comfortable with us using this information and the voice recording for our study?

B.11: Interview Questions for Cape Town Municipality Officials (Communication Flow)
1. Consent Statement

        We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to city residents. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

        Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.

- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

        This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. Process Topics
   a. How does your directorate address complaints sent in from residents?
   b. Through what modes of communication do you receive complaints?
   c. Who manages the service email that residents send information to?
   d. How do you prioritize which services to carry out?
   e. To whom do you pass information along after initial reception?
   f. How do you make final decisions about service delivery?
   g. Is there anyone else that you would recommend for us to talk to about these topics?
3. Challenges of service delivery
   a. What difficulties do you have collecting, managing, and acting on complaints?
      i. What difficulties are attributed to requester error?
      ii. What difficulties are attributed to difficulties with the current data management system?
   b. How long does it take, on average, from service request reception to service implementation?
   c. What steps do you currently take to make sure community input drives your processes?
      i. Do you notify communities about approximate completion times?
      ii. Do you maintain contact throughout the process of service delivery?
4. Closing Ethics Remarks
   a. Do you have any questions for us?
   b. Are you still comfortable with us using this information and the voice recording for our study?

B.12: Interview Questions for Cape Town Municipality Officials (Technical Side)

1. Consent Statement

We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to informal settlements. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.
   ● Do we have your permission to voice record this interview?
   ● Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. Where is service request data from residents stored?
   c. Does data that comes in from online forms and telephone calls all go into one database? If so:
      i. What variables are included in the database?
      ii. Who updates the database? Is it automatic?
      iii. Does it send notifications to certain offices automatically?
      iv. How are requests routinely monitored to see if they are being addressed and cleared?

3. How do you process service requests?
   a. How do you receive requests?
   b. Who receives the requests?

4. If there was anything to change what would it be?

5. What are the most popular complaints that you get?

6. What is the most common method that you use to accomplish this?

7. What technology do you use/prefer to reach out for service?

8. What is the most common way that people get in touch with you?

9. What resources do you need to upkeep this system?
   c. How many people work here?
   d. How many people are on at the same time?
   e. How many services do you provide and what type of service are they?

10. Closing Ethics Remarks
   f. Do you have any questions for us?
   g. Are you still comfortable with us using this information and the voice recording for our study?

B.13: Interview Questions for David Alli of Western Cape Government
1. Consent Statement

We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to city residents. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?

Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.
- Do we have your permission to voice record this interview?
- Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.

This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

2. What is your role in the communication chain between Informal Settlements and Municipalities?
3. Process Topics
    a. How does your directorate address complaints sent in from residents?
    b. Through what modes of communication do you receive complaints?
    c. Who manages the service email that residents send information to?
    d. How do you prioritize which services to carry out?
    e. To whom do you pass information along after initial reception?
    f. How do you make final decisions about service delivery?
    g. Is there anyone else that you would recommend for us to talk to about these topics?
3. Challenges of communication
    a. What difficulties do you have collecting, managing, and acting on complaints as the overarching department?
        i. What difficulties are attributed to requester error?
        ii. What difficulties are attributed to difficulties with the current data management system?
    b. Do you keep a record of service requests and how long it takes to complete them?
    c. What steps do you currently take to make sure community input drives your processes?
        i. Do you notify communities about approximate completion times?
        ii. Do you maintain contact throughout the process of service delivery?
    d. What improvements do you see when trying to improve communication between Informal Settlements and Municipalities? What do you see as your office's role in that?
4. Closing Ethics Remarks
    d. Do you have any questions for us?
    e. Are you still comfortable with us using this information and the voice recording for our study?

B.14: Interview Questions for Esri South Africa
  1. Consent Statement
       We are a group of students from Worcester Polytechnic Institute in Massachusetts. The goal of this interview is to understand the current process of data management and challenges that might be involved with service delivery to city residents. We strongly believe this kind of research will improve the speed, efficiency, and organization of service delivery to informal settlements in Stellenbosch. Are you comfortable with us conducting an interview with you about these topics?
       Your participation in this survey is completely voluntary and you may withdraw at any time. Please remember that your answers will remain confidential. No names or identifying information will appear on the questionnaires or in any of the project reports or publications. We would like to ask some preliminary questions before we begin.
  - Do we have your permission to voice record this interview?
  - Do we have your permission to use your answers in our study?

At any time that you feel uncomfortable answering a question or want to discontinue the interview, please let us know, and we will stop.
       This is a collaborative project between the Stellenbosch Municipality and WPI, and your participation is greatly appreciated. If interested, a copy of our results can be provided at the conclusion of the study.

  2. How do you plan on incorporating the one pager form on an online platform?
      a. How will it reduce time/person spent on collecting data and the requirement of on ground man power?
      b. Will it have a space for community members to include comments/information not directly requested in the questions?
  3. What equipment is needed to operate the new system?
      a. What sort of hardware equipment is needed?
      b. What sort of internet/intranet connection is needed for the uninterrupted operation of the database?
  4. How much time/resources was required to create the database?
  5. Is there any GIS/photo tagging ability of the software?
      a. How was that developed and integrates into the database?
  6. Will you take community input before designing the data entry system?
  7. Who will have access to view and edit the information?
  8.   Is there any failsafe to protect information in case physical device is stolen while collecting data? Can the data be wiped remotely?
  9.   What sort of training will be required of municipality officials to operate the system?
  10.   Will you be able to incorporate a separate page in the database entry form for service requests?
      a. Will it have the same mapping capability?
      b. What sort of training will community members need to operate it if possible?
      c. What additional resources will be needed to keep that system live?
      d. How can that system be limited to prevent overflow of information while still giving adequate access to community members for input.
  11.   Closing Ethics Remarks
      a.   Do you have any questions for us?
      b.   Are you still comfortable with us using this information and the voice recording for our study?

Appendix C: Suggested Guidelines for Use of New Communication Structure

To set up a WhatsApp group, each resident must first download WhatsApp onto their device and create an account. A municipal official will be an administrator of the WhatsApp group for each section. During a community gathering like the one we conducted in Mountain View, people with smartphones will write down their names and phone numbers on the list that pertains to their section. The municipality will create a WhatsApp group for each section within the settlement. The municipal WhatsApp number should be communicated at the community gathering to promote for individual communication. The number will be on the poster and posted in each WhatsApp group. People who do not own a smartphone should make contact with either a close friend or community leader who does own a smartphone in order to have an outlet to make requests. The contact will message any service requests that the original resident asks for and will label it under the original requester's identification and contact information.

Recommendations for how to send a WhatsApp service request:
1. Send a short description of the problem.
2. Indicate the section that is experiencing the problem
3. If a service is broken, indicate the ID number of the service that needs attention and send its map location.
4. If a service is broken, send a picture of the break.
5. If a service is not present, send a picture of the empty area to prove that no services are present. If a service needs to be added that is not currently present, indicate a suggested map location where the new service should be implemented (see Figure 4.1).
6. Include all contact information: name and surname, phone number, and structure number (see Figure 4.1).
7. If the request is about a communal service, send message to the section WhatsApp group to notify the community of the problem and prevent repetitive requests.
8. If the request is about an individual issue that doesn't affect any other household, such as a house problem, then send message to the municipality number in an individual chat.
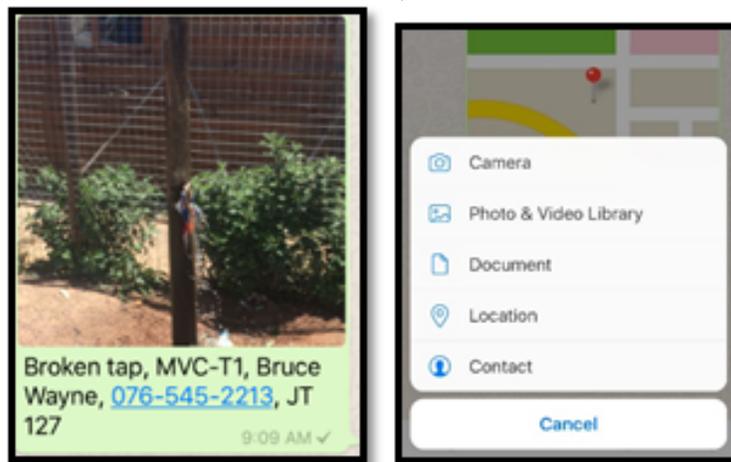
Figure 4.1 Example WhatsApp Service Request and Tab that Contains GPS Location Sending

This information was presented at the final community meeting. This information should be posted on flyers and given to community leaders, added to the ISMU Facebook page, and added as a photo to each WhatsApp group.

In order to ensure that the communication platforms do not get clogged with duplicate requests or messages unrelated to service delivery, a suggested list of best practices has been established which focuses on educating community members on reservations that the municipality has regarding these platforms and how they can be abused.

Appendix D: New municipal infrastructure should be established to manage communication with informal settlements: dedicated WhatsApp, Facebook, and phone call Monitoring

The ISMU needs to make sure that they have the internal infrastructure to handle an influx of mobile service requests. Each WhatsApp group should have at least two municipality representatives in them, both admins. The responsibility of responding to requests can be divided amongst the two representatives and act as a failsafe in case one of the admin misses a message. For the individual WhatsApp messages intended for personal requests, there should be a separate mobile phone designated in the office which the same two municipality representatives can look after on a rotating basis (see Figure 4.2).

For Facebook, there should be multiple admins with different sets of permissions. Each admin will have a set responsibility as defined by the page role he or she is assigned to. Unlike WhatsApp, in Facebook direct personal messages can also be replied to by multiple admins. This further divides the responsibility of answering service requests and other queries.

Even though phone calls are already used as a communication tool for informal settlement service requests, there are a few updates that can improve phone call service. The current distribution of pamphlets with phone numbers of relevant municipal departments should continue throughout Mountain View (and all settlements in the future). The list should also be published on the Facebook page with constant reminders. A PDF or picture of the phone number listing should be posted periodically on the section WhatsApp groups by either a community leader or official. A list of people in each municipal department that can answer requests should be available as a call center in each department. That way, if someone calls the wrong department with a request, the person in the office will know at least a point person and a backup point person to reroute the call to. If this is not already the case, then there needs to be someone in the IS department dedicated to hearing phone calls on the listed informal housing phone number.

Whatsapp Diagram

Community Member/Leader	ISMU	Implementing Partner (IP)

- Take picture of problem with ID # and record location
- Sends whatsapp to section group
- Sends Whatsapp to individual number
- Field Worker Receives Request
- Acknowledges request
- Request verified and forwaded to IP
- Contractor receives request
- Updates ISMU regarding potential time frame after inspection
- Requester recieves preliminary update with potential time frame
- Forwards preliminary update via whatsapp
- Requester receives final update
- Forwards final update via whatsapp
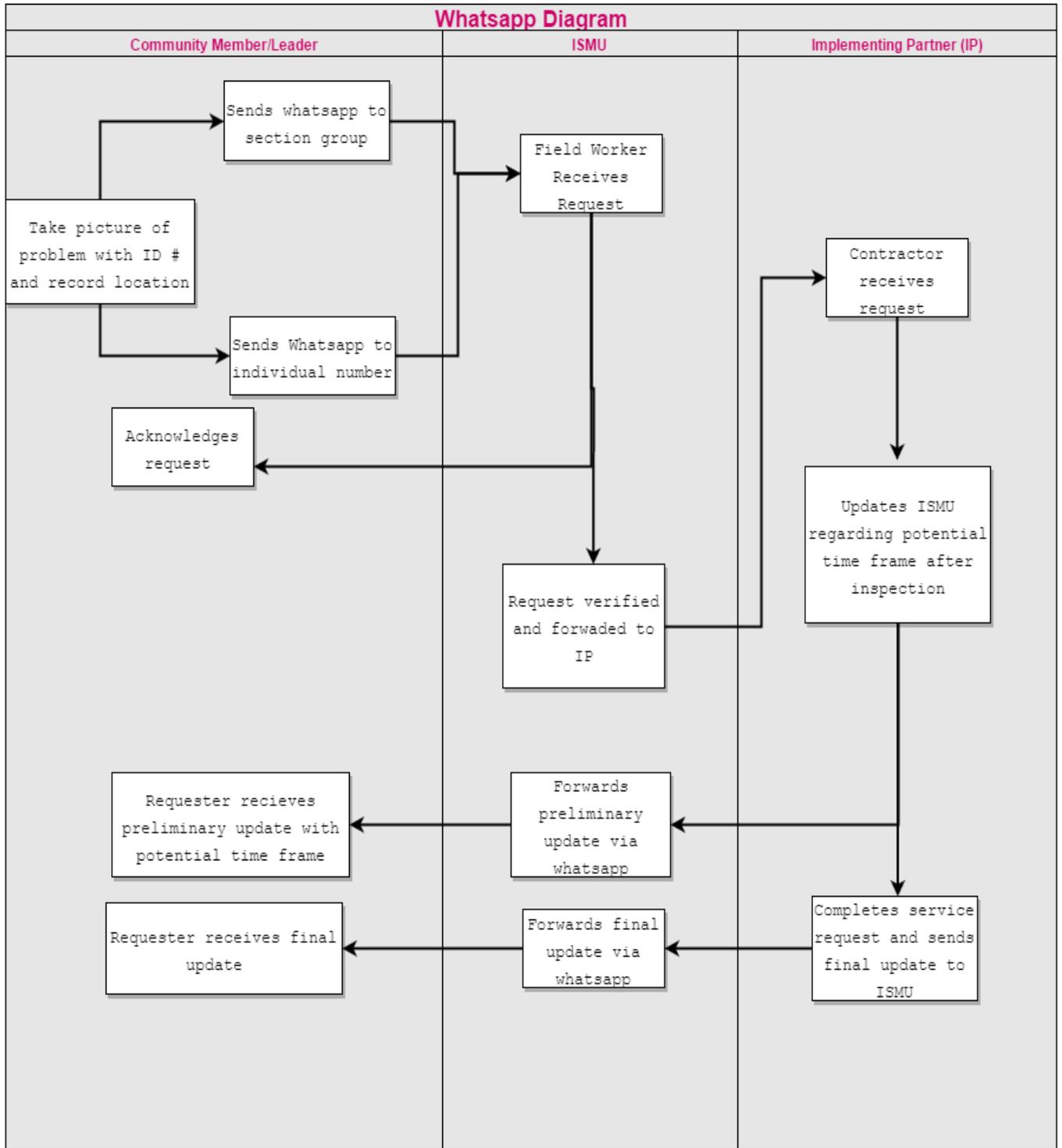- Completes service request and sends final update to ISMU

Figure 4.2 Backend management of WhatsApp and proposed feedback loops

Appendix E: A standardized service identification numbering system will help residents communicate their requests more efficiently to the municipality.

In order for the community members to clearly identify services when reporting a problem, we developed a simple numbering system. Each service installed in the community (toilet, tap, electrical pole and skip) should be numbered with this code and the contact information for the specific service. This implementation will make identification of services easier for the municipality when service requests are submitted. The suggested numbering system is as follows:

MV – Mountain View
A,B,C,D – Section
A – Ablution facility
T – Tap
S – Skip
E – Electrical pole
1-50 – number

Example
MVA-A1 = Ablution 1 in Mountain View section A
MVA-T1 = Tap 1 in Mountain View section A
MVA-S1 = Skip 1 in Mountain View section A
MVA-E1 = Electrical pole 1 in Mountain View section A

MVC – T1

Call: 0218088300

Figure 4.3 Example Service Tag for a Tap in Section C of Mountain View

The tag above demonstrates the numbering system and provides the contact information for the appropriate department of the municipality.

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