The emergence of Namibia OpenStreetMap Community, supporting GIS data generation for Informal Settlements

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Informal settlements and exclusion are synonymous. The seemingly unconventional way informal settlements emerge automatically excludes such settlements from normative planning approaches. Normative planning follows a very traditional inflexible approach, whereby all planning processes are completed before people inhabit such spaces. Limited data on informal settlement households protract planning processes and leads to low prioritization of development. This makes it a challenge for communities to access services. At most times the exclusion in planning is because of no-data on settlements. Majority of informal settlements in Namibia have limited to no access to individual water connections within a reasonable distance, no toilets, or tenure security. Residents are at most times looked at as beneficiaries of planning processes rather than partners in development. To illustrate opportunities for people centered planning and integration of OpenStreetMap data in planning, the study employed a qualitative research design by reviewing approaches and documenting the emergence of OpenStreetMap Community in Namibia. The literature review focused on case studies on the use of Volunteered Geographic Information in land administration. Using data from the volunteer community of Shack Dwellers Federation of Namibia, the study adds to new knowledge on the wealth of information available that can be integrated in Land Information Systems of Local Authorities. Opportunities in the use of geographic data for creation of land information systems produced through volunteer efforts in Namibia can close the data gab for informal settlements. A discussion on how volunteered geographic data can be used in the planning process and integrated in the National Spatial Data Infrastructure is expounded upon. Data creation not only benefits the future users, but also the producers. The study highlights how the use of opensource platforms like OpenStreetMap are essential in contributing towards youth/community empowerment through training and acquisition of digital skills and creating visibility of informal settlement. A new initiative is also discussed on how Namibia Statistics Agency is supporting local authorities in the creation and maintenance of spatial data which is vital for improved land administration. The study concludes with a discussion and recommendations on the potential of improving planning procedures, reduce conflicts and improve land management by integration community generated spatial data in land management and administration.

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1. INTRODUCTION

Data on informal settlements is often rarely available to inform official plans, when available the data is often limited by spatial , thematic or temporal domain (Sliuzas, 2001). Any upgrading intervention or policy should be based on knowledge and understanding of the local conditions of settlements. The first comprehensive data on informal settlements in Namibia was collected by the Shack Dwellers Federation of Namibia (SDFN) covering over 208 informal settlements over 13 regions. Community teams profiled the settlements and provided an overview on population, service access and tenure. This figure was updated in 2018, with estimates that 40% of the urban population is currently residing in informal settlements. Parsons in Sliuzas,(2001) noted that in public policy development information is used from formal , informal to internal and external sources. In decision making on informal settlements in Namibia one can say that authorities really on various sources of information, the data from the Namibia Statistics Agency is seen as the first option, followed by local level surveys and enumerations. This paper discusses informal settlements as areas that are not within the formal planning of urban areas, residents experience a lack of adequate water, sanitation, secure tenure, durable housing and sufficient living space according to the United Nations definition from 2002. Tenure security is one of the most important characteristics for communities in informal settlements, as it has a direct relationship with investment in infrastructure and improved living conditions.(Payne, (2004) identified ten different tenure categories found in cities, with pavement dwellers having no tenure security to freehold being the highest (Payne 2001).The importance of tenure for reducing poverty is identified in the Sustainable Development Goals , Goal 1 End poverty in all its forms everywhere , Target 1.4: By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance ; indicator *1.4.2: Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and type of tenure.*

Measuring the attainment of this indicator will rely on the availability of information on informal settlement households including level of access to basic services.

In the work done by Kohli, Sliuzas, Kerle, and Stein, (2012)slum analysis from space, settlements were identified using size, density, pattern and site characteristics to differentiate between planned and areas and slums. This provides an objective view of informality and cannot be influenced by politics or administrative boundaries, which at times do not reflect the situation on the ground. In the slum ontology, object level consisting of building characteristics, road layout; settlement level, shape density, neighbourhood level, connectivity and hazardous location.

This paper will focus the experience of an emerging OpenStreetMap (OSM) community in Namibia. Initial setting up of the community focused on using combined methods for spatial data collection, this includes remote sensing, volunteered geographic information, community data and field verification.

This paper will provide details on the process in initiating an OSM community in Namibia. A list of opportunities and challenges are highlighted plus recommendations on how to integrate volunteered data within the information systems of local authorities towards enhancing planning efforts in informal settlements.

The main objective of the project is describing the experiences and approaches in using OSM data and community participation to inform land information systems development.

2. METHODOLOGY

The paper used a desk study on the background of OSM and VGI. The section on the development on OSM community relied on internal document review and insight from project participants. To illustrate opportunities for people centered planning and integration of OpenStreetMap data in planning, the study employed a qualitative research design by reviewing approaches and documenting the emergence of OpenStreetMap Community in Namibia. The literature review focused on case studies on the use of Volunteered Geographic Information in land administration. Using data from the volunteer community of Shack Dwellers Federation of Namibia, the study adds to new knowledge on the wealth of information available that can be integrated in Land Information Systems of Local Authorities.

3. LAND INFORMATION SYSTEMS AND COMMUNITY DATA

The OSM community in Namibia is adding on to the work done by the Shack Dwellers Federation of Namibia (SDFN)on informal settlement profiling and enumeration. This activity has been long carried out by organised saving groups in informal settlements and backyard shacks as a tool to negotiate for upgrading of living conditions in collaboration with local authorities. The SDFN has been collecting data on informal settlements for over 30 years, mobilising community members to save for their own needs and negotiate for group access to land in urban areas(Muller & Mbanga, 2012). Informal settlement data has always been collected using paper-based surveys and summarising of data on big charts to present to communities. The digitising of parcels and structures on OSM will be form part of existing data collection efforts.

In the initiation of the project questions on privacy and security were raised by stakeholders within the university and the City of Windhoek. Stakeholders recognised that OpenStreetMap is an open platform, and the open availability of data online was a concern. The project team highlighted that data availed on the platform excludes any personal or identification information of households. The focus of the mapping is on household size, settlement features, roads and service availability. The purpose of this is to support the availability of information for the creation of Land Information Systems (LIS) and the monitoring and evaluation of upgrading projects.

An LIS can be a bedrock of any land management or administration effort. An LIS is a system that captures, processes, stores, analyses and disseminates land information (Tuladhar, n.d.). It supports the provision of timely data on the status of land tenure, land use, land value and land development.

Despite the clear benefits of land information systems, majority of local authorities do not have comprehensive data about informal settlements. Due to the nature of informal settlements, many are

excluded from planning procedures. The lack of data has been cited as contributing factors in the exclusion from planning (Chakraborty, Wilson, Sarraf, & Jana, 2015).

To improve this limitation in data, Shack Dwellers Federation of Namibia (SDFN), affiliated to Slum Dwellers International (SDI) have been collecting data on the situation in informal settlements through informal settlement mapping and profiling and household level enumerations (Patel, Baptist, & D'Cruz, 2012). The data has been collected to support advocacy and participatory planning approaches (Muller & Mbanga, 2012). Communities collecting data started by using paper-based methods for the collection of data, where settlements were profiled through paper-based survey forms, printed orthophotos and handheld GPS devices to map informal settlements. Images on settlements were downloaded from Google Earth and supplied by the National Planning Commission in support of the Community Land Information Programme in 2012 (Mabakeng, 2018).

In early 2013, the SDI looked at supporting the digitisation of the data using the KnowYourCity[1] platform (Beukes & Mitlin, 2014). The online platform has a summary of data that was generated by federations across the world.

In Namibia, enumeration data was captured by federations across the country at the local authority offices and later at the Habitat Research and Development Center, through the Ministry of Urban and Rural Development. Currently, the complete data is stored on a local drive by the Namibia Housing Action Group which is a local NGO that supports SDFN. It has been expressed that data collection using the manual approach creates a challenge for the storage and retrieval of information from surveys.

Recognising the challenge in storage, data retrieval and to update the informal settlement profiles of Namibia, a new opportunity emerged to use OpenStreetMap (OSM) alongside the conventional approach to data collection. The SDFN in collaboration with the Namibia University of Science and Technology (NUST), through the Department of Land and Property Sciences started a project on updating the OSM Layer for Namibia. The Humanitarian OSM community supported the project, through the Eastern and Southern Africa Hub.

4. VOLUNTEERED GEOGRAPHIC INFORMATION AND OPENSTREETMAP

Information from Volunteered Geographic Information (VGI) is important for planning routes and areas not available on formal city maps. VGI promotes the personal usage of GIS by non-expert groups such as informal settlement communities (Basiouka & Potsiou, 2012).

The concept of VGI came from practitioners, users, and researchers in Geographic Information (GI) Science who were more interested in the information itself than in whether it was a participatory process that created and used it (Verplanke, McCall, Uberhuaga, Rambaldi, & Haklay, 2016). In a general GI Science framework, VGI is more about application and large data. The rise of VGI is an overarching term for the set of approaches, systems, and modalities for gathering and organizing citizens' local (spatial) knowledge, including user-generated content (UGC), systems(Verplanke et al., 2016).

The use of Geographic Information Systems for informal settlement upgrading, supported by community efforts have been regarded as a best practice(Abbott, 2003). The study by Basiouka and Potsiou (2012) indicated that communities were willing to participate in crowd sourcing techniques in compilation of a cadastral map. Conventional approaches to cadastral data collection can cause delays

[1] The Know Your City Campaign- https://sdinet.org/explore-our-data/

and limits any participation by communities as the focusses is on the experts(Basiouka & Potsiou, 2012). In contrast, it is easier to train community members on how to use mapping tools, go out in the field and collect data, and without the detection of any gross errors. Basiouka and Potsiou, (2012) explained how the accuracies of measurements can be further improved and how far the landowner's involvement in the cadastre survey process can be extended.

Online maps such as the OSM can be used for official mapping projects such as Cadastre. Basiouka, Potsiou, and Bakogiannis (2015) described how OSM was used in urban areas as an alternative method to the official cadastral surveys. There are possibilities and perspectives of OSM for spatial and attribute cadastral data collection storage for the compilation of draft cadastral maps as an alternative methodology accompanied by verifications using VGI.

5. LAND ADMINISTRATION AND VGI

Participatory land administration is defined in this article as a construct that seeks to contribute to responsible, fit for purpose, and pro-poor approaches to land administration (Asiama, Bennett, & Zevenbergen, 2017).

Participatory Land Administration consists of four aspects namely: top-down institutional (government and professional) influence - Traditional land administration focuses mainly on a top-down approach, (Asiama, Bennet & Zevenbergen, 2017); bottom-up citizen contributions, - Participatory land administration sits at the nexus of the drivers of technological innovation and approaches to development studies (Asiama et al.); push of technological innovation; pull of societal needs – This was former known as the technological-push, advocates that innovation should be determined by the existing technologies, with little involvement of the end beneficiaries. The combination of the technological-push and societal-pull is necessary because these two interact. It is observed that the societal-pull policies also assist in influencing and directing innovation to be closely aligned with the societal needs.

Land administration systems assist citizens in identifying their right, restrictions, and responsibilities (RRRs) that are associated with land and property (Williamson, Enemark, Wallace, & Rajabifard, 2010). Land administration systems should be comprehensive and up to date with land and property related RRRs in such a way that is accessible to communities and decision makers. Land managers can collect land and property RRRs data in several ways in collaboration with citizens. One way to achieve this is using VGI, although, it is complex utilizing VGI in land administration. VGI is part of a profound transformation on how geographic data, information and knowledge are produced by the public and circulation (Sui, Elwood, & Goodchild, 2013).

VGI can offer a potential solution for cost-effective collection and updating of land and property RRRs in land administration systems (Sui, Elwood, & Goodchild, 2013). Volunteered land and property information could be a part of future land administration systems to make a new generation of land administration systems. ("A conceptual framework for utilising VGI in land administration"). The RRRs are right at the top in the same bracket as formal and informal land markets or spaces. The foundation to effectively account for RRRs is to manage, structure and maintain, from a top-down approach. A bottom-up approach- creating a Volunteered Land and Property Information Platform for information dissemination must ensure the quality and user-friendliness of the data and tools and be of a sound standard. Five prevailing principles in participatory spatial information handling: Access and ownership , Trust Validation and usability (Nottingham & User, 2015). All these principles are

important to ensure data collected will be incorporated or used in planning. These principles can be achieved during the implementation of OSM mapping activities.

6. IMPLEMENTING OSM UPDATING

Contributions made on OSM are made by local and international volunteers. To ensure seamless collaborations projects are organised via the Humanitarian OpenStreetMap Tasking manager. Missing maps [2] has material online that can be used to support the initiation of Mapathons. To run a successful mapping event this are some of the activities that need to take place.

Training- Search for legislation and planning restrictions -Students were tasked to contact the responsible public services and collect information about the urban planning regulations, the permitted use of building and archaeological restrictions.

- Data collection and manipulation- here the students were focused on research, the students visited the area and collected attribute data and spatial data by using paper maps. A few of them collected GPS coordinates (for track identification) by using handheld GPS or using smartphones, they enhanced the quality of data collection by taking photographs. After this, they created accounts on OSM and edited the attribute and spatial data. The attribute data was edited according to already existing files or categories and the spatial data was improved based on the three different methodologies that the OSM offers
- Evaluation of the process- at the end of the experiment the students evaluated the process and identified concerns of the process.

7. INFORMAL SETTLEMENTS DATA

Due to the precarious nature of informal settlements, information on size and populations of settlements are limited or non-existent (Patel & Carrie, 2012). Research have been working on approaches to identify the growth and size using various methods. To those with the technology, this can aid in management and planning for future expansion. In areas where data is limited, communities have rolled up their selves and collated data that they can use to plan and upgrade their settlements in partnership with local and national governments.

According to UN-Habitat there are over X- informal settlements in the world. Many are located on land that is owned by government, with no tenure security, access to toilets and water. The conditions are such that, the SDG indicator 1.1 highlights the need to improve tenure for all by 2030. Many researchers have noted that improvement of tenure has a direct correlation to the improvement of living conditions in informal settlements and increased investment in agriculture(Van Gelder, 2009).

Data on informal settlements has the potential to aid in the spatial monitoring of interventions by local and national government (Patel & Carrie, 2012). OSM promotes the use of local knowledge in updating the online map on roads, build-up areas, services etc. A community of users contributes the data. OSM formally operates the site on behalf of the community of contributors[3].

[2] https://www.missingmaps.org/

[3] OpenStreetMap Foundation https://wiki.osmfoundation.org/wiki/Main_Page

8. SPATIAL DATA IN TOWN AND REGIONAL PLANNING

Urban managers need data to plan for the growth of cities. Moreover, data generated can be useful in grasping the extend of urbanisation and inform how to integrate informal settlements within the boundaries of cities (Chakraborty et al., 2015). In the upgrading of informal settlement, participatory methods are deemed best as they reduce disruption of social networks in communities. Upgrading requires the ability to analyse the physical setting of an area and prepare appropriate solutions in collaboration with communities (Sliuzas, 2003). The approaches used by communities in Dar es Salam as described by Sliuzas, (2003) provide opportunities for transparency and enhanced communication between stakeholders. Planning requires extensive and accurate data collection, analysis as well as mapping. The contribution of data made by the VGI system especially for informal settlements will reduce the burden on local authority planners. Several researchers continuously highlight the limitation of spatial data on informal settlements during studies which will now be available once the VGI system is fully embraced (Sinharoy, Pittluck & Clasen, 2019: 5; Gwaleba & Chigbu, 2020: 5). The availability of digitized data on a settlement makes map creation for that settlement less cumbersome. Moreover, Schindler & Kanai (2021: 45) argue that good spatial information leads to greater investment and development. Namibia's Statistics Act (No 9 of 2011) in Section 47 calls for the "promotion, use and sharing of spatial data in support of spatial planning, socio-economic development and related activities" (Republic of Namibia, 2011: 30). The availability of spatial data can make the upgrading efforts of all stakeholders beneficial in a shorter timeframe.

9. NAMIBIA INFORMAL SETTLEMENT DATA

In 2008 SDFN was one of the first communities within the SDI network to complete a country level complete profile on informal settlements. Through engagements with networks and communities in Namibia 208 informal settlements were profiled with a population of over 500 000 (SDFN-NHAG, 2009). The data collection was completed through community estimates, transact walks and verification from community members.

To support citywide planning, the federation started working on settlement wide enumerations to inform informal settlement upgrading. From 2012 to 2020 data was collected in 263 informal settlements in 76 localities, for a population of over 900 000[4]. Some informal settlements were mapped using printed out aerial images and later digitised in opensource GIS platforms such as QGIS and GVSIG. The data collected helped inform the first settlement wide upgrading project in Gobabis.

The NSDI is the main platform that stores spatial infrastructure for Namibia. Spatial data generated by local and national government is available on the platform. However, this data is not up to date, as this relies on data producers to share the data with the Namibia Statistics Agency (NSA) who ensure that it is cleaned and meets the requirements of the systems.

The NSA has a pragmatic project on capacity of local authorities in the use of GIS. To support access to spatial data, a project has been initiated to develop a National Housing Information System, which will be populated by local authorities.

[4] Information from the Community Land Information Programme shared by Namibia Housing Action Group in an internal report from 2020.

Before the commencement of the project, it was important to get clearance from NSA. The process is essential according to the Statistics Act (No 9 of 2011), that requires all geographic data generators to obtain clearance. This is to ensure there are no duplication of efforts.

The authors experience with OSM was in the mapping of settlements in Malawi affected by flooding in 2016[5]. This knowledge gained created an opportunity to initiate this approach in partnership with local organisations in Namibia.

Since 2015, the National Statistics Agency, has conducted training workshops in Kunene, Oshana, Oshikoto and Zambezi regions. The aim of these workshops was to introduce and integrate NSDI to regional councils and local authorities to improve their planning systems. In addition to the workshops, NSA also initiated dialogue with regional councils on the decentralisation of the NSDI and highlighting the use and benefits of spatial data within regional councils. Thus, through the workshops, the NSA was able to assess the readiness of regional council capacity. However, the roll out of the NSDI could not be successfully implemented due to lack of information technology infrastructure capacity. (National Statistics Agency, 2021)

10. UPDATING THE NAMIBIA OSM LAYER

The first Mapathons in line with informal settlements hosted at NUST was in collaboration with undergraduate GIS students interested in contributing to OSM. Mapathons are public and coordinated mapping events helping to improve available information in vulnerable areas. The aim of hosting coordinated mapping events is to create visibility of informal settlements using OSM and promote use of data on shacks for informal settlement upgrading and aid monitoring of upgrading interventions. Participants from the SDFN and Youth mappers upon sharing reflections informed that the use of OSM background satellite imagery would have been useful in the shack count that they normally conduct during the informal settlement profiling.

The event attracted many experienced mappers, with some representing the NSA and observers from private Geoinformation Technology Company. The event would have benefited from the engagement of community members, as the mapping would go beyond the footprint as some of the base images online were not clear for all areas.

One town was selected to map an informal settlement that have been identified for upgrading (Figure 1).

[5] Mapping Party: Putting Malawi on the map
https://www.utoday.nl/news/63459/Mapping_Party_Putting_Malawi_on_the_map

Following an open call for community grants, the SDFN[6] was supported with a grant to initiate mapping

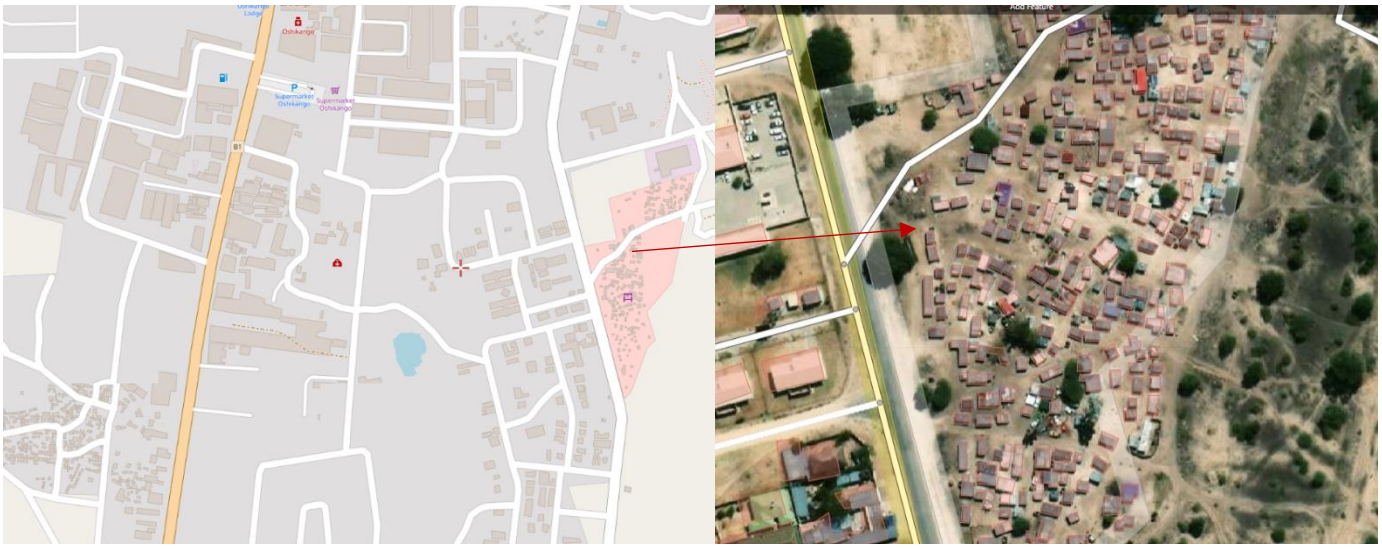

Figure 1 OpenStreetMap Example of informal settlement mapped in OpenStreetMap Oshikango, Namibia

activities. The focus of the mapping project was on building footprints, street networks and availability of services in informal settlements.

Youth mappers from the university were unable to participate as commitments to studies and challenges caused by the COVID-19 regulations posed too much to balance the additional activity. The work on OSM was mostly supported by 17 youth members of the SDFN, who reside in informal settlements. The participants noted that, contributing this data will help in upgrading their settlements.

The collaboration between NHAG, SDFN, DLPS and support from community data specialist Anni Beukes produced a proof of concept. Access to computer labs was facilitated through the Department of Land and Property Sciences. For over five weekends, youth were trained and contributed to OSM using ID-Editor in the updating of the Windhoek OSM layer. The focus was on capturing built up area information, such as the shacks and streets. The second level of the training focused on the use KoboToolbox[7] to capture structure level information in the informal settlements. As the data from the aerial images were not clear, the second level was to use Mapillary in the updating of street level data on households.

[6] Shack Dwellers Federation Namibia: Guardians of The Map: Growing A Community Of OSM Mappers: https://www.hotosm.org/projects/shack-dwellers-federation-namibia-guardians-of-the-map-growing-a-community-of-osm-mappers/

[7] https://www.kobotoolbox.org/

Figure 2 Informal Settlement OSM mapping and Field verification in Windhoek

11. DISCUSSION AND CONCLUSION

The National Geographic Portal has OSM as a base map, indicating the useability of the data within the database. Volunteered geographic data can be used in the planning process and integrated in the National Spatial Data Infrastructure, this will depend on the needs of local authorities. It is important to note that data creation not only benefits the future users, but also the producers, as upgrading projects can be implemented at speed when data on settlements are easily available. The study highlights how the use of opensource platforms like OpenStreetMap are essential in contributing towards youth/community empowerment through training and acquisition of digital skills and creating visibility of informal settlement.

The rapid urban growth, lack of efficient land administration and insufficient spatial data have contributed to the formation of informal settlements to a large extent. Since informal settlements do not form part of the formal city planning, there is a lack of spatial data for planning and are therefore, excluded from the provision of basic services such water, sanitation, and electricity provided in the formal city areas. This paper strongly recommends integrating community generated spatial data in land

management and administration to provide reliable information relevant for improving planning procedures as well as policy formulation. OpenStreetMap for example provides citizens as well as community groups with the ability to participate and use the spatial data to improve their own living condition. Informal settlements are often invisible, and it is important for local government to recognise informal land and to develop it into formal land. Spatial Data forms the basis of a more informed, sound and sustainable development of cities. The absence of spatial data on informal settlements contributes to the emergence of social, economic challenges that becomes difficult for the planning authorities to manage. The integration of community spatial data provides information that considers the various interests of individuals, this help to minimise occurrences of conflict among people as their different interests are catered for. Bellow we summarise the specific outcomes of mapping activities that took place from 2021 to date:

- Youth participation instrumental in completing projects, participants in the mapping events were mostly from high schools within Windhoek. Many reside in the informal settlements identified for mapping.
- There was limited participation from older members of communities on the use of OSM. There is an acknowledgement that digital process can exclude potential participants who are not having the necessary digital skills in using the technology. Based on this, the project is being implemented concurrently with the manual data collection approaches of the communities.
- Availability of technology is highly reliant on university and NGO, creating data centres in communities can reduce the travel time for contributions. As teams must travel to NUST campus to digitize the data and later go into the settlements to verify.
- Use of data by local and national authorities, knowledge of the platforms can enable local authorities to download shapefiles directly from OSM using QGIS. This reduces any strain on resources.
- The use of data from the volunteer community of SDFN, youth mappers and mapathon participants, the study adds to new knowledge on the wealth of information available that can be integrated in Land Information Systems of Local Authorities.

The lessons learned were important. Here are some of the Opportunities for moving forward

1. The National Housing Information System creates an opportunity for integrating OSM within the database. Verifications can be made with local authorities. Town level mapping events can be organised.
2. Definition of Data and tagging, each area can identify important tags that can be prioritised for mapping. This can include amenities, street names etc.
3. Data verification and updating can be supported for informal settlements ready to implement upgrading projects.

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BIOGRAPHICAL NOTES

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