Improving Land Governance Through Innovative and Rapid settlement profiling platform

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SUMMARY

The recent outbreak of Covid-19 witnessed across the world brought about a ravaging health crisis with severe impact in cities and urbanized areas. This is mainly attributed to the high urban population and overcrowding, particularly in informal settlements and other less-developed urban areas. Hence, the livelihoods of millions of people were severely affected by measures introduced to deal with the pandemic that resulted to job losses and restricted movement to the markets and access to basic services. Rapid decision making and speedy implementation of actions during the spread of the pandemic was limited particularly due to lack of authoritative and reliable data to inform about hotspots, accessibility corridors, functional resource centers and patterns of transmission.

Many efforts to promote access to information have come up mostly following the outbreak of pandemics. The open data platforms were rapidly created to consolidate and avail data easily inform policymakers, academia, Civil Society organizations and well-wishers in coordinated efforts toward the curbing the spread of the pandemic. Notably, the added value of these innovations will go beyond the emergency response and will continue to benefit many sectors through continuous access to information and for an increased spotlight on the vulnerability of urban dwellers.

UN-Habitat through the Covid-19 Response Plan of 2020, one of the actions under the plan seeks to provide urban data for evidence-based mapping and knowledge for informed decision making. The goal of this plan is to mobilize local and global partners to participate in collecting reliable and credible data using rapid means such as smartphones and handheld devices in an open and collaborative approach. In order to achieve this, Global Land Tool Network (GLTN) together with select partners is championing an open data platform that seeks to avail rapid data at settlements level in less developed urban areas. This platform is being developed on top of the fit-for-purpose land governance tool, the Social Tenure Domain Model (STDM) to complement land tenure interventions with collective and inclusive approaches at settlement levels and contribute to decision making in a timely fashion.

The vision of the platforms is driven by the commitment of the New Urban Agenda (NUA) toward sustainable urban development and the vision of leaving no one and no place behind in

the Sustainable Development Goal (SDG). GLTN has immense experience in the fit-for-purpose (FFP) tools and solutions such as the Social Tenure Domain Model (STDM) which integrates smartphones and handheld devices for data collection currently driven by different partners at the city level in different regions in Africa and Asia. The development has two elements focusing on mobile-driven data collection application and the visualization dashboard on the web. The app is being tested in three countries; Kenya, Uganda, and Zambia supported by UN-Habitat undertaking various projects. The tool has been tested with support from various Civil Society Organizations in the three countries.

1. Introduction

Urbanization rapidly growing across the world and cities are facing enormous pressure to expand, attract investment, become more sustainable and inclusive and spatially equitable. Similarly, the world population living in cities has immensely increased from 0.8 billion to 4.4 billion from 1950 to 2020, about (26%) and is projected to reach 6.7 billion (68.4%) by 2050 (UN, 2018). The majority of this growth is expected to occur in Africa, Asia, Latin America, and the Caribbean. Key emergent issues related to how the cities and policymakers equally respond to changes at the city level as they urbanize around the issues of urban planning, infrastructure, tenure security and good governance. This becomes even critical during crisis and global challenges such as Covid-19 without proper warning systems, reliable data and information systems, mitigation plans and wide inequalities gaps in cities.

The notion of cities as an engine for growth in transforming inclusive prosperity and development includes the dimension of urban poor context. Unfortunately, informal settlements and slums continue to be disconnected from urban systems and cities' growth and therefore exposed to fewer opportunities for decent livelihoods, housing, and basic services. Habitat III sponsored by United Nations in 2016 defines informal settlements as residential areas where inhabitants have no security of tenure vis-à-vis the land or dwellings they inhabit, with modalities ranging from squatting to informal rental housing and the neighbourhoods usually lack, or are cut off from, basic services and city infrastructure. The future projections indicate that people living in these areas are going to increase and will most likely continue to suffer significantly due to unemployment, access to basic services, housing, land tenure security and effects of future pandemics. According to a World Bank report on fragility and conflicts, it is estimated that by 2030, at least half of the world's poor will be living in fragile and conflict-affected settings and most of them in Africa (World Bank, 2020). In addition, UN-Habitat estimates that over half of the urban population lives in slums, and by 2050, Africa's urban dwellers are projected to have increased from 400 million to 1.2 billion (UN-Habitat. 2008; UN-Habitat, 2013).

The UN-Habitat Covid-19 response plan confirmed that the most devastating effect of Covid-19 will be among the poor and densely populated urban areas, especially for the one billion people living in informal settlements and slums worldwide as well as for refugees, internally displaced people and migrants (UN-Habitat, 2020). The delivery of Sustainable Development Goals (SDG) recognizes the spatial dimension of development toward well-planned and

managed cities for all and more importantly, seeks to leave no one and no place behind (United Nations, 2015). In particular, Sustainable Development Goal 11 seeks to make cities and human settlements inclusive, safe, resilient, and sustainable. Essentially, this goal promotes equitable prosperity in cities and improved living standards. Recognizing these commitments, the frameworks seek to eradicate poverty in all its forms, end discrimination, and exclusion, and reduce the inequalities and vulnerabilities that leave a section of the population behind. (United Nations, 2015; UN-Habitat, 2016).

1.1. Addressing the data gaps

The lessons from Covid-19 demonstrate the need for proactive approaches in city planning including the availability of diagragetated data on livelihoods, tenure security, and health among others. The COVID-19 pandemic has revealed systematic problems derived from inequality and has therefore necessitated a structural change in the way cities are planned and managed (Chigbu & Onyebueke, 2021). In the 2030 Agenda for Sustainable Development, it is necessary to identify and quantify the proportion of the population that lives in slums, informal settlements and those living in inadequate housing in order to inform the development of the appropriate policies and programs for adequate housing and derive sustainable solutions with a fair and equitable allocation of resources, services, land and public spaces (Sharifi & Khavarian-Garmsir, 2020).

The lack of reliable data may inhibit recognition and subsequent response to city-wide sustainable development. Many initiatives for data generation were developed during the pandemic and brought good insights for collaborative approaches in crowdsourcing platforms (Sharifi & Khavarian-Garmsir, 2020). However, there were challenges that emerged with the prevalence of many platforms and reliance on social media particularly in combining data from different sources. It was challenging to evaluate the reliability of the available data due to the intensification of misinformation and lack of standardization, metadata, and retrospective changes that undermined the ability to effectively use it (Badker, et al. 2021).

In response to these open data challenges, UN-Habitat together with civil society groups is revamping its approaches for interventions in slum upgrading in the use of fit-for-purpose tools and STDM by developing an integrated land tenure and settlement profiling data platform at city level. One of the strategies in this approach advocates for engaging civil society and other partners in coordinating data collection, mapping, and access to information. It is hoped that this platform will provide a coherent response for aggregating useful data at the city level that can facilitate timely responses and more targeted interventions on tenure security, housing, and health. Similarly, Capacity development is identified as one of the effective ingredients in dealing with emergencies in terms of preparedness, response, and recovery (UN-Habitat, 2020). This initiative will include consulting with stakeholders particularly city mayors, department heads on the information gaps, baselining existing data, and advising decision-makers and planners on effective strategies for sustainable data generation and management.

Hence, this paper is demonstrating one of the solutions being developed by the Global Land Tool Network toward a web-based platform that integrates rapid data generation at the city level. This tool was informed by the challenges of Covid-19 and the need for a systematic solution that can provide reliable, verifiable, and collaborative data on informal settlement. The tool is being developed and implemented in a similar approach to Social Tenure Domain Model (STDM) along the fit-for-purpose approach and targets to explore integration with other tools to support data aggregation at the city level. This tool has been tested in three case studies at the city level with support from different partners in Kenya, Uganda, and Zambia.

1.2. Supporting the New Urban Agenda

Many cities are increasingly leaning towards technological innovation that promotes sustainable development, particularly in increasing productivity, employability, and urban governance, which has fostered the growth of smart city solutions. Likewise, many people are increasingly connected by mobile devices, due to their increased performance, storage capacity, and connection to the internet in rural and urban areas. Smartphones and related applications are enabling cheaper and more effective access to information in different formats from different sources including sensors and location-based services. Their potential will be multiplied by emerging technological breakthroughs in fields such as artificial intelligence, robotics, Internet of Things, autonomous vehicles, and 3-D printing. However, it is notable that peri-urban and urban fringes may experience varied impacts on digital innovations where slums may be sprawling due to inequalities and the digital divide (UN-Habitat, 2010).

The United Nations Decade of Action calls for accelerating sustainable solutions to all affected by challenges of poverty, gender discrimination, climate change, and inequality (United Nations, 2019). To realize the decade of actions in the Sustainable Development Goals, accountability for all at the individual or collective level is emphasized towards technology innovations and community engagement at the city level. The New Urban Agenda is contributing to the localization of the 2030 Agenda for Sustainable Development in an integrated manner, in achieving the SDG and targets, including Goal 11 of making cities and all human settlements inclusive, safe, resilient, and sustainable. In the strategic framework 2020-2023, UN-Habitat has positioned itself as a leader with a strong and active role in frontier technology, new ideas, and push for smart technologies for prosperity in cities and regions. In a similar thread, a lot of focus is given to addressing inequalities and bridging the digital divide.

1.3. Linking the development to settlement profiling

Settlement profiling represents a people center approach in addressing issues at the urban level in a more sustainable and inclusive manner. Developing a settlement profile provides a complete needs assessment for a particular community through a spatial lens (UN-Habitat, 2020). It builds on the existing knowledge of the communities in combination with other information from local government or other sources towards developing visions for the communities. The process of developing a settlement profile is key in promoting participatory

planning and locally owned solutions by the communities hence, it supports critical action in reviewing policies and planning. In other contexts, the process has the capacity to contribute to promoting the recognition of vulnerable groups and the integration of their priorities in the planning process (Stanfield et. al., 2017, UN-Habitat, 2019).

Following the settlement profiling approach, it becomes important to develop enabling platforms for collecting, integrating and visualizing information from different sources at the city level. By using smartphones as equipment for data generation and common applications such as Kobo toolbox (https://www.kobotoolbox.org/), it is possible to generate data through partners working with communities in slums. Mobile-generated data in settlement profiling can support the inclusion of different objects such as photos, spatial and textual data. Enabling a simple interface for aggregating and interrogating the data through an online dashboard that is accessible by communities can address the scarcity of information for planning and facilitate dialogue with authorities (Budd, Miller, Manning et al. 2020; Young academics network, 2018).

1.4. Supporting urban land governance

Urban land governance is necessary for sustainable practices that impact livelihoods, development and peace. It is rather unfortunate that in many cases, urban land governance is not adequately addressed. This has huge implications in the development agenda for inclusive and balanced development, investment, housing and access to services. The dependence of manual procedures and complex methodologies in access to information complicates mass access to reliable information and limits the citizens as key sources of reliable information, particularly in the informal settlement (Virtudes & Sá, 2017).

GLTN has widely documented the challenges of poor governance, particularly in land sector as a major contributor to informal development in cities. Through working with partners, the experiences of using STDM has demonstrated the power of community-driven incentives on data generation for tenure security and integrating priorities in the development agenda (Antonio, Njogu et.al, 2021). STDM is a concept and model that has been developed into an information tool to support fit-for-purpose land administration approaches and overcome the barriers of conventional land administration systems (Antonio, 2013). The STDM model conforms to the global standards for land administration systems and provides a simplified framework for adapting it to local applications. The recent development of the tool integrates web dashboard which is primarily oriented toward data visualization and reporting.

The use of STDM provides a strong justification of fulfilling the New Urban Agenda in the implementation of secure tenure for all and eventually contributing to leaving no one behind. The STDM tool is now being used by Civil Society Organisations (CSOs) and local governments to develop inventories at the city level on land tenure security, access to services, health, and other priorities being recorded in the participatory enumeration process. This has been successfully embraced in many contexts both rural and urban promoting collective diagnostic of community challenges for inclusive dialogue (Louie, Papeleras et.al., 2017). Hence the development of the rapid data generation platform integrates the experiences

of STDM in its use and application and focusses on settlement profiling broadening the scope of information and coverage.

2. Designing the web visualization platform

Local awareness of the issues in urban contexts and mainly informal settlements need to be informed by accurate data. Also, working with reliable data provides evidence for linking land governance to Sustainable Development Goals (SDG). Previous experiences with the use of STDM demonstrated the potential of reliable data for inclusive planning and good governance. The added value of the profiling tool is demonstrated by integrating land tenure information with overarching issues of governance, health and livelihoods at the settlement level. Hence, the focus of this paper is to promote the achievement of the profiling platform alongside STDM towards a data-driven collaborative approach in the cities. The participatory approach seeks to work with the communities and GLTN partners to generate reliable information about the slum. (Louie, Papeleras, Ruby, et.al., 2017)

2.1. Designing tools and surveys for settlement profiling

The initial consideration in the design of the platform was the evaluation of other related solutions or projects implemented by UN-Habitat and other partners such as Slum Dwellers International (SDI). Hence, we profiled available tools and platforms to assess their relevance, methodologies, data, and outputs. In addition, we evaluated the existing survey tools and ran a comparative analysis on the questions, sectors involved, language, and priorities in different counties. In the beginning, we approached Participatory Slum Upgrading (PSUP) colleagues at UN-Habitat that provided a set of questionnaires that have been used in 3 regions from Latin America, Africa, and Asia. This information included the semantics and text used in different contexts that were relevant in harmonizing a standardized survey tool. In addition, we also approached civil society groups from Uganda, (Actogether Uganda); Kenya, (Pamoja Trust), and Zambia (People Process on Housing and Poverty in Zambia) that have ongoing projects with support from UN-Habitat in settlement upgrading and planning initiatives. The validation exercise with the communities was not considered at that level because it was based on existing tools pre-validated and used in many projects. It was then possible to fabricate a survey tool that capitalized on the specific areas of focus particularly health, tenure security and housing tenure issues.

2.2. Developing the system

The available survey tools enabled the compilation of different sector issues into one settlement profiling survey tool. To ensure the survey tool captured tenure information, a few considerations relating to STDM were also accommodated notably focusing on access to land, properties and use of land. A series of meetings were held to discuss the survey tool and was also circulated to country partners for additional review and input. Therefore, the consolidated survey tool was reviewed, validated and approved for testing by the partners. This validation exercise paved way for the design and development of a web-based visualization platform that supported mobile-based data collection methodologies. Mostly, the target was based on the Kobo toolbox and also, involved the development of a robust interface for data analysis and visualization.

Table 1: Analysis of common tools being used at settlement level

Tool	Application context	Link	Software
SHERPA The Sustainable Housing Design Tool	Evaluating performance of the housing sector and the Sustainability aspect	sherpa4housing.org/	Yes
STDM- land information management tool	Support innovative land tenure recording through participatory and inclusive methodologies	www.stdm.gltn.net	Yes
City Prosperity Initiative	Tracking city prosperity index and performance on key.	cpi.unhabitat.org/	Yes
United for Smart Sustainable Cities" (U4SSC) (To confirm)	Sustainable Development Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable".		-
Tracking basic services in Brazil	Helps you make safer decisions about your mobility, based on the safety score of an area		Yes
TRAM Tool for Rapid Assessment of Urban Mobility in cities	Implementation of participatory approaches in transportation through data gathering, such as focus group discussions and household travel surveys.		Yes
Accelerator App	Ease access to public transport by providing real-time data on urban mobility.		Yes
Urban Gateway	Hosts the city prosperity initiatives	urbangateway.org/	

In addition, the development team prioritized the use of the Kobo collect application for data collection to populate the web visualization dashboard. This also enabled the customization of Kobo API to automate and aggregate data from different sources transmitted Over The Air (OTA) and immediately access it on the visualization platform.

2.3. Data collection

After running several tests, the platform was ready for pilot with partners across three countries of Uganda, Kenya and Zambia. This was done to evaluate the real-time data transmission process, response speed to the survey questions and quality of the data. The existing survey form was converted into a kobo toolbox form and a link was shared with different users in different countries to collect sample data and submit to the web dashboard. This was also another good opportunity to request for more feedback on the settlement profiling survey form for further enhancement.

All the data sent to the platform rested on the Kobo server including pictures, spatial information, and attribute data. The test data generated by partners required a few tweaks on the form. Most of the data generated was gathered from the project work and did not necessitate additional fieldwork. The free kobo toolkit called KoBo Toolbox which is used for collecting and managing data in challenging environments and in humanitarian emergencies context was used in the pilot phase to provide free service for storing the submitted data. An online account was created for this testing purpose.

2.4. Visualization dashboard

An online data visualization platform was developed to support web data access and analysis including custom generation of statistics and other reports. The visualization section includes the map display section, a summary record of submitted entries that can be filtered on submission date and source. This dashboard is hosted separately from the data server currently setup using Digital Ocean cloud service platform and is anticipated to be hosted by GLTN once the development is completed.

To view the settlement profile information, users need to select one record on the data list and that trigger loading of the map showing the location of settlements, basic information of the settlements including population, livelihood issues, land issues, available services, governance challenges and required priorities. The dashboard is being improved and tested and more features are continuously being added to automate statistic and analytic reporting from the data. Currently, the development needs to be strengthened to accommodate a wide array of data analysis, export, aggregation and tabulation features. Another consideration being evaluated includes enhancing linkage to SDG indicators. This necessitate working with other partners, city department and UN-Habitat to make the system robust and effective.

2.5. Implementation and data security concerns

Implementing this platform, particularly the data dashboard will be done initially as a demo system hosted by GLTN to provide awareness and create demand from users both partners and government departments. Consequently, the deployment of the platform will depend on the capacity of the partner or government department to install, deploy and manage the data with technical facilitation by GLTN. This will ensure that data management roles and security is managed by the owner of the data that can control access rights, backup and updates as required.

The demo system will be maintained by GLTN as a prototype system that will be periodically reviewed and revised to enhance integration with other tools and systems. This will also allow partners to agree on the appropriate mechanisms for deploying the platform and dashboard in respective areas to serve the interest of the projects, government partners and other policymakers. The data available in the demo system will not be actual and factual until the system is deployed with clear structures and roles. The access rights to the demo server will be based on user account created by the administrator or the manager of the platform and this add to the security layer of the data.

3. Initial Results

The initial results in this paper capture the current working prototype of the online dashboard for city profiling linked with STDM in the web. The final system is almost finalized and evaluating the future development roadmap to connect with other systems and SDG reporting targets.

3.1. Presenting the demo dashboard to various partners of GLTN

A demo version of the dashboard was presented to partners and colleagues to expose them to the features and functionalities of the platform. This included representation from Uganda, Kenya, Zambia, Philippines and Nepal partners of GLTN. Similarly, the session was also attended by some colleagues from GTLN and later included the participation of the Participatory Slum Upgrading Programme colleagues (PSUP). The session focused on the data submitted to the platform, feedback and key suggestions provided during the evaluation phase by partners and a demonstration of the possible. The emergent concern has been issues of data privacy and linkage to other initiatives at the city level. These contributions are taken forward in the future enhancement of the platform.

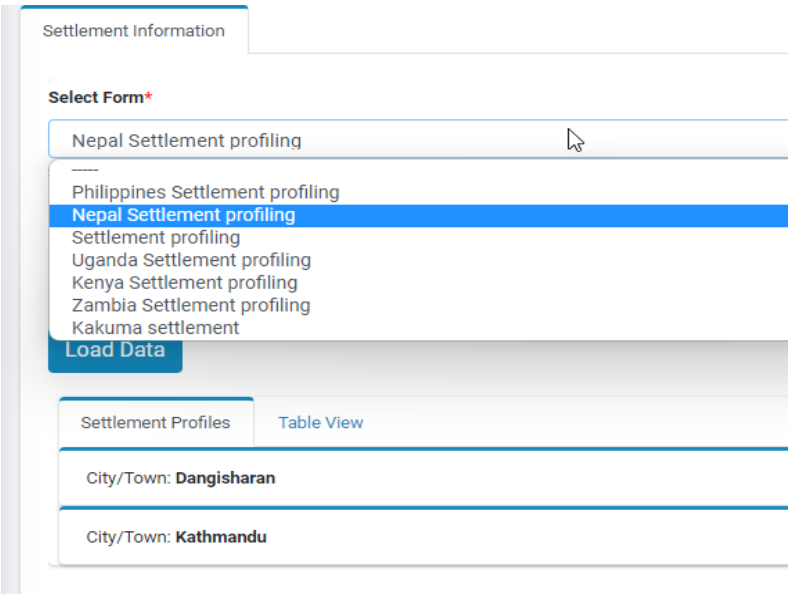

Figure 1: Initial landing page of the profiling web dashboard

3.2. An inclusive and elaborate tool for data generation

These are partners involved have extensive exposure to STDM and fit-for-purpose approaches which are incorporated in the design of this platform. Hence, the existing data from the ongoing project can be linked and integrated via the online dashboard. Therefore, the dashboard adds value to the project work and provides a continuous interface for updating and accessing real-time data of the settlements. At the UN-Habitat level, this has been appreciated as a platform that monitors and provides feedback on the interventions at the city level from the different organizations. This aggregation of data from different profiles to city level analysis is critical and contributes to the SDG indicators and assesses the impacts of Sustainable urban development under the New Urban Agenda.

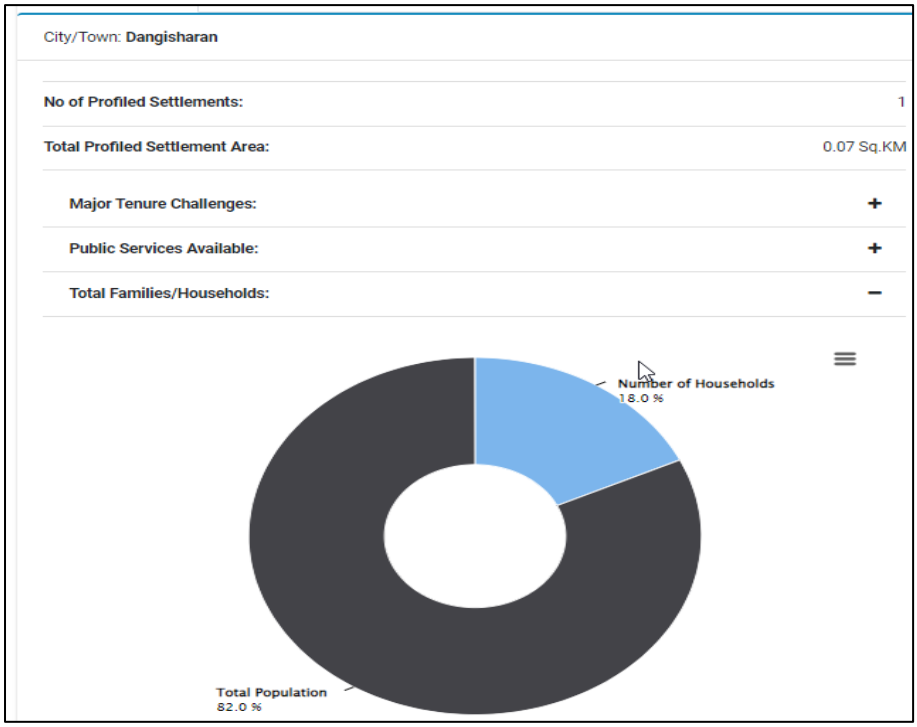

Figure 2: Visualizing summary data for the selected settlement

Designing new systems will not be required because new projects can be based on the same platform and or customize it to the local needs as need be. The survey tool has been standardized across for homogeneity of information and to avoid different and varied questions that complicate compiling various datasets. However, the survey form can be altered in the localized setup similar to the same approach of STDM where users can create their own database and data templates.

3.1. Improving spatial and statistical reporting

The main advantage of the platform is data aggregation and reporting in a dynamic and interactive mode. Users have the capacity to view the data and perform custom analysis for both spatial and textual data and can download the results for later use and sharing. This will be accompanied by the option of adding other data from different times with the ability to

perform overlays, filters and comparisons using own criteria. These features are being tested and improved to align with different user needs and complement existing tools.

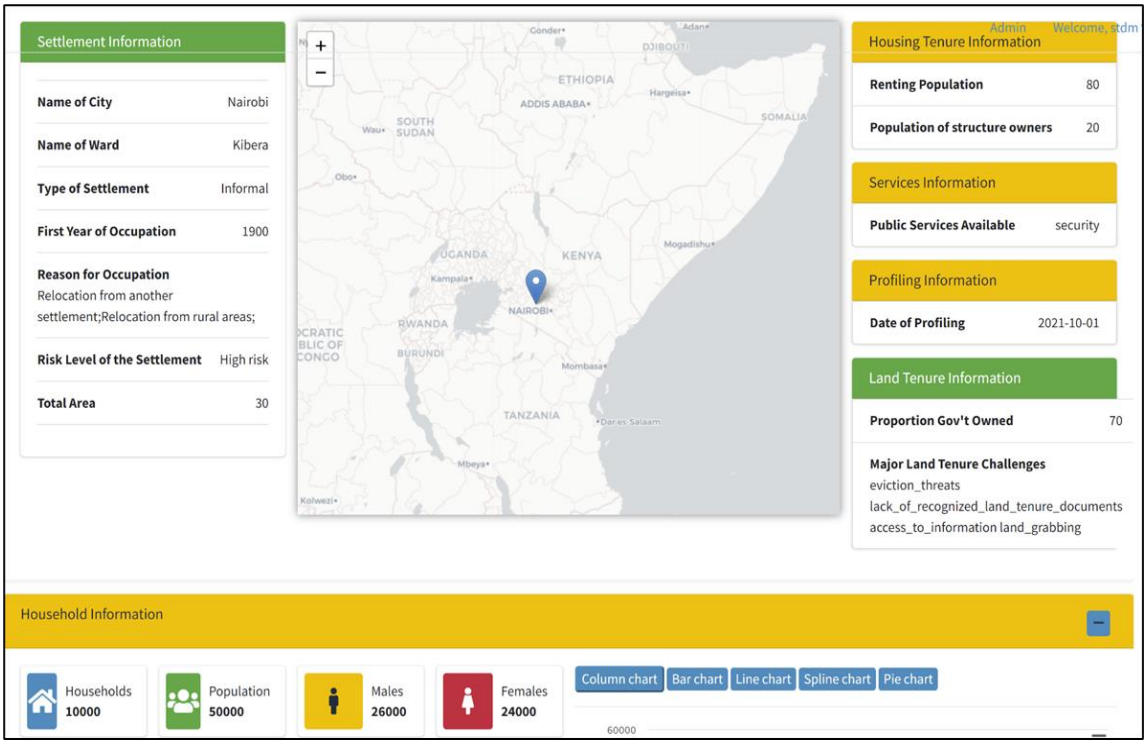

Figure 3: Settlement data dashboard

3.2. Broadening the role of STDM in urban planning and development

The scope and application of STDM has really broadened and created a strong user base at the global level. Similarly, the tool is now becoming relevant to local governments and land departments to support land administration, revenue generation and settlement upgrading initiatives. Its focus has been on offline applications to reach many users in remote places. However, with the growing number of users in the web and the need to integrate and share the data over the web, it is therefore relevant to build additional features that promote comprehensive approaches at the city level in different sectors for inclusive and integrated solutions. This will enhance developing land and housing land tenure initiative as the foundation of development but also connect to the social and economic demands at the city level.

In order to promote a coherent platform among the civil society groups and with the governments, the integration with the STDM framework will enable a comprehensive approach for developing targeted responses in different contexts. Integration with STDM will enhance the statistical and spatial analysis of the data on the web. The web users will have access to data generated from smartphones on real-time basis during emergencies and in other

instances such as the Covid-19 crisis. It will ease generation and access to critical data similar to other initiatives from Ushahidi, map box and Open Street Map (OSM) initiatives.

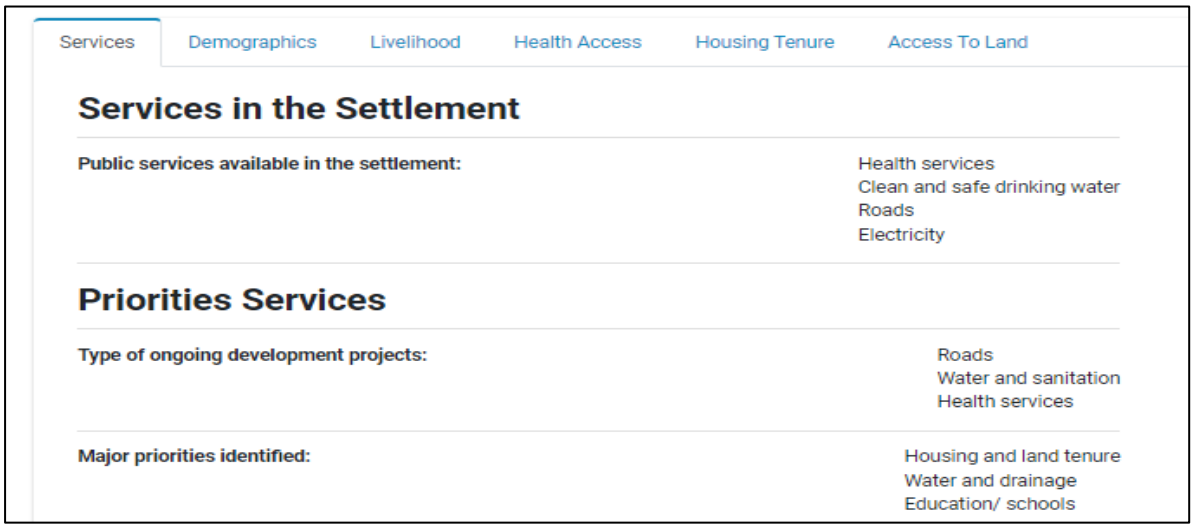

Figure 4: Sectoral visualization of generated data

3.3. Contributing to one tool and one data approach

It will become a big milestone once the tool is accepted by all partners using STDM and can integrate it in their projects and localize it for effective data management. This will reduce the need for duplication of settlement data or project work and in baseline data generation and will equally support in monitoring and evaluation of the project outcome. Generally, settlement profile data is available publicly and has not been very effective because the data is not publicly available or up to date. This platform addresses all these gaps and encourages the project and implementers to localize and monitor for data security and privacy of key information.

Figure 5: Enhancing visualization of population and livelihood data

3.4. Promoting good governance in sustainable development

The platform is developed to promote active and continuous data generation at the city level. This is critical to monitor the urban growth by encouraging stakeholders and communities to interact and coordinate in generating and using the data for daily decision making. This will promote development of responsive and effective solutions in a participatory approach. This will improve good governance that will provide solutions of future challenges.

3.5. Limitations

3.4.1. Data validation

It has been expressed that we shall face complex issues of trust based on voluntary data on the platform as a basis of decision-making and accountability for policymakers and many stakeholders. Therefore, it has necessitated streamlining the application of the platform towards community-driven initiatives as source of data and verification process similar to the approaches of STDM application. Similarly, the platform can be installed at the department level for quality control of the data and monitoring. This has already been tested using the Nepal use and deployment is well documented in the user manuals.

3.4.2. Limited laws and restrictive policies

There are restrictions in different countries pertaining to sharing of data and using open platforms to gather information. Such data may not be fully recognized by planners and decision-makers in the process of developing new policies.

3.4.3. Hosting data and security features

Hosting the platform is rather straightforward and requires fewer resources to host within the GLTN website. However, hosting settlement profiling data may be restricted due to a lack of enabling regulations to host such data within GLTN and UN-Habitat and link it to policymaking. This approach will be linked to the Global Urban Observations (GUO) as an innovative model enhancing the ongoing initiative of urban data monitoring, collection, and analysis.

3.4.4. Metadata

Metadata is described as data about data. This is a critical requirement in any data system and affects the way data can be consumed and analyzed in relation to other data. The data will be collected in different places and by different users that cannot provide metadata to inform on the quality, sources, users and accessibility issues. This necessitates active interaction with partners once data has gaps to ensure we can seek additional information and document those requirements as standard.

5. Recommendation and Conclusion

The feedback received from users and partners is that the system provides a historical and systematic approach of documenting urban trends and patterns from the continuous data

generation approach that will inform current and future decision makers on the appropriate interventions based on the past decisions. This has resulted to huge demand for the integrated platform for both STDM and settlement profiling initiatives. Further development and enhancement have been proposed to connect this development with other platform to ensure the data is promoting other sectors at the city level. Similarly, the scope of the data generated will be strengthened to enhance inclusion of other sectors for collaborative practices and decision making. Integration with STDM has been hailed as a huge success to promote a comprehensive approach to solutions at the city level.

Therefore, we are optimistic this approach will have a far-reaching impact in consolidating urban knowledge from informal areas and will inform quick decision-making on major gaps. It will also inform better decision-making in a timely manner without redundancy of the processes, efforts and projects. This means there will be added value in efforts to transform the city's informal areas and strengthen settlement profiling approaches and contribute to SDG goal 11. We are therefore convinced this approach contributes to UN-Habitat efforts on frontier technologies and ideas for change toward well-planned, well-managed, and inclusive cities.

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