Community Mapping for Flood Resilience – The case of Dar es Salaam, Tanzania

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Abstract

This paper is based on the experiences from the Ramani Huria -community mapping project in Dar es Salaam, Tanzania, where spatial data of the informal settlements have been collected and uploaded into the OpenStreetMap for improved community flood resilience. The project has been run through the participation of the community members, university students, local government officers and Tanzanian authorities. The objective of Ramani Huria is to map the whole city of Dar es Salaam and by March 2018, more than 50% of Dar es Salaam has been mapped. The mapped area comprises over 4 million people, 450,000 buildings and 1,700 schools. Furthermore more than 470 university students have been trained and more that 300 Red Cross community members have been involved in the mappings. Since most of the communities have not been using maps before, maps have been able to support establishment of a planning process where communities have increased their resilience to floods by understanding where the vulnerabilities in their living environment are.
Keywords: Tanzania Urban Resilience Program, Community Mapping, Participation, Participatory Mapping, Flood Resilience.

1 Introduction

Dar es Salaam is one of the most rapidly growing cities in Africa. More than 70% of urban infrastructure comprises of unplanned settlements, which are prone to annual floods. Due to poor infrastructure, inadequate drainage and lack of solid waste management, residents of the informal settlements are vulnerable to losses of property and sometimes loses of their lives amidst severe flooding.

One crucial dimension of the problem is lack of spatially explicit information of the infrastructures combined with lack of participation of local communities. In the absence of up-to-date map data of the settlements and infrastructures, data driven decisions cannot be made. Furthermore, most of decisions are made by individual persons, such as Ward Executive Officers (WEO) or local Mtaa Leaders who are Local Government leaders where their decisions are based on the experiences from the community and interpretation of information they get from being the leaders in respective settlements. Other decisions are based on outdated the maps from 1980's which shows only contours and natural features. Lack of up-to-date maps and current data of settlements and infrastructures hinders better decision-making from the Central Government and the Local Government. As a result, community members become less resilient to flooding each year due to 1). Lack of information regarding the flooding from the resident areas where most of the community members buy land during dry seasons, 2). Community lives into the areas where there is less cooperation between the government, NGO's/CBOs and the community members (Celedon *et al.*, 2012).

Tanzanian Government has been trying to find solutions to the flooding problems of Dar es Salaam since 2011 and urgent solutions are needed in order to improve authorities' and local communities' decision-making capacities. These solutions should enable spatially explicit mapping of flooding as well as making decisions based on that knowledge (Eckle *et al.*, 2016).

Ramani Huria ('*Free Map*') -project is a community mapping project (http://www.ramanihuria.org/), where the main objectives are:

- Enable hazard and risk analysis of flooding and building understanding of community exposure to floods
- Improve understanding of urban infrastructure vulnerability and to inform maintenance and planning of infrastructure
- Build local skills and capacity including communities, town planners and local leaders
- Support risk awareness activities related to urban flooding
- Create capacity for community feedback mechanisms during flood disasters

2 Methods

In practice, Ramani Huria –project works though strong engagement and participation of the community members, who are involved in collecting spatial information from the residential areas with the support of tool such as QGIS software, Java OpenStreetMap (JOSM), Field papers, Open Data Kit (ODK) and Open Map Kit (OMK). The collected data include locational data of the buildings, flood prone areas, household sizes, drainage system and land uses. Community members collect and edit the data, and upload it into the OpenStreetMap. University students from Ardhi University and University of Dar es Salaam are involved to learn how to use simple open source tools in spatial planning, and how to engage communities into flood planning and management. Students are helping the community members in data collection and map production. This way the students are able to use improve their professional skills as future planners. Furthermore, local government leaders are participating in

order to familiarize them and utilize produced information and maps for decision making.

Collected geospatial data are uploaded into the OpenStreetMap -website (http://openstreetmap.org/) and flood maps are produced by community with the help of students (Figure 1). Maps help the communities to become more resilient by making residents to understand how floods impact their living environment, what are the most safe areas in the neighbourhood and what are the flood risk area (Iliffe 2017). Red Cross is involved in Ramani Huria in order to understand, which areas are most severely flooded, what are possible consequences of flooding disasters and how to provide help to the communities during the disasters. InaSafe (http://inasafe.org/) allow analyses of inundated areas and thus enables identififcation of buildings, which get affected by floods (Eckle *et al.*, 2016).

Figure 1: Participatory mapping to identify flood prone areas
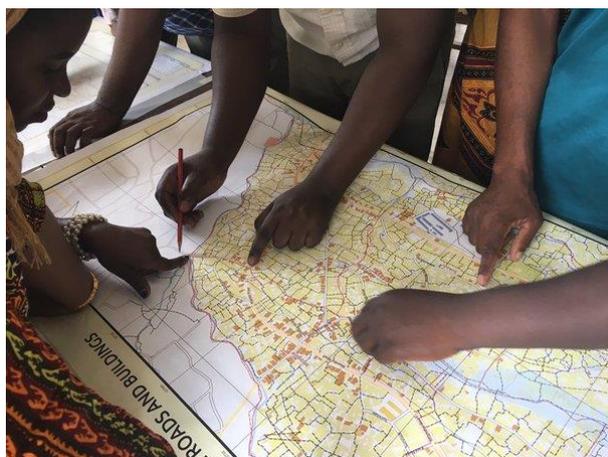
Source: Field work, Ramani Huria 2.0.

In Ramani Huria project, each stakeholder has its own important role in the success of the project:

- Community members are the main project participants and beneficiaries, trained regularly with the students. They conduct the data collection since they know best their living environment. They walk around and collect information using simple tools like pencil, field papers and mobile phones.

- University students are important participants, who have experience and knowledge of mapping, mapping tools and data collection. These students provide training and help the community members by showing how to do digital data collection, how to use the mapping tools (GPS, field papers, mobile phones) and how to edit and upload all the information into the OpenStreetMap.

- Local Government officers gather and involve municipality, ward, sub-ward and community members into the project. To successfully work with the communities, the municipality officers are required to understand the project well and to be able to introduce the project to all the participants with a proper protocol, including an introduction letter, which is needed officially to make the project happen at the grass-root level. Additionally, municipalities are involved into the opening and closing of data collection exercises but also into the workshops done during the project.

- Other participants are Global Facility for Disaster Reduction and Recovery (GFDRR) who are the funder of the Buni Innovation Hub, who acted as the educator of the tools and the methodology to other networks, Dar es Salaam City Council as the main supporter who requested to have the mapping of the whole Dar es Salaam and Commission of Science and Technology (COSTECH).

3 Results

The objective of Ramani Huria is to map the whole city of Dar es Salaam. By now (March 2018), more than 50% of Dar es Salaam has been mapped (45/90 wards). The mapped area comprises over 4 million people, 450,000 buildings and 1,700 schools. Furthermore more than 470 university students have been trained and more that 300 Red Cross community members have been involved in the mapping. The impact is geographically and expected to expand as Ramani Huria operations spread to other areas in Dar es Salaam (Figure 2). The yellow areas in Figure 2 represent wards where community members and student have ground surveyed all the areas. The green colour refers to the areas where full community mapping has been done and the blue colour indicates areas where drainage mapping has been conducted.

Figure 2: Maps showing the current status of the Ramani Huria mapping in Dar es Salaam in January 2018


Source: http://ramanihuria.org/focus-wards/
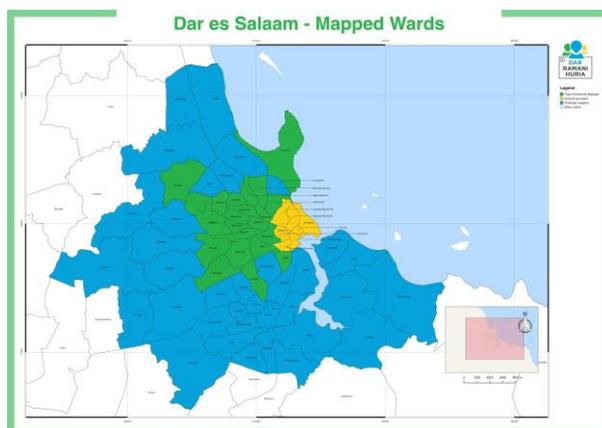
On top of the mappings, the main achievements of Ramani Huria have been the fact that all the ward offices have been presented with the maps of their ward showing buildings, roads, land uses, toilets, water points, rivers, solid waste points and other important features of infrastructure. The Ward Executive Officers (WEO) have used the knowledge to have discussions with the residents and with the higher-level officers. In Tandale ward, for example, the produced maps have been used to identify the spread of Cholera within the ward.

Since most of the communities have not been using maps before, maps have been able to support establishment of a planning process where communities have increased their resilience to floods by understanding where the vulnerabilities in their living environment are (Figure 3).

Figure 3: Map showing inundated buildings in the Tandale Ward (marked in orange). The map was produced with InaSafe tool.
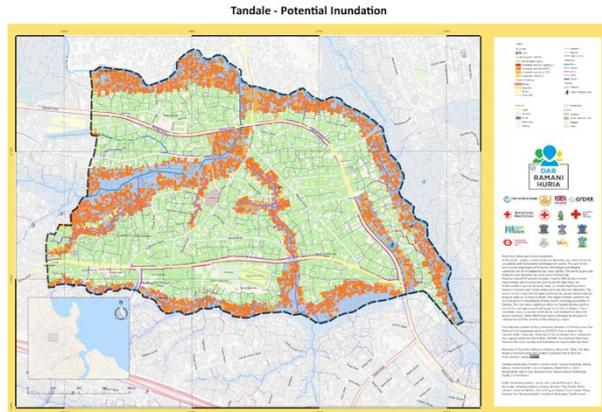
Source: Ramani Huria 1.0

There are still a work to do in the Ramani Huria –project in order to achieve the main goals and make communities flood resilient. However, the project is progressing well and its main achievements are worth sharing as an example of what community participation as a combination with open source solutions can achieve. Having all the Local Government officers, the university students and the community members participating in a shared project gives an opportunity to work together in understanding flooding and flood risk areas. It gives practical tools to tackle environmental challenges threatening human well-being in rapidly growing urban environments in Global South.

Acknowledgements

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