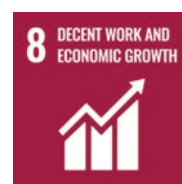# Assessing YouthMappers Contributions to the Generation of Open Geospatial Data in Africa

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Ebenezer N. K. Boateng, Zola Manyungwa, and Jennings Anderson

Abstract

As leaders of tomorrow, we, the African YouthMappers, are taking the initiative of contributing toward the attainment of the Sustainable Development Goals that are a blueprint for a better and more sustainable future for all. Our contributions center on the generation of open geospatial data, which is critical when making decisions on achieving desired development across all seventeen goals. In response to the African continent's alleged data inadequacies, YouthMappers, as vital members of the OpenStreetMap community, have made significant contributions to open geospatial data in Africa. This chapter highlights the contribution of YouthMappers *to not just build maps* – which especially supports reduced inequalities around data access in Africa (SDG 10) – but also *to build mappers* – by advancing the geospatial capacity of young people across the continent, addressing (SDG 8) decent work and economic growth.

E. N. K. Boateng (✉)
University of Cape Coast, Cape Coast, Ghana
e-mail: ebenezer.boateng@stu.ucc.edu.gh

Z. Manyungwa
Chancellor College, University of Malawi, Zomba, Malawi

J. Anderson
West Virginia University, Morgantown, WV, USA

YetiGeoLabs, LLC, and YouthMappers, Helena, MT, USA

Keywords

YouthMappers in Africa · Mapping contributions · Digital divide · Geospatial skills · Ghana · Malawi · Youth

1 The Landscape of Youth and Open Data in Africa

Let us imagine an Africa where there is enough data.

Enough data to meet all our development objectives, from economic to social to environmental. Enough data to know the location of every house in Mozambique and every road leading to it. Enough data for the easy delivery of life-saving malaria prevention services. Where we can see all the rural villages that are without electricity, pointing the path to electrification initiatives that will bring light and energy to them.

Imagine an Africa where young people see themselves in the maps they create. An Africa where students can build a social infrastructure

around knowledge and technology that empowers the whole continent to achieve all of the Sustainable Development Goals.

While we are not there yet, map contributions by YouthMappers residing in Africa and beyond are charting aspirational paths. Aside from creating spatial data, our core mandate is to raise the youth to engage in sustainable economic growth and reduce inequality by building our workforce for the future. This fundamental mandate is aligned with SDG 10 (Reduced Inequality) in that we work with open data and 8 (Decent Work and Economic Growth) in that improving geospatial skills increases labor capacity in a fast-paced, high-growth industry.

The SDGs have been described as one of the noblest decisions to promote prosperity to millions of people by addressing social, economic, and environmental challenges (UN Communications Group [UNCG] in Ghana and CSO Platform on SDGs 2017). These goals target the sustainable development of all forms of life across all spheres of the earth (biosphere, lithosphere, atmosphere, and hydrosphere). SDGs have largely been globally accepted, and conscious efforts seek to successfully implement these goals to ensure national, regional, and global peace, prosperity, and stability. The Global Partnership for Sustainable Development Data, a coalition of 280 organizations, states that "it will require unprecedented amounts of data to ensure we leave a better planet for future generations" (Global Partnership for Sustainable Development Data 2015). A conscious effort by governments, the private sector, civil society, citizens, and youth movements such as YouthMappers is thereby required to contribute to this unprecedented amount of data needed for sustainable development. In our data-driven age, the lack of readily available data for decision-making motivated us to create enough data for the achievement of the SDGs.

One of the key factors that restrained the full implementation of the precursor global targets for development, known as the Millennium Development Goals (MDGs), in some parts of the world, particularly Africa, was limited spatial data (UN-Habitat 2019). Thus, the absence of spatial data to aid in informed decision-making was not achieved, which hindered the MDGs' implementation. Even after the launch of the SDGs, a report from the United Nation-HLPF (2018) showed that there is limited data available to track the performance of the SDGs, especially spatial data. The forebears of MDGs suggested the generation and utilization of spatial data since it offers much more data visualization opportunities that aid in informed decisions resulting in target-oriented policies and programs within a specific area. This led to several initiatives and interventions through global and local movements and programs to help bridge the spatial data gap, particularly in Africa.

African regions have been identified as some of the poorest in the world, with limited data for informed decision-making (Keeton and Nijhuis 2019). According to the International Labor Organization (ILO) (2021), the youth unemployment rate in Africa is 10.6%. Although this represents a rate below the global youth unemployment rate (13.8%), a majority of the youth in Africa cannot afford not to work. Simply put, the youth suffer from underemployment and lack of decent working conditions (ILO 2021). The majority of young people lack the requisite skills and abilities to find suitable work or start their own business. Based on the ILO (2021) statistics, the rate of unemployment among young women (11%) is relatively higher compared to the number of young men (10.4%). Interventions by organizations and groups such as YouthMappers, the United Nations, the World Bank, the Global Partnership for Sustainable Development Data, and Humanitarian OpenStreetMap Team (HOT) channel their focus on grooming the youth in creating and using spatial data for the achievement of all 17 Sustainable Development Goals.

This chapter thus focuses on how the activities of YouthMappers help in the achievement of SDG 8 (Reduced Inequalities) and 10 (Decent Work and Economic Growth). SDG 10 seeks to reduce inequalities within and among countries (UN Communications Group [UNCG] in Ghana and CSO Platform on SDGs 2017). According to ILO (2021), there is a gender gap in youth unemployment in Africa.

Therefore, it is essential that this gap is reduced so that young women enjoy the same access to opportunities for employment as boys and men. The purpose of SDG 8 is to promote inclusive and sustainable economic growth, employment, and decent work for all. According to the UNCG (2017), decent jobs mean safe working conditions with fair wages that allow people to lift themselves out of poverty. Linking this to the challenge of youth being underemployed and/or lacking decent working conditions in Africa implies that there is a lot of work left to attain SDG 8. Efforts to achieve SDG 8 might not be complete if there is unequal access to job opportunities based on characteristics such as gender, race, income, disability, and others. This makes it essential to couple SDG 8 with SDG 10 to ensure a holistic achievement of the SDGs. To address these issues, the question is asked: How can SDG 8 and 10 be achieved aside from government interventions? Based on this question, we focus on the contributions of YouthMappers in Africa toward achieving SDGs 8 and 10.

Several studies have been conducted about YouthMappers in terms of bridging the digital divide generally and the global potential for workforce capacity building in geospatial skill sets (Coetzee et al. 2018; Solís et al. 2018, 2020a, b). However, there is less information assessing the specific regional contribution of YouthMappers in creating spatial data by African youth toward attaining these goals as they relate to the SDG 8 and 10 here. In the subsequent sections, we assess the creation of open-source spatial data by YouthMappers and examine its implications for SDG 8 and 10 among the African youth and challenges encountered, lending our own experiences as YouthMappers to this assessment.

2 Generation of Open Spatial Data in Africa

OpenStreetMap (OSM) is an openly editable map of the world to which anyone may freely contribute. Globally, OSM has seen contributions from more than 1.7 million users worldwide and is considered the largest free and open geospatial database available today. On the African continent, mapping activities in OSM have been increasing the availability of free, open geospatial data for African countries since 2012. This growth can be partly attributed to the drive toward humanitarian mapping across the continent (Herfort et al. 2021). Since 2013, just over half of all OSM changesets with a #hotsm comment or hashtag are located in Africa, indicating that the editing was related to a campaign issued by the largest organizer of humanitarian mapping efforts in the world, the Humanitarian OpenStreetMap Team (HOT; see also Chapter 30 in this volume). Conversely, Fig. 15.1 also shows that nearly half (47%) of the changesets submitted for Africa to OSM as a whole include a #hotsm-related hashtag. This pattern spikes between mid-2017 and late-2019, showing that most of the changesets in Africa during these years included a #hotsm-related hashtag.

Africa is among the latest continents to receive considerable mapping attention from OSM editors compared to other continents. Figure 15.2 presents the total edits per continent since the beginning of OSM. The rate of editing in Europe, while higher, has been relatively consistent since about 2010, appearing more linear in Fig. 15.2 of cumulative edit counts. In contrast, while other locations have steadily increased over time, edits only began to surge, as indicated by the dark blue line representing Africa that began curving upward since 2015, the year YouthMappers was formally founded.

When YouthMappers was founded, the first inaugural university to join the network of three organizing universities was the University of Cape Coast in Ghana, Africa. The addition of new university chapters has been vital in the region, to where among the nearly 300 campuses at the end of 2021, half of them are in Africa. Of
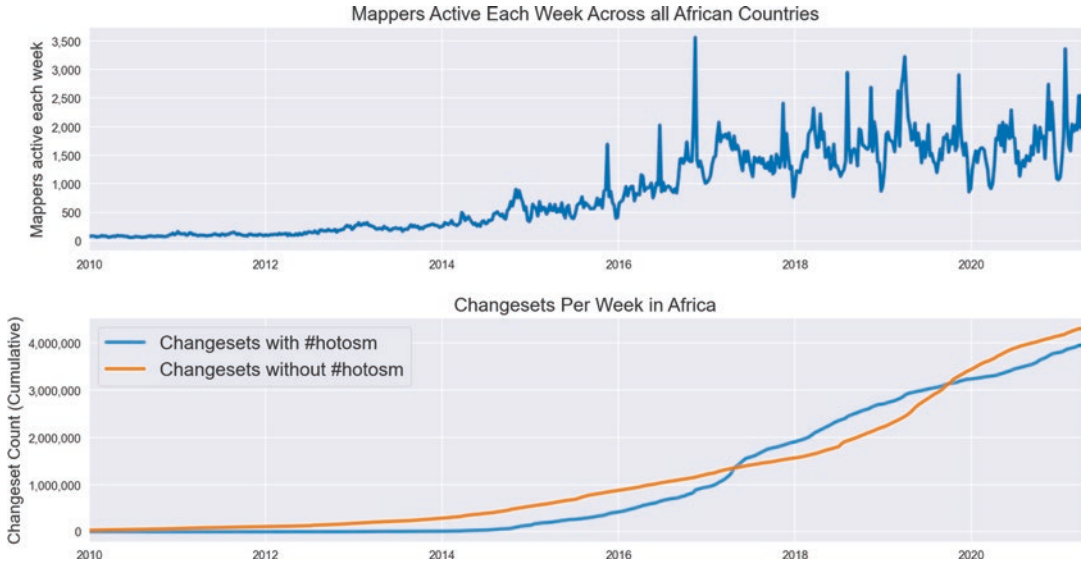
Fig. 15.1 The number of active contributors across Africa fluctuates but has grown over time

the 64 countries with chapters, half of those countries are in Africa.

It is no surprise that the YouthMappers in African universities have made considerable contributions to the generation of OpenStreetMap data, and YouthMappers everywhere have been committed to mapping in the continent. While YouthMappers have been active across all continents, Fig. 15.3 shows that YouthMappers are most prolific in Asia and Africa, with 48% and 45% of all features edited by YouthMappers located on these continents, respectively.

Figure 15.4 presents a cumulative count of features edited by YouthMappers in Africa. Among African countries, Uganda, Zimbabwe, and Mali have seen the most editing (by feature count) among all YouthMappers.

In sum, YouthMappers have performed 7.1M edits across African countries from 2015 through the end of 2021. Of these edits to OpenStreetMap, 6.2M were building objects, and 98,000 were amenities, such as schools, businesses, or points of interest. As of the start of 2022, 113,000 km of roads and paths across the continent were last edited by YouthMappers. Buildings and highways are more easily traced from satellite imagery by remote mappers. Amenities require having some level of localized knowledge. The chapters

in African universities and the network collaboration to map the continent with joint campaigns have produced these results (Fig. 15.5).

3   Implications for the Sustainable Development Goals

Our contributions have significantly increased the amount of open geospatial data accessible by all for several purposes geared toward the attainment of the SDGs. The engagement of the African youth in YouthMappers activities offers some opportunities aside from creating open geospatial data.

3.1   On SDG 10: "We Don't Just Build Maps" That Bridge the Digital Divide

In addition to the contributions to OSM outlined above, which represent an important fundamental publicly available dataset for locations that had previously been poorly mapped, our mapping activities aid in human resource development in Africa that breaks the "gender digital divide."
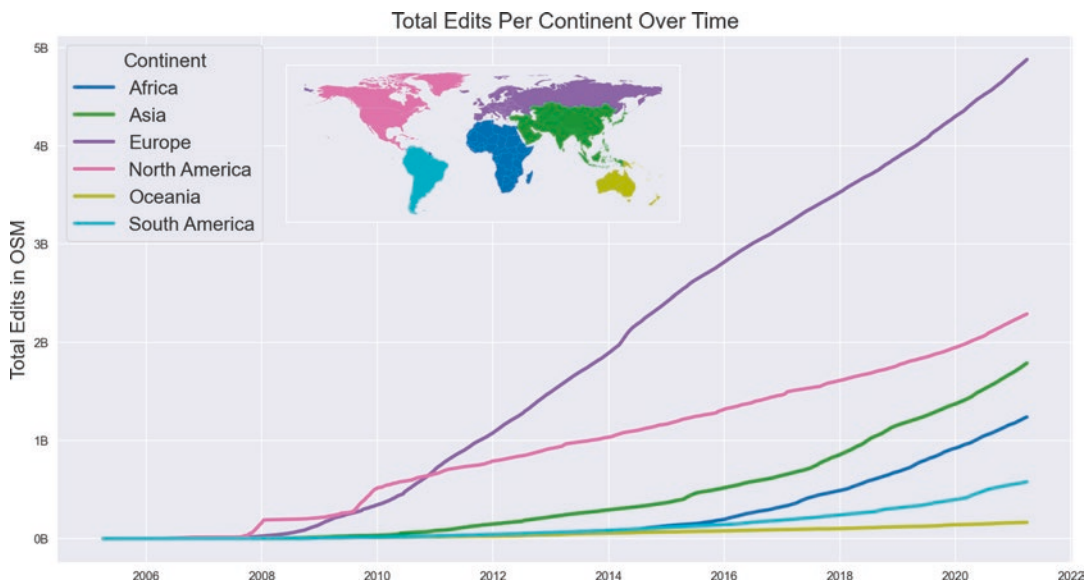
Fig. 15.2 The total OpenStreetMap edits contributed over time by continent shows significant increases since the establishment of YouthMappers for Africa
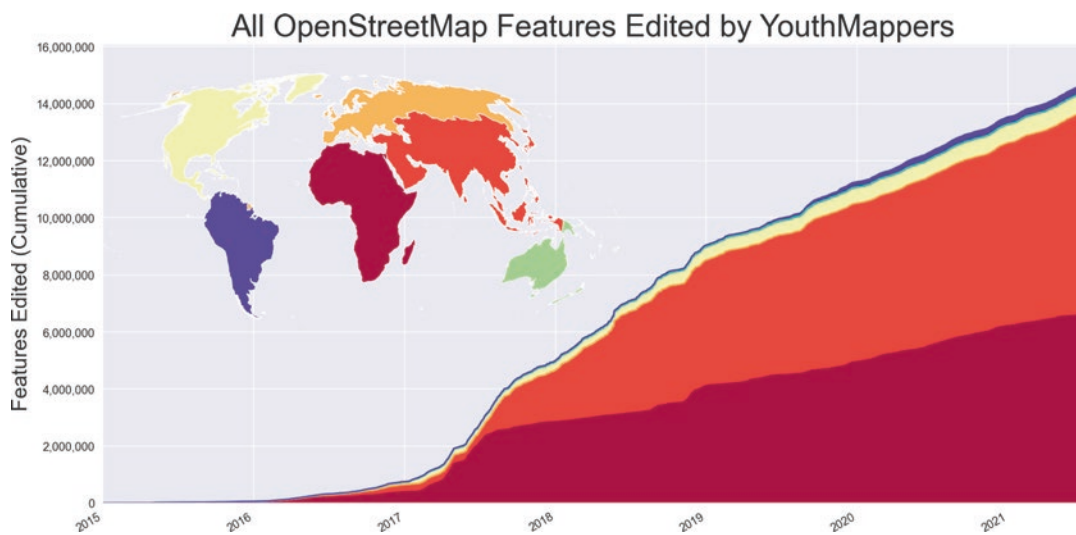

Fig. 15.3 YouthMappers contributions by region from 2016 to 2022 are significant in Africa and Asia

Regarding SGD 10, Reduced Inequalities, several programs have been put in place to bridge the gender gap in geospatial sciences. Two of these initiatives are "LetGirlsMap" and "EverywhereSheMaps." To bridge the gender gap in geospatial science, YouthMappers have awarded African women an opportunity to further their skills and knowledge in geospatial science through advanced degree study at higher education institutions with international fellowships. This contributes to the achievement of SDG 10, where inequality is reduced with access not just to data but also to the knowledge and networking circles. Aside from bridging the gender gap, these initiatives promote education, aiding in the achievement of SDG 10.
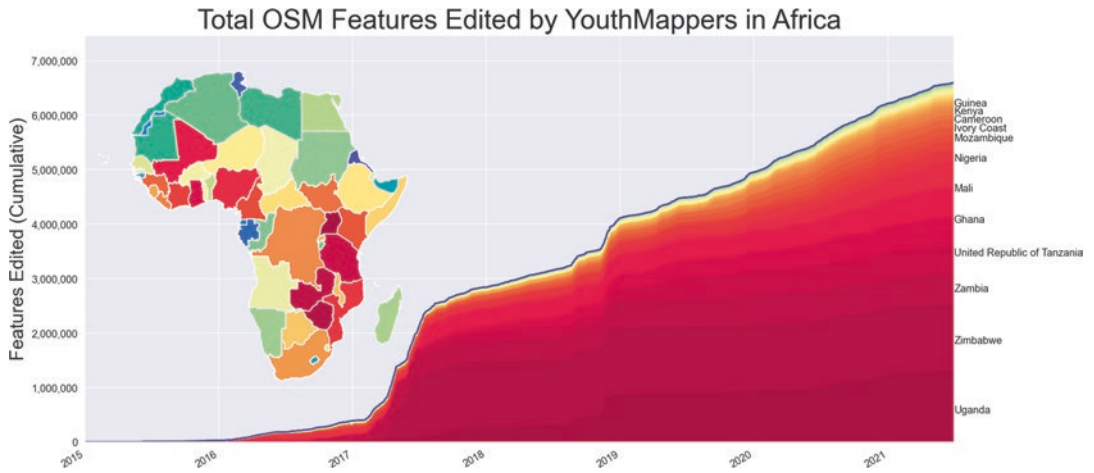
Fig. 15.4 YouthMappers feature contributions by country from 2016 to 2022 are significant in Western Africa and Eastern African countries
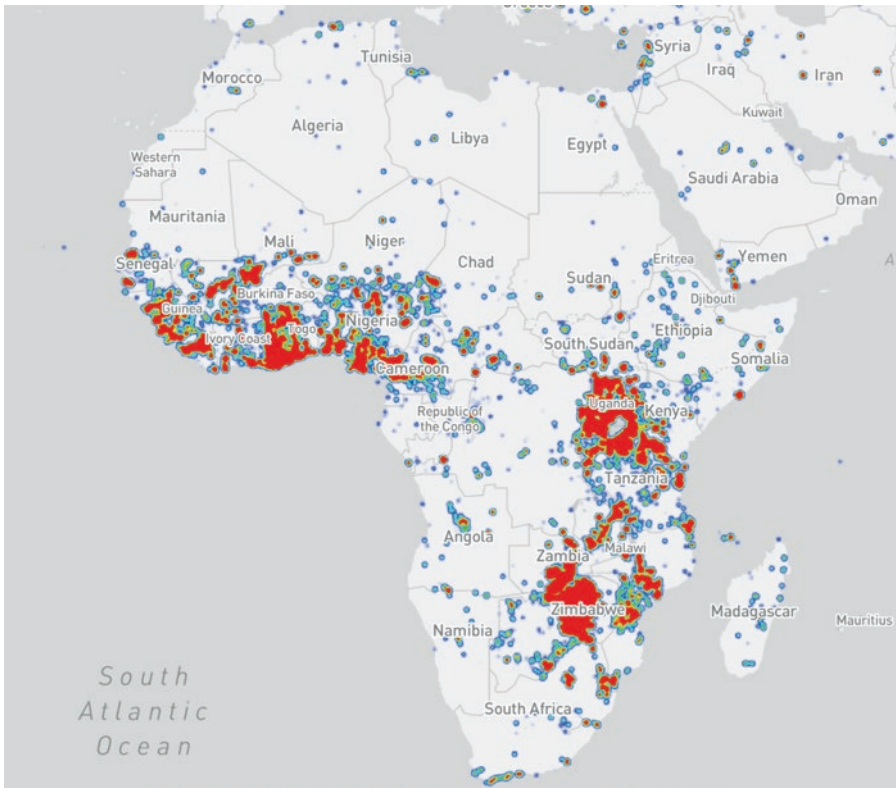

Fig. 15.5 The pattern of edits contributed by YouthMappers across the African continent have supported many projects related to the UN SDGs

3.2 On SDG 8: "We Also Build Mappers" with Geospatial Skills

The billion-dollar geospatial industry has grown exponentially in recent years. Jobs of the future will require spatial literacy and technological abilities that intersect with geospatial data and tools. A study by Solís et al. (2020a) revealed that mapping activities build the capacity of all participating youth to prepare for geospatial careers. One such activity is the introduction of internships. This is a key element to unlocking job opportunities for the African youth. Further, the study found a growing self-reported proficiency in the use of open geospatial tools that promote workforce capacity. In our current dispensation, acquiring geospatial skills offers one the opportunity to establish their firm with a little capital. This would reduce the overreliance on governments and other large firms for job opportunities. Once such a purpose is achieved, there is a higher chance that SDG 8 could be achieved in innovative ways.

4 Challenges and Opportunities

Our experiences elucidate the challenges encountered and opportunities available to YouthMappers in Africa as we contribute to the generation and use of open-source data in Africa.

The YouthMappers program has provided us with a platform to network and acquire the necessary soft and technological skills to transition into professional careers in a world rapidly adopting geospatial technologies. Beginning with the fundamentals, the YouthMappers program provides guidance and training on how to map with OpenStreetMap and how these also offer networking opportunities. Since YouthMappers chapters are student led, we gain employability skills like teamwork, resource mobilization, communication, and interpersonal skills. These soft skills prepare us for real-world scenarios that involve critical thinking, problem-solving, and working with others on a day-to-day basis.

We are also enabled to pursue opportunities outside of the university, such as internships with government and non-governmental organizations. Some YouthMappers have worked as USAID GeoCenter and YouthMappers virtual interns, interns with the Humanitarian OpenStreetMap Team (HOT), and interns with organizations in their countries of residence.

In Africa, as a testimony to this is University of Cape Coast YouthMappers alumnus Benedict T.K. Nartey, who secured an internship at the Center for Remote Sensing and Geographic Information Services at the University of Ghana. He credits his affiliation with YouthMappers as an added advantage in obtaining this internship. Laura Mugeha, a pioneer of YouthMappers in Kenya, has thrived with her geospatial career, both drawing from and building beyond her student experiences, to support the first TechFugees hackathon in Africa; to support the organization of the first Nairobi Ideation Lab with the Archimedes Project; to an appointment with the African Union Youth Envoy; to the Steering Committee of Women in Geospatial+; to service on the gender equality, disability, and social inclusion working group of Digital Earth Africa; to coordinator of OSM Kenya; and to employment with Sanergy. She often gives keynote speeches on behalf of youth, women, and technology. Temidayo Isaiah Oniosun, an inaugural YouthMappers leadership fellow from Nigeria, has launched his career to quickly rise to establish and become the manager director at Space in Africa and be named one of Forbes 30 under 30 for Africa in 2021. There are countless other examples of our students gaining excellent career opportunities, becoming entrepreneurs, and rising to new leadership positions.

This happens partly because of the YouthMappers leadership fellowship, research fellowship, and regional ambassador programs, which have greatly improved the capacity building of many university students. It works as a talent incubator and launchpad. YouthMappers ensures that all students develop a capacity for local empowerment by teaching us to be mindful of the challenges in our communities and promoting chapter initiatives that use geospatial

technology to solve these challenges. The network provides an open and supportive environment that enables us to demonstrate our skills and talents. YouthMappers goes even further by acknowledging our contributions through blog posts, social media articles, and the annual YouthMappers awards. On its Award and Recognition page on the consortium's website, the YouthMappers network recognizes and appreciates award and grant winners and people who carry on different leadership positions across the network. This gesture boosts recipients' morale and makes us more recognizable to future employers and partners worldwide. As YouthMappers, we can also apply for and attend international conferences that widen our professional networks.

Women and girls are explicitly supported by the YouthMappers project in a coordinated effort to build an inclusive mapping community. The 30% participation rate of females in YouthMappers (Solís et al. 2020a) demonstrates this. Females have been supported in attending or organizing mapathons, receiving training, initiating local chapter-led projects, performing field mapping, acting as a mapping intern, and receiving a YouthMappers Leadership or Research Fellowship, according to the results of open geospatial participation in YouthMappers (Solís et al. 2020a).

Furthermore, YouthMappers has provided women with opportunities to serve in various capacities within the network to date, i.e., as regional ambassadors and mentors. Female-centered YouthMappers campaigns such as "LetGirlsMap" and "Everywhere She Maps" seek to empower women members of the mapping community while also steering mapping efforts toward addressing women-centered concerns such as gender-based violence and female genital mutilation (FGM). The various opportunities that women are exposed to as part of the program help close the gender digital gap while also empowering and preparing women for entry into the global workforce.

However, the nature of the aforementioned opportunities is not without its drawbacks. Chapters of YouthMappers, especially in Africa, face challenges due to a lack of resources. One of the most significant issues we face is a lack of a reliable and affordable internet connection, which impedes our mapping activities, such as using the in-browser iD editor on osm.org. In one case, YouthMappers from the University of Cape Coast resorted to hiring a generator for electric power and using student phones as Internet hotspots. The University of Malawi YouthMappers partnered with a local tech hub called Mhub that brought in Wi-Fi devices for mapping exercises. In addition, some university chapters still lack the requisite equipment, such as computers and GPS, for remote and field mapping activities. Furthermore, students face institutional obstacles like a lack of support from university administration or approval to use university labs, thereby limiting their ability to fully engage in the program's activities in universities where the concept of student-led humanitarian mapping is unfamiliar.

5 Imagining Africa's Tomorrow, Today

As members of the YouthMappers project who live or work in Africa, we are proud to have made significant contributions to open-source geospatial data for Africa over the last five years. These open spatial data cut across a wide range of features such as buildings, roads, and water bodies. We have shown through the data that YouthMappers have contributed millions of edits in Africa, predominantly within the sub-Saharan region, and are a large part of the major force of open data edits that have come about in that region. Through YouthMappers activities, youth in Africa can attain geospatial skills and knowledge that would increase their levels of employability. This advances achievements toward SDG 8 and 10 in particular and provides the underlying data and knowledge capacity that can ultimately serve to inform all seventeen of the SDGs in a region where data has notoriously been a challenge to meet global targets. Although the

YouthMappers community has built our capacity in diverse ways toward the generation and use of open-source geospatial data for the SDGs, we remain committed today to solving a handful of challenges for Africa's tomorrow.

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