Digital Public Works PlayBook

Improving Data For Covid-19 Mitigation And Recovery While Building Digital Skills And Earning Opportunities

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(DRAFT)

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Introduction

This playbook is designed to provide guidance to help facilitate the implementation of the Digital Public Works (DPW) project. It details all dimensions of project implementation. It is intended to guide project staff and stakeholders with respect to the project structure, order of operations, roles, and responsibilities, and to bring transparency to the process so that there is a shared understanding of how the pilot will be implemented. For every project component and activity, the playbook clarifies what needs to be done, when it is done, how it is done, and by whom.

The playbook may be used by any of the stakeholders involved in the DPW project, including but not limited to: the national government, city officials, national and international development organizations, consultants, and community members.

What is the Digital Public Works project?

The goal of the Digital Public Works project was to produce the information necessary for informal settlement upgrading by engaging with and providing short-term employment opportunities to urban youth through data collection.

The project was carried out in collaboration between Nairobi County, the World Bank, the State Department of Housing and Urban Development, the project implementing partner Spatial Collective, and the three communities: Embakasi Sokoni, KCC Settlement, and Kahawa Soweto.

To an extent, the project drew inspiration from the Kazi Mtaani initiative, an initiative aimed at empowering youth and providing them with a source of income mainly through the beautification and sanitation of the city's public spaces.

The DPW retained the youth component similar to Kazi Mtaani but engaged them in digital work instead of physical activities. The youth, instead of working on beautifying community gardens, learned about the digitization of aerial imagery; instead of creating and paving walkways, they used terrestrial cameras for image acquisition; and instead of repairing and refurbishing public spaces, they carried out digital micro-tasking and household surveys.

The project further implemented the concepts of community data ownership and localization of knowledge and took advantage of the proliferation of new and affordable technologies. Instead of relying on private companies to carry out the work, DPW recruited and trained the youth from the settlements and gave them tools to collect their own data.

Apart from providing short-term employment opportunities to the youth, the project had to satisfy the data needs of the Kenya Informal Settlements Improvement project. These were thematically organized as data for investment selection, disaster risk management, solid waste management, socio-economic inclusion, and crime and violence.

DPW set out to answer a question: Can the youth use affordable and widely available technologies to gather the information necessary to support informal settlement upgrading?

Each of the thematic areas mentioned above had unique data requirements. For this reason, Spatial Collective developed several data collection modules consisting of digitization of aerial imagery, mobile data collection, acquisition of terrestrial imagery using 360-degree cameras, micro-tasking, and household surveys.

The project recruited, trained, and employed 300 youth from the three informal settlements to collect data, while at the same time monitoring their progress, and paying them for the work done.

The project specifically targeted youth because they represent the majority of the population and are among the most vulnerable groups due to the lack of opportunities, especially in urban centers.

The applications for work were made open so anyone living in the three settlements aged between 18 and 35 could apply and the selection criteria were as inclusive as possible. In the end, out of 300 youth, 70% were women, 10% were persons with disabilities, and they came from all walks of life, religion, education, and income levels.

Once selected, the youths were placed in the data collection modules to receive orientation and training and start work. Each individual, each day received a number of predetermined tasks depending on which module they were placed in. For example, the digitizers had to digitize 200 buildings per day, the mapping team had to collect data on 30 points of interest, micro-taskers had to tag 300 images, and the survey team had to carry out 10 household surveys in a day. Each of these tasks took approximately the same amount of time to complete to make the work more equitable.

At the end of the day, they submitted their work for evaluation by experienced validators who checked the quality of the data and estimated their daily payments.

The payments were divided into three categories: base pay, quality, and overtime. Each youth received an equivalent to the daily minimum wage for all completed tasks in a day. But the youth who produced good quality work earned extra cash and qualified for overtime which earned them another level of payment.

The project used incentives like these because it was found to be the best way to ensure that the quality of work satisfied the requirements of the government.

At the end of a four-month-long exercise, the youth collectively spent thousands of hours on digital tasks, producing the most detailed dataset on the three settlements ever created. They performed 1,8 million digital tasks, digitized 350,000 buildings, collected thousands of points of interest, gathered 6,500 terrestrial imagery, produced 1,5 million tags on that imagery, and

carried out 700 household surveys, providing essential information for KISIP and earned money in the process.

Why is this project important?

Accurate and timely spatial information is a crucial component in the strategic planning of urban development, environmental and disaster management, service provision, and financial management of any city or geographic area. In fact, geo-services have become an essential part of the fabric of common society and geographical information has moved to be interwoven with many aspects of life. The key to these services is accurate, up-to-date, extensive data collection.

Mapping is the process of collecting, managing, and visualizing geospatial data, including man-made and natural physical features, or more social, even personal, indicators. Similarly, participatory mapping is a process of capturing more subjective perceptions, ideas, emotions, and experiences about a place. It can help identify missing resources, problem areas, stories, and solutions to problem areas. Mapping and maps make a local situation legible to an outsider, (in this case, a city government official or international or national development worker).

Traditionally, governments are responsible for acquiring these critical geospatial datasets. However, governments are often overstretched and under-resourced to keep key geospatial datasets, and city maps current.

Further, the emergence of Covid-19 identified new barriers that challenged the way data is gathered. In-person data collection and mapping, household surveys, community forums, and focus group discussions were impossible for an extended period, and heavily restricted when resumed. For this reason, many on-the-ground initiatives had to be re-designed to fit these new realities as many projects were put on hold. An unfortunate consequence is that the most marginalized populations, those living in informal settlements, as well as many professionals, were most affected by the sudden lack of opportunities.

The Covid-19 pandemic heightened the existing need to utilize low-cost disruptive technology to create the information required to manage and recover from the crisis while providing skills development and earning opportunities at the same time.

The Digital Public Works project merges new technologies and new patterns of collective action, bringing together the government, communities, technical professionals, and development workers to produce the information necessary for informal settlement upgrading.

To mitigate the effects of Covid-19 on communities, especially unemployment and lack of opportunities, and to provide KISIP II with adequate data services, the project worked with the partners on the ground to acquire a comprehensive insight into the scale of the problems, identify the needs of the end-users of the data, and inform on the further design of the community mapping.

Further, it worked with youth from Nairobi's settlements to gather data relevant to their settlements' improvement. Through training and daily engagement, youth and community members gained skills relevant to today's digitally-oriented job market.

Additionally, the project was tested on the ground and scrutinized in detail with the aim to produce high-quality, ground-truth spatial information in three settlements in Nairobi: Kahawa Soweto, KCC, and Embakasi Sokoni, and to provide short-term learning and employment opportunities for the settlements' youth.

This PlayBook contains the step-by-step process, aimed at providing information to anyone who would like to replicate a similar initiative in their city or community.



DPW Roadmap


DIGITAL PUBLIC WORKS
A Shared Vision
An intention that the community of people strives for
Learn Through Data
Data contains information on the most pressing issues
People and Technology
People use technology to generate information
Center the Community
The only people who know what is going on are the people who live there
Payment Structure
Should be designed to generate quality data
Keep it Practical
Utilize new technologies to create high-quality data
Communication and Monitoring
Clear, concise, and timely communication is essential

Step One: A Shared Vision

A vision is an inspiration, it is an intention that the community of people strives for. The common vision can be achieved through conversations, sharing ideas, feedback, and the inclusion of different points of view.

To ensure that all the project partners share the same vision and are “on the same page,” initial consultations have to be held with all the stakeholders. These meetings are critical to ensuring the success of the project and will be used to identify the needs of the end-users of the data, establish communications with settlement representatives, and help with the recruitment of workers and sensitization of settlement residents.

The stakeholders include government authorities, settlement leaders, representatives of non-governmental organizations, community-based organizations, representatives of businesses, religious institutions, and citizens.

The meetings have to be transparent about the goals of the project and expected outcomes. The outcome is a change we expect to result from the program we aim to implement. A change can touch “individuals, systems, policies, or institutions and it can also reflect shifts in relationships, knowledge, awareness, capabilities, attitudes, and/or behaviors.”

The intended outcome of the project has to be considered at the start. It guides the activities of the project from project design to implementation.

Guiding questions when designing a project should be[1]:

- What is the project aiming to achieve?
- What are the changes you can expect the target population or area to experience as a result of the project?
- How will the target population or area fare better as a result of the project?
- Are the outcomes realistic and attainable?

The Digital Public Works project had two very clear outcomes, these were:

1. To produce better data for decision-making and thus better development outcomes for the Kenya Informal Settlement Improvement Project.
2. To provide short-term employment opportunities and skills development for the local youth.

The most efficient way to discuss the project details is to abide by the ‘open-door policy,’ meaning, all the stakeholders are always invited to participate and provide their opinions on all aspects of the project.

[1] Inspired by: http://learningforaction.com/define-the-outcomes

Meeting Agenda
The list below is not exhaustive following (at a minimum) should be discussed during these meetings:

- Common goals of the project
- Data needs, data ownership, and data protection strategy
- Overview of the methodology and technology
- Expected outputs and impact of the project
- Work plan of activities
- Community engagement, including recruitment strategy
- Payment for workers, budget, and logistics of payment
- Monitoring mechanisms
- Communication strategy
- Roles and responsibilities of the stakeholders

DPW built a common vision through organizing a series of meetings, on various levels of authority, and with the following people and organizations:

1. NMS, KISIP, and Spatial Collective visited the area chiefs and sub-county officers in each informal settlement to share the vision, discuss project details, and gather feedback.
2. KISIP validated Settlement Executive Committees and Grievance Redress Committees. These committees played a vital role in project coordination.
3. Baraza with community leaders was held to confirm the committees and fill in the missing gaps.
4. The project information was shared with the wider community for feedback and validation.
5. The community meeting was held in each settlement to introduce and explain the process of Digital Public Works.
6. Advertisements for recruitment were prepared and posted in public spaces within the community.
7. Community centers were established in each community for continued presence.
8. Communication platform KatiKati was set up for the community to share feedback, including grievances.



Step Two: Learn Through Data

The way to learn about a place is through information. Information is contained in the data which can be qualitative or quantitative, statistics, facts, or other values, and is usually organized in tables or structures.

Data is necessary to decide what are the most pressing investment priorities that the community will benefit from. The best way to describe the data is through a data model, an “abstract model that organizes elements of data and standardizes how they relate to one another and to the properties of real-world entities.”

The data model should be developed in collaboration with stakeholders and based on the development and community needs. The more precise and accurate the data model is, the easier it will be to implement.

The data model should include

- Thematic areas
- Type of data: raster, vector, statistics, etc.
- Location
- Attributes: descriptive information
- Method of data collection
- Time
- Etc.

The goal of the DPW project was to create high-quality urban geographic data to inform future urban planning and disaster risk reduction efforts in Kenya’s settlements.

The project was designed to support the Second Kenya Informal Settlements Improvement Project (KISIP II) interventions, touching on infrastructure upgrading and tenure regularization. The overall objectives of KISIP II are

- Improving access to services
- Roads upgrading
- Improving access to safe drinking water and adequate sanitation
- Reducing crime through street lighting and economic opportunities
- Upgrading drainage network and landslides protection
- Enhancing tenure security for the residents of the settlements

To unify the efforts of data collection and to collect relevant data to support the effort of KISIP II, the data model had to be put in place.

Developing the Data Model for KISIP 2’s needs

In KISIP II, the data needs to fall into several categories, each with unique questions the data model should answer, as outlined below.

1. Investment Selection Plan
    a. What type of social service infrastructure is available?
    b. What is the state and functionality of infrastructure?
    c. What infrastructural-related challenges and opportunities exist?
    d. How do the communities currently address infrastructural-related challenges?
    e. Is the existing infrastructure adapted to the needs of persons with disabilities?
    f. What are the priority infrastructure needs and in which specific areas?
    g. Etc.

2. Disaster Management Plan
    a. What type of disasters occur in the communities and with what frequency?
    b. What are the risks associated with such disasters?
    c. How many people are affected?
    d. How do the communities mitigate disasters?
    e. What are the gaps in disaster mitigation?
    f. Etc.

3. Solid Waste Management Plan
    a. What are the waste collection challenges in the communities?
    b. How do people get rid of waste?
    c. Are there waste collection points?
    d. Are there waste recycling stations available?
    e. Who provides waste collection services?
    f. Etc.

4. Crime and Violence Assessment
    a. Which types of crime are most prevalent in communities and where?
    b. Which support systems for victims of crime exist within the settlement?
    c. How are spaces in settlements traversed differently according to peoples' perceptions of safety?
    d. Etc.

5. Vulnerability Assessment
    a. How are people with disabilities (PWDs) catered for in the community?
    b. Does infrastructure cater to PWDs?
    c. Are there safety net programs that cater to PWDs?
    d. What are some of the gaps that should be addressed when it comes to PWDs?
    e. Etc.

6. Identifying Opportunities

a. Which opportunities for employment exist in the communities?
b. Which challenges do people face in accessing opportunities?
c. Etc.

An excerpt from the data model can be found below:

SETTLEMENT OVERVIEW				
Spatial Collective - Overall Data Model				
	Geographic Data			
Tasks	*Geographic Feature*	*Description of feature*	*Attribute/Key*	*Values*
Initial consultations with the relevant stakeholders/initial workshop with the stakeholders				
Community network mapping				
Digitization of buildings using aerial imagery				
Tracing building outlines	Buildings	Building outlines (geometry) as seen from imagery	building	yes
Tracing roads	Roads	Roads visible from the imagery	highway	residential, path, footpath, unclassified, service
Rapid data collection using terrestrial camera				
Data collection using terrestrial c	Street view images (georeferenced)	Street level images	capture_date	date
			coordinates	coordinates
Tagging of features using terrestrial imagery and micro tasking				
Veryfying and validating features in Mapillary	Traffic lights	Traffic Lights	highway	traffic_signal
	Manholes	Manholes	man_made	manhole
	Street Signs	Street Signs	highway	traffic_sign
	Buildings	Materials used in cons	building:material	cement_block, iron_sheet,wood, earthen
	Buildings	Roofing material	building:roof	tiles, iron_sheet, concrete, tarp

Step Three: People and Technology

Technology are machinery and equipment, and also scientific methods, that people can harness to generate the data they require. The technology consists of equipment that is adapted to highlight long-term development needs using spatial and statistical information, SMS, pictures, video, and narrative stories.

The technology, in turn, is used by the network of people, organizations, and government representatives to generate information that serves as a communication point between stakeholders. It is only through the coordination of people and technology that the project has the potential to be effective and achieve its goals.

Questions that should be considered before deciding on which technology to use are

- Does the technology fulfill the need of the people and project?
- Is it easily available?
- Is it equitable?
- Is it easy to use?
- Does it enable coordination and monitoring of activities?

The DPW initiative harnessed existing information systems to improve the planning of development projects, by providing community-generated data on local issues and resources.

The role of technology in this project was twofold, first, it acted as a tool for data collection, and second, it supported organizing, monitoring, and communications.

Several technologies were utilized for the purpose of data collection. They can be divided into hardware and software, used either for data collection, or communications, organizing, and monitoring.

During DPW, the hardware and software that were used for data collection were

- **Hardware**
  - **Mobile Phones** were used to collect both locations and attribute data.
  - **Computers** were used for digitization, data processing, data management, and product design.
  - **Insta 360** and **GoPro Max** terrestrial cameras were used for the collection of highly accurate, high-resolution terrestrial (street view) imagery which will be used for further data collection.
- **Software**
  - **Aerial Imagery** was used as a base image layer for the creation of the base maps such as building outlines and road networks.
  - **Tasking Manager** was used for coordination and organization of workers to map on OpenStreetMap.

- **Google's Task Mate** is a mobile micro-tasking platform that was used to match individual users with daily tasks that focused on image terrestrial tagging.
- **OpenDataKit (ODK)** is open-source software for collecting, managing and using data in resource-constrained environments. Together with **OpenMapKit (OMK)**, ODK was used to collect additional information on public amenities.
- **PLACE Warehouse** is an API-centric data platform for the storage of PLACE datasets. The platform was used to validate the terrestrial imagery data and make it accessible to all the partners and stakeholders.
- **Celantur's Cloud Service** was used for terrestrial image anonymization.

The software that was used for the coordination of activities, communications, monitoring, and payments was

- **Software**
  - **Caspio** is a software that focuses on database-centric web applications. Caspio served as the primary platform for monitoring this project.
  - **Katikati** is a social venture which enables organizations to build stronger, more valuable relationships with the people that matter to them through 1-1 digital conversations. The platform was used for communication.
  - **MPesa** is a mobile phone-based money transfer service, payments, and micro-financing service and was used to pay the workers.



Step Four: Center the Community

> "You cannot make informed decisions about the community and its people if you don't know what is going on in that community. The only people who truly know what is going on are the people who live there every day."
>
> — Spatial Collective

The community should be the first and the main stakeholder and has to be involved in the development of the project from the start. Efforts have to be made to ensure public participation at all levels. The lack of such participation will lead to a lack of buy-in from the community and subsequent project failure.

The key to the participation of community stakeholders is providing an environment that is welcoming to the entire community. All opinions matter and the inclusion of as many people as possible makes the project stronger.

Some of the key stakeholders who should be involved are local administration, local leaders, civil society organizations, and individual citizens. These 'interest groups' will ensure the buy-in for the project, promote the project to the rest of the citizens, help with recruitment, provide security, help with disputes, and act as an intermediary between the project, the government, and the community.

Geographic area, leadership, cultural aspects, and needs have to be considered when it comes to community involvement.

- The geographic area will determine the area of operation which will in turn inform the recruitment process and determine the needs.
- Leadership will help find allies and address potential opponents of the project, help provide security, and facilitate recruitment and logistics.
- Cultural aspects, such as community norms, rules, and organization have to be considered in every project.
- And last but not least, the needs will determine the type of data that the project will aim to collect.

The DPW worked with the communities in the three settlements at various levels of the project. It worked with the Settlement Executive Committees in the planning of fieldwork activities, logistics, and overall project coordination. It relied on government representatives to help with permissions and coordinate payments to workers. And finally, it recruited, trained, and paid the youth to carry out the work of data collection.

Recruitment Guidelines

Members of the community are best placed to carry out the data collection of their own settlements. The youth are particularly well placed because of their numbers, and familiarity with the new information and communication technologies, and

For this reason, the participants have to be recruited in an equitable manner, ensuring that the entire community is well represented.

The recruitment process has to rely on some general guidelines that have to be observed during the project. These considerations include gender, age, disability, number of applicants expected, and a brief description of what the recruitment process would look like for a participant.

Gender
In order to guarantee to learn from gender dynamics and participation for an eventual scale-up, it is strongly recommended a deliberate effort to enforce a 50% rate of participation of women. Through its task-based structure, the project should encourage women's participation by allowing workers to participate part-time and on a flexible schedule. To meet the target of 50% of the workforce being women, it is essential that the recruitment campaign market this opportunity to women and support them in the application process.

Age
It is important to determine the age group of the targeted population. Different generations have different experiences and some are more or less important for the project in question. One of the primary objectives of DPW was to engage unemployed youth, for this reason, the target population that was prioritized in recruitment efforts was young people between 18 and 35 years old.

Persons With Disabilities
It is strongly recommended that the project guarantees at least a 5-10% rate of participation among persons with disabilities. Digital work is more inclusive because it often relies on remote work and flexible schedules.

Number of Participants
The application process should be open to all and the number of participants for each settlement is to be determined proportionally based on the size of the settlements.

Qualification of Participants
The qualification of participants should not be based on academic qualification but rather that they have access to at least a mobile phone or a computer.

Application and Selection Process

The recruitment process has to be highly transparent and accountable. The starting point is to create an ad for the job and have it placed in strategic places in the settlements. The Settlement

Executive Committee, led by the local chiefs, has to be the entry point supporting the recruitment process. The recruitment itself process has to be highly reliant on collaboration with authorities both on the city and local levels for outreach and mobilization inside the communities.

The application process has to be open for at least two weeks to allow for as many people as possible to apply. The most effective way to carry out the application process is to open a venue in the community of question and have it open from morning until, allowing people to come there and apply in person. Additionally, the application should be made available online for those who can't come to the physical venue. It is also recommended that facilitators are made available during the application process to help people apply.

The main steps during the recruitment period are

1. Creating an outreach plan for each settlement.
2. Creating an ad and displaying it in public places around the community.
3. Transforming the application questionnaire to a digital form.
4. Opening a venue in each community and keeping it open for two weeks.
5. The applicants are required to fill in the form.
6. Facilitators are made available at each venue to help with the application process.
7. The data is sent to the database.
8. The implementation team reviews the data and makes it available for the selection of participants.
9. The participants are selected based on the recruitment criteria described above.
10. The selected participants fill in the second form that serves as a baseline to determine initial levels of skills before participating in the tasks.
11. The implementation team details the training requirements for each type of task and assigns each worker to a specific task.
12. After the work is complete, the participants are required to fill out a final form to assess their skills and level of satisfaction with the process.

DPW recruitment process included the following steps

1. KISIP and NMS and Spatial Collective set out a target to reach approximately 200-300 applicants in each settlement.
2. Ad was done and put up in the public places in the settlements.
3. The application form was transformed into a digital form.
4. A venue was opened in each settlement where applicants could come and apply in person.
5. Facilitators were made available at every venue to help with the application process.

6. The complete application required applicants to fill out a form with around 50 questions.
7. After applications were submitted, the implementation team reviewed the data and selected participants in each settlement based on the recruitment criteria.
8. A waiting list was created to allow for a smooth recruitment process in the event that selected participants decided not to enroll.
9. Participants were selected and organized into work groups.
10. Contact information of participants was obtained and included in the communication channels.



Step Five: Payment Structure

The payment mechanism should be designed to generate quality data, bring new income opportunities to youth, and incentivize the development of different types of skills. The payment should be organized as a payment-per-task incentive scheme by prioritizing the two principles: flexibility and incentivizing skill development through good quality of work.

Flexibility - The principle of flexibility is rooted in the fact that people are able to choose the time of day that they will work on the platform. This is especially important for members of the household that have additional work, study, or care responsibilities and are in need of more flexible time management.

Incentivizing skill development through good quality of work - The data has to be of the highest quality to support settlement upgrading. The best way to ensure the quality of work is through incentives in the form of a pay raise and 'promotion' or overtime work. Each member has to do a certain amount of work per day in order to receive minimum base pay. However, if they apply themselves and produce good quality work, they can earn extra cash each day. This means that extra pay, or bonus, is based on their performance granted according to the verified work quality. Additionally, the members that consistently produce good quality work can qualify for overtime, which usually consists of fixing other members' mistakes, for extra cash.

This payment per-task mode that is based on quality is designed to generate incentives for people to learn how to be better at task completion, which reflects better times per task, higher capacity to engage in more difficult tasks, and better quality. The best performers and highest earners can be considered to move up from task completion workers to data validators that supervise other workers.

The payment structure during DPW was as follows:

Payment Component	Description	Values
Basic Amount	Completion of the tasks assigned in a day	654 KES
Quality Bonus	If Quality < 60%	0% of the basic amount added and worker under review
	If 60% < Quality < 70%	5% of the basic amount added or 32.7 KES
	If 70% < Quality < 90%	10% of the basic amount added or 65.4 KES
	If 90% < Quality < 100%	15% of the basic amount added or 98.1

		KES
Overtime	One can qualify for extra work if the quality of their work consistently reaches between 90% and 100%	A maximum 25% for extra 2 hours of work or 163.5 KES
Total	The stipend received by the worker	Basic Amount (654) + Overtime (163.5 max) + Quality (98.1 max) = 915.6 KES



Step Six: Keep It Practical

With the rapid diffusion of digital technology, new patterns of collective action emerge. New tools decrease information costs which in turn enable large-scale coordination at low cost, leading to a situation where a loosely affiliated group can sometimes accomplish something more effectively than an established institution (Shirky 2008).

This approach aims to utilize new technologies to create high-quality data that can support the informal settlement upgrading in Kenya and elsewhere. The aim isn't just to create high-quality data but to also create short-term income-generating opportunities for Kenya's youth. The juxtaposition of innovative technology and citizens is at the center of this initiative.

To fulfill the requirements of the Kenya informal settlement Improvement project and at the same time create opportunities for youth to contribute and learn, several data collection modules are considered. These are

- Digitization of Buildings Using Aerial Imagery
- Data Collection on Public Amenities Using Mobile Phones
- Terrestrial Imagery Acquisition
- Micro-Tasking
- Household Survey

As it was mentioned in the recruitment and application section, the groups of youth were assigned to these modules to learn, work, earn, and contribute to the development of their communities.



Digitization of Buildings

Digitization of buildings is an act of using aerial imagery and GIS mapping software to trace over outlines of buildings. The outlines of digitized buildings represent a base layer or a foundation on which all the other data is built. For this reason, this activity comes first.

How is the digitization of buildings set up?

The first step in setting up the digitization activities is acquiring good-quality aerial imagery. This high-resolution aerial imagery can be acquired from pre-existing suppliers in Kenya.

DPW purchased high-resolution aerial imagery of the three settlements from Ramani Geosystems.

The second step in the digitization of buildings is choosing and setting up the software. There are several options that can be used and they range from proprietary ArcGIS Pro to open-source QGIS or Java OpenStreetMap Editor. Open-source software is recommended due to ease of use and cost. Another consideration when it comes to software is its capability to assign tasks and monitoring of work.

Because of the reasons stated above, the DPW project relied on the well-established Taskin Manager and Java OpenStreetMap Editor for digitization.

- **Taskin Manager**: is a tool for coordination of volunteers and organization of groups to map on OpenStreetMap. Tasking Manager enabled control of assigning digitization tasks to individuals.
- **Java OpenStreetMap Editor (JOSM)** is an extensible editor for OpenStreetMap.

The digitization tasks were assigned with the help of the Tasking Manager and the buildings were digitized using JOSM.

Once the image is obtained and the software selected it's time to set it up for use. The main goal is to digitize all the buildings in an organized manner and to ensure the quality is of an accepted standard.

To organize the digitization tasks for the youth, the DPW used Tasking Manager. The process of assigning tasks for digitization, the digitization itself, and finally validation was set up in the following way:

- Daily tasks were created with the Tasking Manager.
- Every morning, the youth log into the Tasking Manager, select the task, import it to JOSM, and start work.

- Each worker would digitize 200 buildings per day.
- Once the digitization was complete, the worker would upload the digitized buildings to OpenStreetMap and mark the task as complete in the Tasking Manager.
- The validator would then log into the Tasking Manager, select the completed task, and check for completeness and overall quality.
- The validator then keys the metrics into a data management system for each worker and for each day.

How were the digitizers paid?

All payments follow the principles described in the Payment Structure, these are

1. A **Base Pay** is received if an individual completes the digitization of 200 buildings per day, regardless of quality.

$$Base\ pay\ =\ 654\ KES$$

2. **Quality Pay** is received if an individual produces work that is between 60% and 100% accurate (check the breakdown in the Payment Structure). Each day, the workers' daily contributions are reviewed by the validators to determine the quality of work. The validators look for the following errors in digitization:
    - Missing buildings
    - Features misidentified as buildings
    - Improperly drawn buildings
    - Duplicates
    - Overlapping buildings
    - Improperly tagged buildings
    - Etc.

    The quality is then calculated in the following manner:

$$Quality\ of\ work\ (\%)\ =\ \frac{Errors\ in\ digitization}{Digitization\ contributions}$$

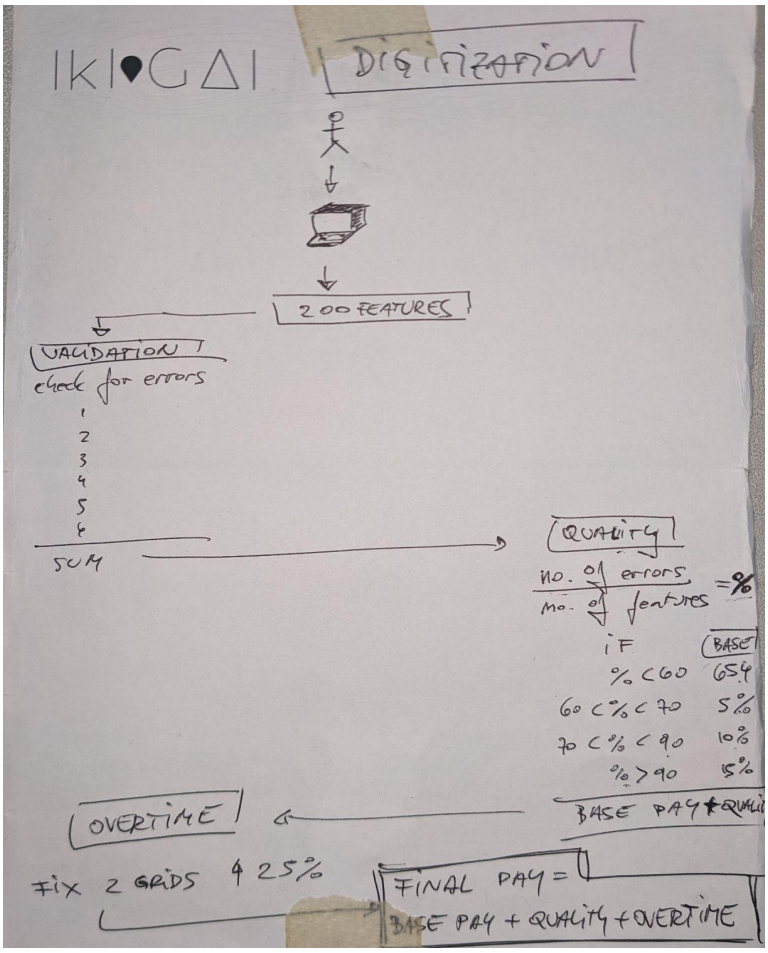
3. Overtime is received if an individual carries out overtime work to which they qualify if they consistently produce work that is between 90% and 100% quality. The overtime consists of reviewing the contributions of other peers.

$$Overtime\ =\ 25\%\ of\ Base\ Pay$$

4. The overall pay for the worker for the day is calculated in the following manner:

$$Total\ pay\ =\ Base\ pay\ +\ Quality\ of\ work\ (\%)\ +\ \ Overtime$$

The diagram visualizing the process for digitization can be found below:



An example from DPW.

An individual was assigned 200 buildings for digitization in a day. Once they completed the digitization their work was verified by an experienced validator. After review, it was determined that they made 14 errors. Their pay for the day was calculated in the following manner:

$$Base\ pay\ =\ 654\ KES$$

Base pay was received if an individual completed all 200 tasks.

$$Quality\ of\ work\ (\%)\ =\ \frac{Errors\ in\ digitization}{Digitization\ contributions} = \frac{14}{200} = 0.07$$

In this case, the quality estimate was 93%. That means that according to the payment structure, the worker qualified for an additional 15% of the basic amount, or 98.1 KES.

Finally, if the digitizer was someone who consistently produced good quality work, they qualified for overtime, which means that after they completed their work, they reviewed two randomly assigned tasks from their peers. They were able to earn additional

$$Overtime = 25\% \, of \, Base \, Pay \, or \, 163.5 \, KES$$

In this case, their final daily pay was:

$$Total \, pay = Base \, pay + Quality \, of \, work \, (\%) + Overtime$$

or

$$Total \, pay = 654 \, KES + 98.1 \, KES + 163.5 \, KES = 915.6 \, KES$$

In this case, the worker received the maximum amount of money possible that day.



Data Collection Using Mobile Phones

Mobile data collection is a process that utilizes widely available smartphones and specialized software to collect location and attribute data on public amenities. This method of data collection requires physically deploying mapping teams on the ground to visit points of interest as indicated in the data model.

How is the mobile data collection set up?

The goal of mobile data collection is to acquire location and attribute information on public amenities, such as buildings, schools, hospitals, public toilets, public transportation stops, streetlights, public spaces, playgrounds, administration buildings, safety, and security features, etc. For this reason, the first step in mobile mapping is to determine which points of interest are necessary to collect.

Once the list of features is set, the team has to design the data model. The data model determines the level of detail of information that has to be obtained for each feature. For example, if the feature in question is a school, the information of interest can be the location of the school, the number of students and teachers, the number of classrooms, whether the school has electricity, etc.

This data model is then transformed into the questionnaire and transferred into an Internet-enabled data collection software. There are many mobile data collection software available, such as OpenDataKit, ONA, OpenMapKit, KOBO Toolbox, etc.

Once the data model is defined and the software is set up, the fieldwork has to be organized. The whole settlement is divided into sections of roughly equal size to ensure consistency of data collection and easier monitoring of activities.



The data collectors are then divided into groups of 2 and assigned to each area. The youth perform their assigned tasks in one area for one to two days then they rotate to a different area. In this way, the project avoids the repetition of tasks and burnout of both workers and the community and compares the quality of each worker to other workers.

The data provided by the youth is evaluated based on a set of criteria, these are

1. Location Accuracy: geospatial location has to be accurate in order to know where the point of interest is located.
2. Form Completion: all the fields in the questionnaire have to be represented with data.
3. Duplication of work by individuals: the work must not be duplicated, meaning, the youth from the same group cannot collect the same information on the same feature/amenity.
4. Duplication of work of other groups: the groups of youth have to coordinate with each other to avoid duplication of data collection.

The main steps in mobile mapping are

- Determine which amenities to capture.
- Create a data model.
- Create a survey for data collection.
- Set up mobile phones and a base map.
- Train the workers on how to collect amenities data.
- Carry out data collection.
- Validate and process the data.

After the data collection is complete it has to be validated.

To organize the mobile mapping tasks for the youth, the following methodology was used during the DPW project:

- Each morning, the youth were briefed on the points of interest to be captured.
- The youth downloaded the required forms from ONA to their phones.
- They were assigned an area in which to collect data.
- The youth went to the field, collected the data, and sent it to the server.
- The data were run through a computer script to check for completeness and overall quality of work.
- The validator then keys the metrics into a data management system for each worker and for each day.

The payment of mobile mappers

All payments follow the principles described in the Payment Structure, these are

1. A **Base Pay** is received if an individual completes the mapping of 30 buildings per day, regardless of quality.

$$Base\ pay\ =\ 654\ KES$$

2. **Quality Pay** is received if an individual produces work that is between 60% and 100% accurate (check the breakdown in the Payment Structure). Each day, the workers' daily contributions are reviewed to determine the quality of work. The quality is calculated and weighted based on the following:
    - Location Accuracy is determined by the distance between the location selected by the data collector and the point of interest (these were determined in advance).

$$Location\ Accuracy\ (LA)\ =\ 15\%\ of\ the\ total\ quality$$

    - Form Completion: each missing field in the form was tagged as an error.

$$Form\ Completion\ (FC)\ =\ 35\%\ of\ the\ total\ quality$$

    - Duplication of Work by Individuals: if the worker collects data on the same amenity multiple times.

$$Duplication\ of\ Work\ by\ Individuals\ (DWI)\ =\ 25\%\ of\ the\ total\ quality$$

    - Duplication of Work of Other Groups: if workers assigned to the same area collect data on the same amenity multiple times.

$$Duplication\ of\ Work\ of\ Other\ Groups\ (DWOG)\ =\ 25\%\ of\ the\ total\ quality$$

    The quality is then calculated in the following manner:

$$Quality\ of\ work\ (\%)\ =\ LA\ +\ FC\ +\ DWI\ +\ DWOG$$

3. Overtime is received if an individual carries out overtime work to which they qualify if they consistently produce work that is between 90% and 100% quality. The overtime consists of collecting extra 10 points of interest.

$$Overtime\ =\ 25\%\ of\ Base\ Pay$$

4. The overall pay for the worker for the day was calculated in the following manner:

$$Total\ pay\ =\ Base\ pay\ +\ Quality\ of\ work\ (\%)\ +\ \ Overtime$$



Terrestrial Imagery Acquisition and Image Processing

The terrestrial camera is used to capture street-level images of the environment. These images can then be used to extract geo-located features using a geographic information system environment or through micro-tasking using mobile phones.

A methodology such as this has the potential to generate a lot of data within a very short period of time, and, more importantly, it offers a suitable solution for data collection during the Covid-19 pandemic, when human interaction is discouraged.

Street-level mapping of the settlements can capture images of all the roads, streets, and alleyways. The resulting imagery dataset can be published on the Data Trust, such as PLACE, for post-processing and easy access.

Image acquisition

Terrestrial imagery can be obtained by using specialized cameras. These can be simple and easy to use such as GoPro Max which enables the capture of 360-degree images, or heavy-weight and sophisticated cameras such as Insta 360 which enables mapping-level of quality.

Fieldwork should start with a reconnaissance mission to observe the characteristics of the environment. The building extraction, described in the Digitization of Buildings section, can be used to plan the routes. The fieldwork should be planned in a way that eliminates duplication of measurements, meaning, each route is only captured once.

The main steps in capturing terrestrial imagery are

- Planning the routes.
- Informing the local area chief of the mapping activity.
- Setting up the camera to take an image every 7 seconds, gyroscope stabilization, and GPS connectivity.
- Going to the field and walking the routes according to the plan.
- Reviewing and transferring the image to the hard drive.
- After the imagery is collected, prepare it for post-processing.

Digital Public Works project collected approximately 7,000 terrestrial images.

Image post-processing

The most important post-processing activity is ensuring **the protection of privacy and preventing the identification of individuals** in those images. Each image has to go through the following post-processing steps before it can be used:

The main steps in post-processing are

- Anonymization of images to blur Personally Identifiable Information.
- Orientation of anonymized images.
- Cropping of anonymized images to remove fish eye lens distortion.
- Shrinking the anonymized images to reduce their size.
- Uploading to the server ready for micro-tasking.



Micro-Tasking

This is a process of dividing a high-volume job into small tasks that can be distributed over the internet to many workers. These tasks are normally repetitive in nature and can be performed independently and remotely. Micro-tasking, when coupled with the near-universal use of smartphones, provides an opportunity to engage hundreds of workers to remotely generate large sums of datasets in a short amount of time. Using various software platforms, the project can develop a series of micro-tasks, train workers on how to sign up for and carry out micro-tasking assignments and work with them to generate data on urban infrastructure features within their settlements.

How to set up micro-tasking?

Micro-tasking is intimately connected with terrestrial imagery described in the previous section. The single micro-task consists of workers identifying various features on the imagery and then tagging them as such. Each image is georeferenced both locationally and temporally and for this reason recognizable in space and time. When a worker identifies a feature on the image and tags it, it ties the feature to that location and that time. In this way, we can identify the location of any feature we are interested in.

To set up micro-tasking, terrestrial imagery has to be collected and processed. This part of the work is described in the previous section.

Once the images are processed for use, the software which allows for image tagging has to be set up. There are a few options available, however, only two were tested for the purpose of this PlayBook. The first is Google's Task Mate and the second is Spatial Collective's Micro-Tasking Tool.

The main steps in micro-tasking are as follows

- Organizing images into batches of 300 to be done by workers on a daily basis
- Assigning the organized images a specific question
- Creating distinct lists of workers who will swipe through the organized images
- Uploading the questions, worker lists, and images to Task mate and Micro-Tasking tools
- Workers then login to either of the tools and access the question they have been assigned
- Workers swipe through the images identifying the features in the question
- Validation of work done on a daily basis

Consensus

Consensus is a general agreement of what is represented in the image. Consensus is one of the most important features of micro-tasking because it is directly tied to accuracy which in term is tied to the quality of work and subsequently to payments of workers.

To best way to explain consensus is to ask: How does one know whether a feature, tagged by the workers on an image, is truly represented in that image, and by extension in that location?

The best way to determine whether a certain feature is truly present in the image is to crowdsource that image to a number of people and ask them their opinion. If a majority of the people say that the feature in question is in the image, then we can assume that it is so. The majority of people that agreed are within a consensus.

The consensus is best represented as a percentage. Through a series of testing, it was shown that a 70% threshold for consensus works well. This means that if 70% or more people agree that a feature is represented in an image, then the consensus is reached, and one can assume with a certain degree of confidence that that feature is indeed in that image and in that location.

But what about if 50% of the people say that a feature is represented in an image and 50% say it is not? In this case, it cannot be determined with certainty that a feature is or is not in that image. If the opinion is divided, and the confidence falls anywhere between 70% and 30%, then that image is put for further review.

The breakdown of consensus is as follows

$$100\,\% \geq Consensus\ is\ reached\ (feature\ is\ present) \geq 70\,\%$$
$$69\,\% \geq Image\ needs\ further\ review \geq 30\,\%$$
$$29\,\% \geq There\ is\ no\ feature\ in\ that\ image \geq 0\,\%$$

The payment for micro-tasking is organized around consensus

All payments follow the principles described in the Payment Structure, these are

1. A **Base Pay** is received if an individual completes the micro-tasking of 300 images per day, regardless of quality.

$$Base\ pay = 654\ KES$$

2. **Quality Pay** is received if an individual produces work that is between 60% and 100% accurate (check the breakdown in the Payment Structure). Each day, the workers' daily contributions are reviewed by the validators to determine the quality of work.

The quality of micro-tasking work is intimately tied to the consensus described above. The quality of each worker's contributions is evaluated based on the number of times they are within consensus (70% - 100%), in between (69% - 30%), or out of it (29% - 0%).

The **Quality Pay** for that worker is evaluated as follows:

Each time the worker is within consensus they are awarded a full percentage point; each time they are in between they receive half a percentage point; and each time they are below 30% they receive 0 points.

Half a percentage is awarded because one cannot say with certainty that a feature is or is not represented in an image and the workers shouldn't be penalized for uncertainty.

$$Quality\ of\ work\ (\%)\ = \frac{Within\ consensus}{Number\ of\ images} + \frac{In\ between}{Number\ of\ images} \times \frac{1}{2}$$

3. Overtime is received if an individual carries out overtime work to which they qualify if they consistently produce work that is between 90% and 100% quality. The overtime consists of reviewing the contributions of other peers.

$$Overtime\ =\ 25\%\ of\ Base\ Pay$$

4. The overall pay for the worker for the day was calculated in the following manner:

$$Total\ pay\ =\ Base\ pay\ +\ Quality\ of\ work\ (\%)\ +\ \ Overtime$$

An example from DPW.

For example, 1 worker will be assigned to review 100 images. At the same time, a number of other workers, let's say 99, are reviewing the same 100 images. This means that 100 workers are reviewing the same 100 images. In this way, consensus statistics can be built for each image and for each worker.

The payment is organized as follows

$$Base\ pay\ =\ 654\ KES$$

Base pay was received if an individual completed all 300 tasks in a day.

At the end of the workday, one worker's statistics reviewing 100 images are as follows

$$Within\ consensus\ (70\ \% - 100\ \%) = 73\ times$$
$$In\ between\ (69\% - 30\%) \geq 6\ times$$
$$Out\ of\ threshold\ (29\% - 0\%) = 21\ times$$

The quality of work is calculated as follows

$$Quality\ of\ work\ (\%) = \frac{Within\ consensus}{Number\ of\ images} + \frac{In\ between}{Number\ of\ images} \times \frac{1}{2}$$

in this worker's case, the quality is

$$Quality\ of\ work\ (\%) = \frac{73}{100} + \frac{6}{100} \times \frac{1}{2} = 76\%$$

The worker reached the quality of work at 76%, for this reason, he receives a quality bonus of 10% of the basic amount added or 65.4 KES (see the Payment Structure).

If the worker consistently produces good results they qualify for overtime, which is reviewing 50 extra images and earning additional

$$Overtime = 163.5\ KES$$

Finally, the worker's payment for the day was:

$$Total\ pay = Base\ pay + Quality\ of\ work\ (\%) + Overtime$$

or

$$Total\ pay = 654\ KES + 65.4\ KES + 163.5\ KES = 882.9\ KES$$

Household Socio-Economic Survey

“Household surveys are questionnaires that are given to a sample of households in a population.”[2]

The household survey follows the same principle as mobile mapping in that it utilizes widely available smartphones and specialized software to collect data.

In a similar fashion to mobile mapping, the household survey requires a questionnaire. In this case, the interest is more on peoples’ experiences than publicly available information.

The best way to carry out a household survey is to randomly select the households to ensure good representation throughout the settlement. The question is, how do you carry out a random selection of households in areas without street addresses?

Random selection can be performed using the QGIS Research Tool which allows for the randomization of datasets. Any number of random buildings can be selected in this way.

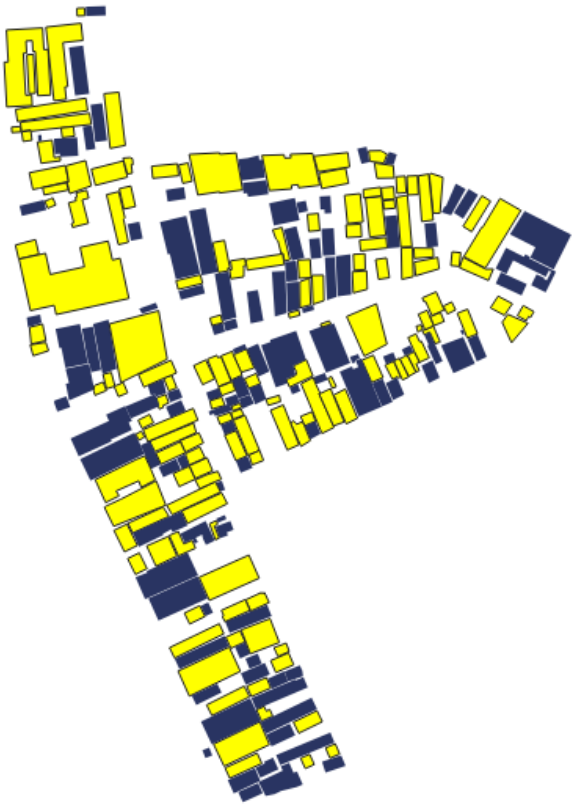
Once the buildings are selected, their locations are loaded on the mobile phones as a base map and tied to the questionnaire. To complete the survey, the enumerator walks to the selected household, presses its location on their mobile phone, and fills in the questionnaire.

Steps in carrying out a household survey are as follows

- Questionnaire is developed.
- Questionnaire is transformed into a digital form using KOBO Toolbox and uploaded on mobile phones.
- Target households are randomly selected using building outlines.
- Locations of selected households are loaded on the mobile phones as a base map.
- Field surveyors are recruited and trained to carry out the survey.
- In the field, they use the base map - digitized buildings and selected buildings - to navigate to the selected house.
- Once at the selected household, the surveyors use the KOBO Toolbox on their mobile phones to complete the survey and send the data to the server for storage and review.

Digital Public Works project randomly selected households in each settlement to carry out the survey. At the end of the exercise, 684 household surveys were carried out.

[2] See: https://www.sciencedirect.com/



150 randomly selected households (yellow) in Embakasi Sokoni

NOTE: Due to time constraints, the household survey didn't follow the payment structure. The best data collectors from previous tasks were selected to carry out the work and got paid the maximum amount.

Step Seven: Communication and Monitoring

Clear, concise, and timely communication is essential in any project, especially a project involving hundreds of people. Communication has to be relationship-centered, meaning, it has to allow for a free flow of information among all the participants. It has to enable people to speak their own voice and give them the power to not only passively receive information but to participate, lead, and design the process itself.

Communication technology has to be inclusive, simple, and, if possible, free. It has to allow anyone to participate in their own language and voice, using available devices, such as mobile phones, and it has to support organizing, monitoring, and communications.

To support human-to-human communication for the purpose of organizing and communications, the Digital Public Works project set up communication channels using the KatiKati platform. With Katikati, DPW was able to build mobile-text-based, one-on-one, or group conversations using a simple (and free for youth) shortcode.

Link: https://www.africasvoices.org/tag/katikati/

One of the most important features of the DPW work is near real-time monitoring of activities. Monitoring touches on keeping track of the project's activities, recording and observing the progress of youth, and evaluating the quality of the data produced.

To provide almost real-time monitoring of activities, the DPW set up the Caspio platform. The platform enabled the creation of custom web forms, searchable databases, multi-user portals, interactive dashboards, and automated workflows.

Link: https://www.caspio.com/

Outputs

Following the steps in the playbook, one can expect several outputs tailored to support the Kenya Informal Settlement Improvement Project. The main objectives of the project were to provide short-term employment opportunities to the Kenyan youth while at the same time generating data that informs the Kenya Informal Settlement Improvement Project. For this reason, the main outputs can be divided into two categories:

1. Youth Employment: how many youths participated, for how long, how much did they earn, and what did they learn
2. Geospatial and Statistical Data: what type of data was collected

The examples of outputs below will touch on the Digital Public Works project carried out between April and September 2022.

Youth Employment

Following the recruitment, application, and selection guidelines, one can expect to attract youth from the community ranging from all education and income levels, all genders, and persons with disabilities.

Providing employment and learning opportunities to Kenyan youth was one of the major goals of the DPW project. In the end, 282 youths participated in the activities spanning nearly 5 months. The youth were put into different training modules based on their preference as well as project needs. The breakdown of youth per settlement can be seen below:

Settlement	The total number of youth engaged	The total number of men	The total number of women	Number of able-bodied participants	Number of persons with disabilities
Embakasi	74	23	51	60	14
KCC	99	34	65	92	7
Kahawa Soweto	109	40	69	103	6
Total	**282**	**97**	**185**	**255**	**27**

Each youth participated for at least two months. Depending on the module they were placed in, they learned how to digitize aerial imagery using Tasking Manager and Java OpenStreetMap Editor; how to collect data on structures and public amenities using mobile phones and ONA software; how to use GoPro and Insta 360 cameras to collect terrestrial imagery; how to use Google's Task Mate and Spatial Collective's micro-tasking tool to tag imagery; and how to carry out the household survey using mobile phones.

At the end of the five-month-long stretch of the DPW project, the youth collectively made 6,075,354 KES.

Geospatial and Statistical Data

Completing the practical steps described in chapter **SIX** can produce a variety of datasets, all relevant to informal settlement upgrading. These data can be divided into sections based on the data module.

Building Extraction

The Digitization of aerial imagery produces building outlines. These outlines represent a base layer or a foundation on which all the other data is built.

By using high-resolution aerial and satellite imagery, the youth working with the DPW project traced the outlines of buildings to produce more than 350,000 digitized buildings. These buildings encompassed the three settlements in question, as well as the surrounding areas, and were used as the base layer for all other activities.



All the buildings digitized in the three settlements

Data Collection Using Mobile Phones

Mobile data collection is designed to acquire the location and attribute information on public amenities.

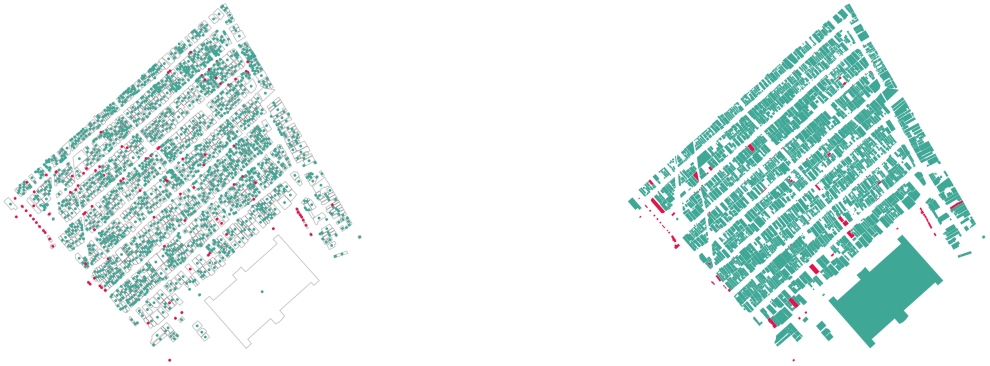
During DPW, the youth used mobile phones and ONA software to collect location and attribute data on buildings and other public amenities. More than 10,000 points were collected in this way.

The mobile data collection was divided into data collection on buildings and data collection on amenities that aren't attached to the buildings.

Data collection on buildings included gathering information on building status, use, building materials, condition, roof, access to water and sanitation, etc. The youth visited every building in the three settlements to gather the required information as seen below.

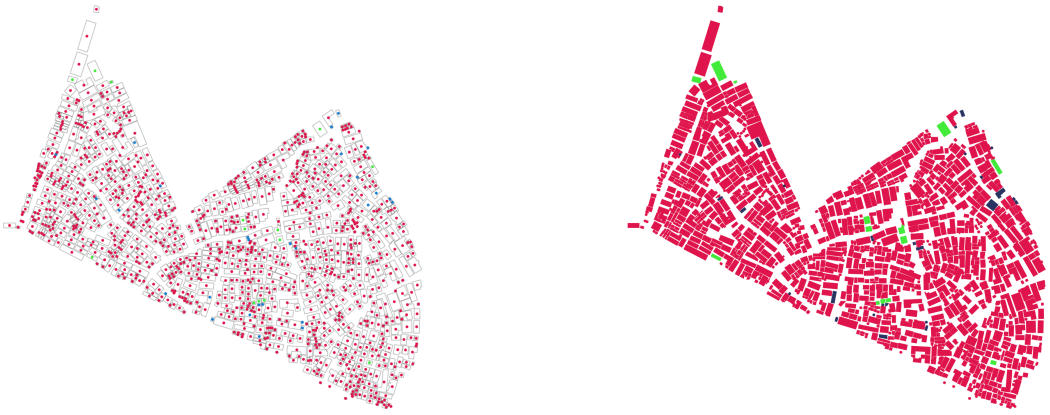


Embakasi Village access to electricity mobile points (left) and attributes attached to buildings (right)



KCC Settlement access to piped water mobile points (left) attributes attached to buildings

(right)



Kahawa Soweto building status mobile points (left) and attributes attached to buildings (right)

The second part of data collection using mobile phones touched on amenities that aren't tied to buildings, such as streetlights, water points, public toilets, solid waste locations, etc. Below is an example from Kahawa Soweto.



Mobile points include public toilets, solid waste management sites, and public water points in Kahawa Soweto

Terrestrial Imagery Acquisition

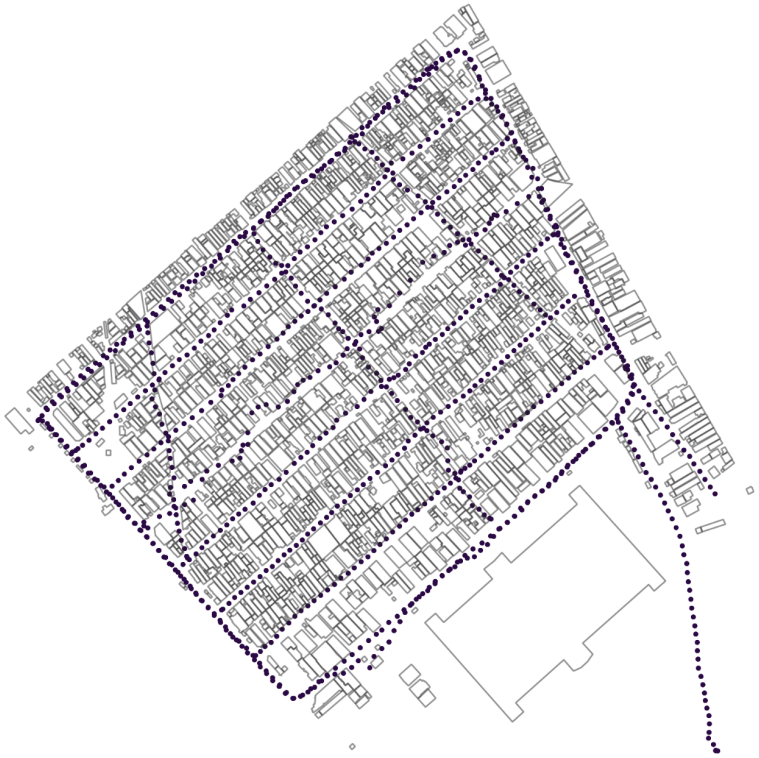
Terrestrial imagery is obtained using specialized cameras, such as the simple and easy-to-use GoPro Max, or heavy-weight and sophisticated cameras such as Insta 360 which enable mapping-level of quality.

Using these cameras, the youth collected almost 7,000 terrestrial images of the three settlements. These images were later anonymized and used in micro-tasking through image tagging.



Terrestrial imagery was collected and anonymized for further use

The map below shows all the locations of the 360-degree imagery collected in KCC Settlement.



Micro-Tasking

Micro-tasking divides high-volume jobs into small tasks that can be distributed over the internet to many workers. Micro-tasking is intimately connected to the terrestrial imagery described in the previous section. The single micro-task consists of workers identifying various features on the imagery and then tagging them as such.

During the DPW, the youth created over 1,3 million tags on 7,000 images collected with terrestrial cameras. By tagging the imagery, the youth built a consensus of what is and isn't in those images. Some of the amenities that were identified by using micro-tasking were locations of mobile money operators, street vendors, mobile money agents, kindergartens and schools, religious institutions, businesses, and other public features.

Micro-tasking data is presented in location clusters. These clusters indicate the general area where a certain feature is or isn't. The clusters are necessary because micro-tasking relies on imagery taken from the middle of the road, and for this reason, the points of interest can only be shown at a general location as opposed to the exact location.

An example below shows the clusters or general locations of religious institutions in blue and schools in pink in Embakasi Sokoni.



Location cluster of churches (blue) and schools (pink) in Embakasi Sokoni

Household Survey

The aim of the household survey is to obtain socio-economic indicators on the population in question as well as peoples' experiences about a certain topic.

During the DPW project, the youth carried out 684 household surveys in the three settlements. The household survey had about 50 questions touching on the five topics relevant to KISIP. These include investment selection, disaster risk management, solid waste management, socio-economic inclusion, and crime and violence

Some results of the survey can be found on the data dashboard developed for KISIP.

Data Dashboard

The dashboard was developed by spatial Collective and it visualizes data on urban infrastructure in the three informal settlements.

Link to the dashboard: http://kisipdpw.co.ke/

Recommendations

These observations and recommendations are based on the months of practical work running the DPW project. They touch on all the steps described in the previous sections.

- Identify the authorities involved to better coordinate activities, obtain information, carry out community sensitization, and release the funds.
- Determine the roles of all the stakeholders to speed up the implementation of the project. Who is responsible for sensitization of communities, releasing of funds, coordinating activities, providing feedback, resolving grievances, etc.
- Organize the working group that includes representatives from each stakeholder group.
- KISIP should carry out initial sensitization of communities before the contractor sets out to carry out the work.
- Organize the technical working group to design the data model. The precise data model that is agreed upon by all parties speeds up the process significantly.
- Improve the way of selecting youth. While using computer software and indicators is a transparent way that removes bias and favoritism, it is not necessarily accepted by the community.
- Clarify requirements for payments of youth, for example, which information is required, provide a timeline for the disbursement of funds, who is responsible for sharing payment updates, and provide confirmation of payment to the stakeholders.
- Set up the venue with high-speed internet in every settlement. The venue provides a safe working environment for the youth and a place for the coordination of activities and logistics. A venue should be in the community and community-owned. It needs to have basic infrastructure and should be well ventilated, have electricity, water, toilets, tables, and chairs.
- The implementing partners should have a continuous presence in the community from start to finish. SEC and GRC should also be present on a daily basis to help with the coordination of activities and resolving grievances.
- The project has to have open communication channels that operate on various levels, from word of mouth and public forums to text messages and online.
- Set up software for near real-time monitoring of activities that keeps track of the project's activities, allows for recording and observing the progress of youth, and evaluates the quality of the data produced.