



# Urban vulnerability mapping

11 SUSTAINABLE CITIES  
AND COMMUNITIES



Participatory Data  
Collection and Mapping  
of Urban Communities

toolkit



PULSE  
LAB JAKARTA



Australian Government







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# Foreword


Most of the discourse and practice connected to data innovation for development is stuck in an extractive paradigm. By this we mean that the data on local social, environmental and economic trends is extracted to inform central decision-making. It disappears up the hierarchies of public administrations and development agencies never to be seen again by the the subjects of the data, and ironically away from those who could better interpret and benefit most from its insights.

Jeffrey Sachs offers a perspective that one way to improve data collection and use for sustainable development is to create an active link between the provision of services, the collection and processing of data for decision-making and the communities that benefit from the services. He refers to the potential of technology to this end.

Indonesia continues to experience new waves of decentralisation. In parallel to this trend, though not connected, is the observed increase in open and affordable technologies for data collection. Whether for geospatial mapping, remote sensing, digital surveys or mobile communications, user-friendly and increasingly affordable technologies are available to communities, enabling a greater understanding of their context and increasing influence through hard evidence.

Pulse Lab Jakarta (PLJ) provided a grant of US\$10,000 to the Urban Poor Consortium (UPC) to conduct a two-month project from July–September 2015, entitled Mapping Vulnerability in Urban Communities. The Urban Poor Consortium (UPC) together with Peta Jakarta and d-associates architects formed a partnership to pilot a community-led data collection approach in two kampung (communities) in North Jakarta.

In the context of the Sustainable Development Goals, the key result of this project is the development of local approach to community empowerment through collaborative data collection and mapping of urban communities. Sustainable Development Goal 11 on making cities and human settlement inclusive, safe, resilient could be informed by this approach.

Derval Usher  
  
Lab Manager  
Pulse Lab Jakarta



# Summary

Urban Poor Consortium and its partners tested an integrated method for data collection, management, and visualisation to empower citizens to be more actively involved in the production and updating of data, as well as in determining policy priorities based on these data.

This toolkit provides the methodology for focusing the data-gathering power of existing communities, increasing their capacity to work together and building awareness of the potential of the data created by this work.

The power of this toolkit lies in how it can help citizens identify and articulate their own problems using the supplementing data in their communities.

Team of citizens and municipal governments can choose what issues they want to address (water quality, land disputes, government welfare distribution, etc) and using their own local knowledge, they can differentiate between problems they can and cannot solve alone, and then create targeted strategies to address them.

This toolkit empowers communities to tackle their own problems quickly and efficiently. If it does not lead to solutions, the visualizations that emerge can lead to discussions with government and other parties that can pave the way for improvements.

This model can be scaled from a small neighborhood all the way up to whole cities.

With local knowledge, issues can be mapped in a meaningful way that outside parties cannot match.



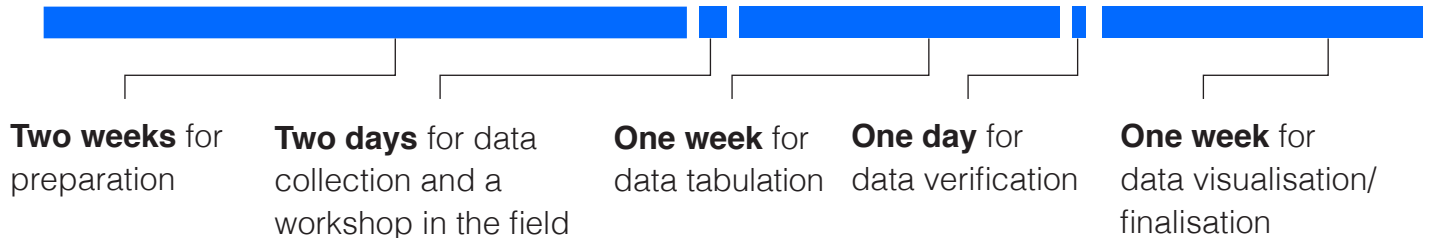


# Collaborative data collection and mapping of urban communities:

## in a nutshell

The amount of time required depends on area density, the number of available volunteers, the level of mapping detail required and most importantly the willingness and readiness of the wider community. There are two options: a) rapid mapping to immediately showcase results to the community to prompt a rapid response; or b) detailed mapping to get a deeper understanding of certain issues or areas, which will result in a longer mapping time.

### Total timeframe: 1 Month



### Resources

GPS tracker  
Smartphones  
Laptop  
Open Street Map and  
Fieldpapers account

### Team (External)

Community: 5-20 people.  
Facilitators: 3-5 people

### Cost

10,000 USD

# How to read this booklet?

Use the **Understanding the Project** section to introduce yourself to the ideas and methods presented in this booklet.

Use the **Workbook** section as your practical guide to every stage of the project. This is an individual pull-out booklet/manual for planning to take with you in the field.

Use the **Poster** for your workspace to remind your team what they are working for, and where they in the process. This is a pull-out that you can put up on the wall.





# Understanding THE PROJECT



## Intro to the Team

### Residents:

**Mapping Group:** Teenagers are smartphone-savvy, well-networked, have time and are often creative. This helps with technical issues, data collection and visualisation.

**Household group: Ibu-ibu** - The community's women and mothers possess a lot of information and involving them is crucial for determining and targeting the community's concerns and actions for the future.

**History group:** the rest of the community, particularly the elders

Communities can add extra topics/activities to their timeline to help customise it to their village.

### UPC:

Community Officer: One individual

Support group: Up to five individuals

## Who has done this before?

### Gugun Muhammad

Urban Poor Consortium

### Ariel Shepherd

Spatial Planner/ Researcher and  
Community Liason of PetaJakarta.org

### Yantri Dewi

Independent Researcher for Spatial Planning at  
UPC

### Kamil Muhammad

D-associates



## Summary Of Case Studies

### Kampung Budi Dharma

- Residents evicted by PT. Pulomas in 2010. PT. Pulomas suggested they build a new village nearby. The new village is still in the same area. During the eviction, some people were very reluctant to move.
- Flooding in the village before and after the evictions.
- The name of the village is taken from the Budi Dharma Factory nearby.
- “Street seller” is the most common profession.

### Kampung Volvo

- Residents originally came from outside Jakarta. They built street food shops before they built their houses.
- Village was evicted because the government is planning to build an RPTRA (public space for children).
- Each family spends Rp 400,000 a month on clean water.
- “Food seller” is the most common profession.

### Kampung Bayam

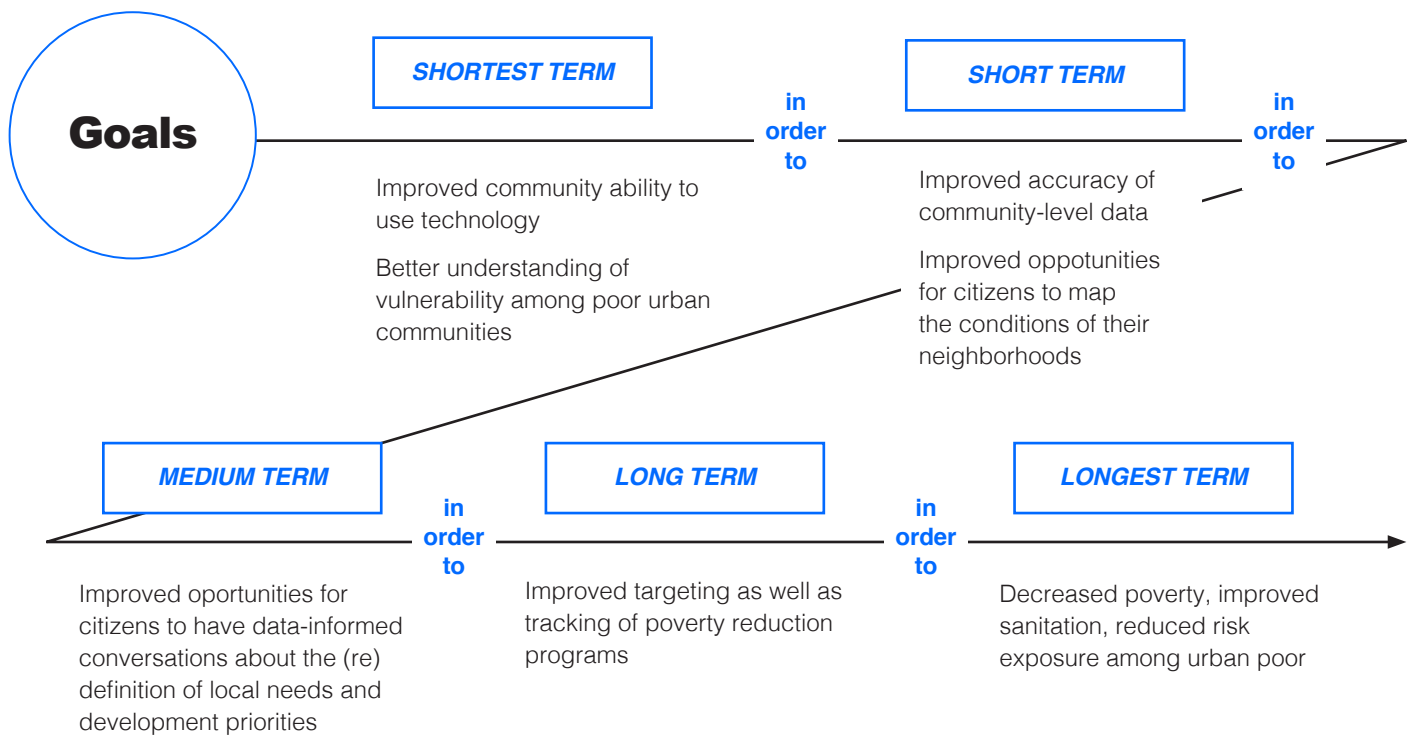
- Village originally built on empty land but was later hit by a land dispute.
- The area is of value because it is near a railway, a dam and a highway.
- The village name comes from the spinach grown on the fertile soil there
- “Labourer” is the most common profession of the residents.

*\* Kampung Bayam, failed during project implementation, due to a political conflict. UPC changed location to Kampung Volvo.*



# Why participatory mapping?

This approach is for anybody who is looking for an integrated method for data collection, management, and visualization that would empower citizen to be more actively involved in the production and updating of data, thus ensuring validity and accessibility, as well as in determining policy priorities based on these data.



## Co-create with whom?

This exercise works best in a community that has:

### 1. Clearly defined problems or opportunities.

It is important to ensure that there are strong issues to tackle. Issues can be anything from eviction threats, to flooding, to new government policy on identity cards, to solid waste management.

### 2. A community leader with significant influence and legitimacy.

The role of liaison within the team which serves as contact person for the community leader is also important. The liaison must communicate the objectives of the exercise clearly.

### 3. A cohesive community that can provide a good example to others.

Community buy-in is fundamental; it helps sustain cooperation.



# Work book



## OUTLINE OF ACTION PLAN

### **Step 1: Approach the community**

(WORKING WITH LEADERS, FOCUS  
GROUP DISCUSSIONS AND POPULATING  
THE TEAMS)

### **Step 2: Prepare for data collection**

(TIME, TEAM AND TOOLS)

### **Step 3: Data Collection Day**

(DATA-GATHERING)

### **Step 4: Making sense of the data**

(TABULATION AND  
VISUALIZATIONS)

### **Step 5: Conclusion**

(DECIDED BY  
COMMUNITY)



## STEP 1:

# Approach the community



This is the first step which can take almost 75 percent of the project's timeframe. You need two to six weeks, approximately, to engage with residents in the community to explore vulnerability issues and to introduce the purpose, as well as the method, of the project.

Community meetings entail discussions about present as well as historical community conditions and experiences. This also includes a presentation on the purpose of the data collection and a discussion, with the help of facilitators, on the expected benefits to the community of engaging in this data collection exercise.

## How do you “pitch” the exercise to the community?

- The community must be able to understand the benefits which may appear minimal to some community members. The primary benefit is to be prepared for various future eventualities. The Indonesian idiom “prepare the umbrella before it rains” may be useful way to explain benefits.
- Involve the community and existing sub-communities in as many activities as possible. For example some of the mapping may be beyond the capabilities of some local residents, but other mapping tasks are easier and they will be able to complete them.
- Consider data security and privacy. Data can be sensitive, and some residents may be scared about what will happen after data is collected — how will it be used? So it is important to ensure that data collection is conducted with consent and used responsibly. It is important to communicate these aspects of the project to residents.

## TIPS

**It is important to have a smart facilitator with a strong ability to engage with the community. The facilitator should be able to show the community why they should want to engage in the project.**



## STEP 2:

# Prepare for data collection



### The Team

#### Number of people

The team needed for data collection depends on the size of the village. You can start with few people — perhaps 5 — and build up as others take an interest in what the volunteers are doing.

#### Requirement

The number one requirement is a willingness to participate. If a given individual knows about the history of the village and is willing to volunteer: that's great. If they do not know much about the village then that is also OK. If they are part of an existing group or “sub-community” that may be even better as they have a ready-to-use network of data collectors. What is most important is that these community members are keen to be involved.

#### Selection process

Typically the CL (community leader) will select team members. In some previous exercises, the community members did not volunteer and instead the CL told people what their roles would be.

# The Tools

Take a look at our fold-out poster, which maps these options. You can put that up in your room so everyone can see how the process works and how they fit in!



## Software Options

### Mapping

#### Fieldpaper

Converts paper-based maps into a digital format.  
Enables plotting on paper.

#### QGIS

Links the survey information from Google Forms with spatial information from Fieldpaper into an interactive map.

#### Google Maps

To locate social/public service facilities within a given radius.

#### Open Street Map (OSM)

For help with creating visualisations.

### Data Management

#### Google Documents (including Google Forms)

Free digital surveys tool compatible with android devices.

#### Open Data Kit

Another example of open-source software for data collection.

### Visualisation

#### CartoDB

An online application for publicly sharing geospatial data visualisations.

#### Pictochart

Links directly to GForms to increase the quality of visualisations.





## Hardware Options

These are the physical tools you can use to gather and analyse data.

### 1. GPS Tracker

Adds spatial information such as small roads and landmarks in the kampung. Can help but should be used with reference to maps to compensate for inaccuracy.

### 2. Laptop

Collate all your data here. Must have a computer to run the survey software that you choose to use. Respondent can complete the survey on the laptop.

### 3. Mobile phone (Android)

Can be used for the GPS Tracker and the Google Form.

## How to combine the tools:

Different elements can be plugged into the toolkit depending on time, capacity, energy and resources. The amount of time required depends on area density, the number of available volunteers and the level of mapping detail required.

- The most basic one day version uses only Google Forms with a laptop and comes with only basic visualisations. If you surveyed only a sample of the families, you could use that very basic visualisation for a rapid discussion on the same day.
- If you want to increase the quality of the visualisations, you “plug in” the option of producing a poster or a booklet.
- If you want to bring basic spatial awareness into the discussion you “plug in” the hand-drawn map feature.
- If you want to bring complex spatial analysis into the discussion you “plug in” QGIS and optional Field Papers and/or the GPS tracker.
- If you want to share the results with the world you “plug in” CartoDB.

Plan what you will use before you begin the project, to ensure you are able to achieve your goals.

## STEP 3:

# Data collection



There are three teams that operate on a given project. In this section, we will discuss how they operate, the tools they use, potential pain points in the process and focus group discussions that help the community learn about the space in which they are working.

### Introduction

- 30 minutes

- Explain vulnerability mapping
- Explore the role of the community and form teams
- Explain data collection

### Task division

- 30 minutes | Max 2 hours

#### GROUP 1: MAPPING TEAM

1 trainer/facilitator  
a guideline

- **GPS Tracker**
- **Open Street Map**
- **Field Paper**
- **Google Maps**

#### GROUP 2: FORM TEAM

1 trainer/facilitator  
a guideline

- **Google Forms**

#### GROUP 3: FOCUS GROUP DISCUSSION (FGD) TEAM

1 trainer/facilitator  
a guideline

### Data collection

- Half day

#### GROUP 1:

Stays at the workshop venue; the facilitator explains field paper to the team and they work on mapping area around the venue. The community usually knows the exact location of houses, facilities, etc. Use a paper-based map to identify points of interest.

#### GROUP 2:

Start with a trial or test-run outside the venue: one person collects data while the others observe. Any problems or questions that arise are discussed directly. Follow with another attempt by a different person, and continue until each member of the group has had a turn.

**Communities can add extra topics/activities to their timeline to help customize it to their specific needs.**





## Data Collection Day Breakdown

**The day begins with an introduction to the project for the community.**

**The community must understand why the project is being conducted.** Typically, community engagement will be organised through the community leader, however not all members of the community will have been consulted. The first meeting is an opportunity to bring all the volunteers “up to speed” on why they should want to be involved. The community must understand the substantive benefits of the project and it is important that community members understand that they are not going to receive money from those conducting the project.

### Workshopping

The first workshop is a one-day event consisting of three big sessions:

- Introduction to vulnerability mapping (why it is important, specific objectives, how it works)
- Team formulation
- Data collection

### The community preparation session

This is to create community buy-in. It is important to start from *their* problem, rather than an outsider trying to vet their situation.

In this session, which is a forum group discussion, the community will receive information on:

- What is collaborative surveying and crowdsourced mapping
- Types of data collected

**It is at this stage three groups are created.** The first session, in which all volunteers are gathered, lasts for 30 minutes, followed by an additional group training of approximately 30 minutes. Based on past experience, it is important that these initial sessions do not last more than two hours in total, otherwise people may become bored and disengaged.

In the first workshop the community's interests must be gauged by asking what are the community members' problems and their hopes, what data they think are important and why.

Once everyone has agreed with the objectives, three teams are created to deal with mapping, forms/surveys and focus group discussions (FGD), respectively. Training is then conducted with each group on how to accomplish their tasks.

Asking who are the most knowledgeable people in village is helpful to identify potential team leaders, or those who can be better relied upon.

Following surveying and mapping, the community will present their efforts, and verify the socio-spatial data that has been collected. Through FGD they can openly discuss the proposals to upgrade their village amenities, infrastructure, planning, and other concerns.

## TIPS

1. Involve young people who are comfortable with digital technology.
2. Four to five people can comfortably assess a 42 household community, with an additional two people designated to village-scale mapping.

### Mapping team

This group is devoted to collecting spatial data. Prior to the data collection day, Fieldpapers should be prepared to be used for training and for data collection. The Fieldpapers consists of only the main roads with GPS identifying some main focal points.

A facilitator work together with the community to populate in the Fieldpapers with information they want to see on the map: economic production, where people hang out, houses, social facilities, small alleys, big roads, main access points in and out of the village and an aerial picture via Google Earth highlighting public amenities and facilities within a 5 km radius.

### POTENTIAL PAIN POINTS

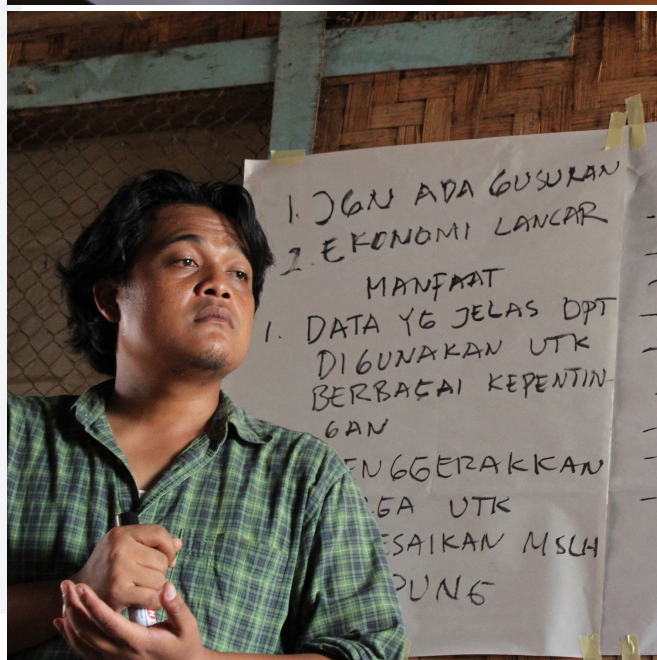
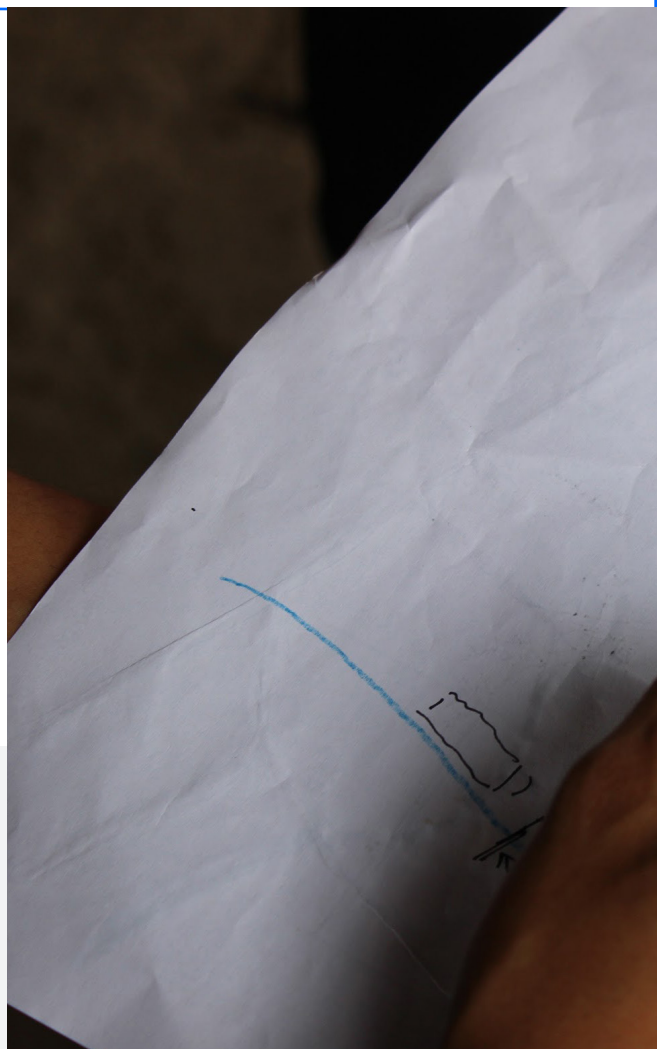
- **Fieldpaper** maps are very user-friendly, and can be uploaded onto the web using a simple handphone camera, but detail and scale are both issues.

If the houses are too small, the application cannot read the lines.

If the area is too dense, mapping using Fieldpapers can be quite challenging because of the zoom limitations of Fieldpaper maps

- **GPS tracker** was not sufficiently accurate for pinpointing the doors of houses, but was accurate enough for mapping lakes, trees, main streets, small alleys, and significant points of interest from which volunteers can locate themselves, and their houses, on the map.

The GPS tracker can be used temporarily, for detailing OSM, and filling in the Fieldpaper.



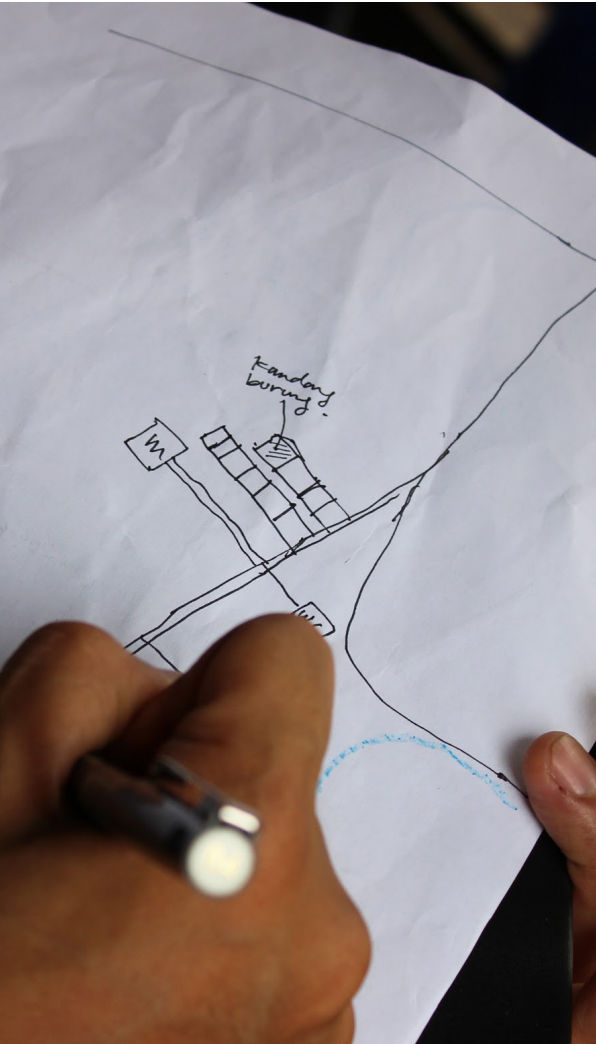


## Household survey Team

This group is devoted to collecting socio-economic data. The primary tool that is used is an online Google Form, accessible by devices such as smartphones, tablets, etc. Printed versions of the forms are also necessary to provide a physical back-up in case of smartphone failure (running out of battery, program crashing, etc.).

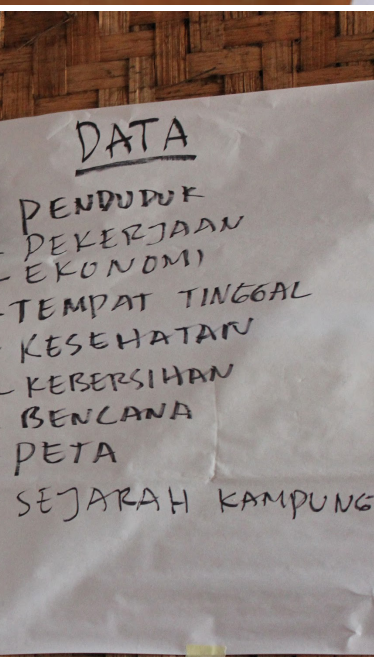
A first time volunteer surveyor will take approximately 15-20 minutes to complete one household survey, but with practice will become faster. One surveyor can work on 10 households.

A deadline can be arranged and agreed with volunteer surveyors prior to handing out a mobile phone but the daily surveying schedules should be self-organized by the volunteers in light of their other daily activities.



### POTENTIAL PAIN POINTS

- **House coding:** how to choose house numbers during the survey that link with house numbers on the map. The community know best: they decide this, which avoids issues with external parties.
- **Internet connection:** working with Google Forms requires an internet connection. Reception may vary, use a pre-paid data package and ensure all your settings are correct prior to commencing the survey, so that your data quota is not exceeded.





## History (Focus Group Discussion) Team

Focus group discussions are required to discover the village's history. This knowledge is important so that we are aware of the changes in the village, and the drivers of change. There must be at least two community members selected to coordinate focus group discussions. These two volunteers will organize the discussion and contact appropriate community members to take part. This is how you learn about the village.

At focus group discussions, the results of surveys and mapping are shown through pictures/visualisation. A sample question might be to ask when houses were first built in the village, or to find out the origin of the village name. Any history of disasters (for example, mudslides, flooding, etc) is also very important.

### Questions to consider:

Does the data from previous phases feed into this discussion?

Based on that data how can we better formulate the discussion questions?

### An example of FGD in action:

Flooding — a community thought that flooding came from other areas, however, based on discussion of the villages history, it became clear that a change of land use in a certain local area caused the flooding.







## STEP 4:

# Making sense of the data



**This is how you bring all that data together to create visualizations everyone can use! Data visualisation are displayed for community residents to review and provide the basis for the facilitation of community discussions on the important findings.**

## Spatial Data tabulation and processing

### Using Carto DB

Carto DB is an online application for sharing geospatial data visualisations. Using this platform one can hover the cursor above any given household in the visualisation to see the data for that household. Carto DB directly links with OSM and GoogleForms, so if either the spatial data (OSM) or the survey data (GoogleForms) is updated the visualization on CartoDB automatically updates.

### Using QGIS

QGIS is a tool for creating and analysing geospatial information. While QGIS is boring to look at, and very technical, it is actually relatively simple to use after some basic training. If you don't want to work with a mapping program like this you can use an existing map or graph.

The advantage of QGIS is the ability to link the survey data collected with the spatial data of the map — and visualise this link for every survey question.

For example: quality of water - with QGIS you can automatically see a spatial representation of which households have access to good quality water and which ones do not, for each water source. This is valuable material if the community wants to build a strategy for better access to water.



## TIPS & LINKS

- The community can request a training session from OpenStreetMap, if required. OSM has budget to conduct training workshops and is willing to do so.
- Create cross-check mechanisms among the volunteers. There can be a tendency for volunteers to manipulate data to make their area appear better than it is; for example, by hiding waste sites and broken roads. This can be checked by comparing with data collected by other groups, like the form team. It may be possible to cross-check with a drone.
- Surveying all households is possible in a small area. Sampling is possible for a rapid one-day survey, but has not been done so far because communities wanted to get a complete usable dataset, so decided to spend a little more time.
- OSM is open to the public, so others can also edit that map.
- You could request that OSM temporarily lock the area you intend to map so that only the data generated by the community is displayed.



## POTENTIAL PAIN POINTS

- QGIS requires some technical training and consequently its usage should to be kept to a minimum.
- UPC has not found a platform/tool, other than QGIS, to link .xls (Excel files) and OSM to create spatial visualisation of household data. In its previous experience, this was to visualize the distribution of water quality, construction materials, sicknesses and so on.
- QGIS can also be used to create an easier to use .shp (shape file) to be uploaded on the CartoDB website application. Put simply, QGIS is for more detailed representations and while it looks tough to use, it is relatively simple and can be explained by the UPC team. OSM can also be used to make .shp (shape files) for the CartoDB website application, however it can not link with survey data in .xls format.



Kampung Budi Darma, East Jakarta

## Data Visualisation

There are three basic types of visualizations:

Poster

Booklet

Charts

### Using Pictochart

It is freely available online, and can create easy-to-use templates for highly visual posters. Pictochart can automatically link to Google Forms.

**For example:** volunteers can map facilities and amenities like the pharmacy, the market, etc, and their quality (near/far, good/bad). At the same time, they can use information from the survey drawing on answers as to where residents go to buy medicine or groceries. Drawing on these sources they can create a visualisation of the facilities and analyse their condition.

### What do they highlight?

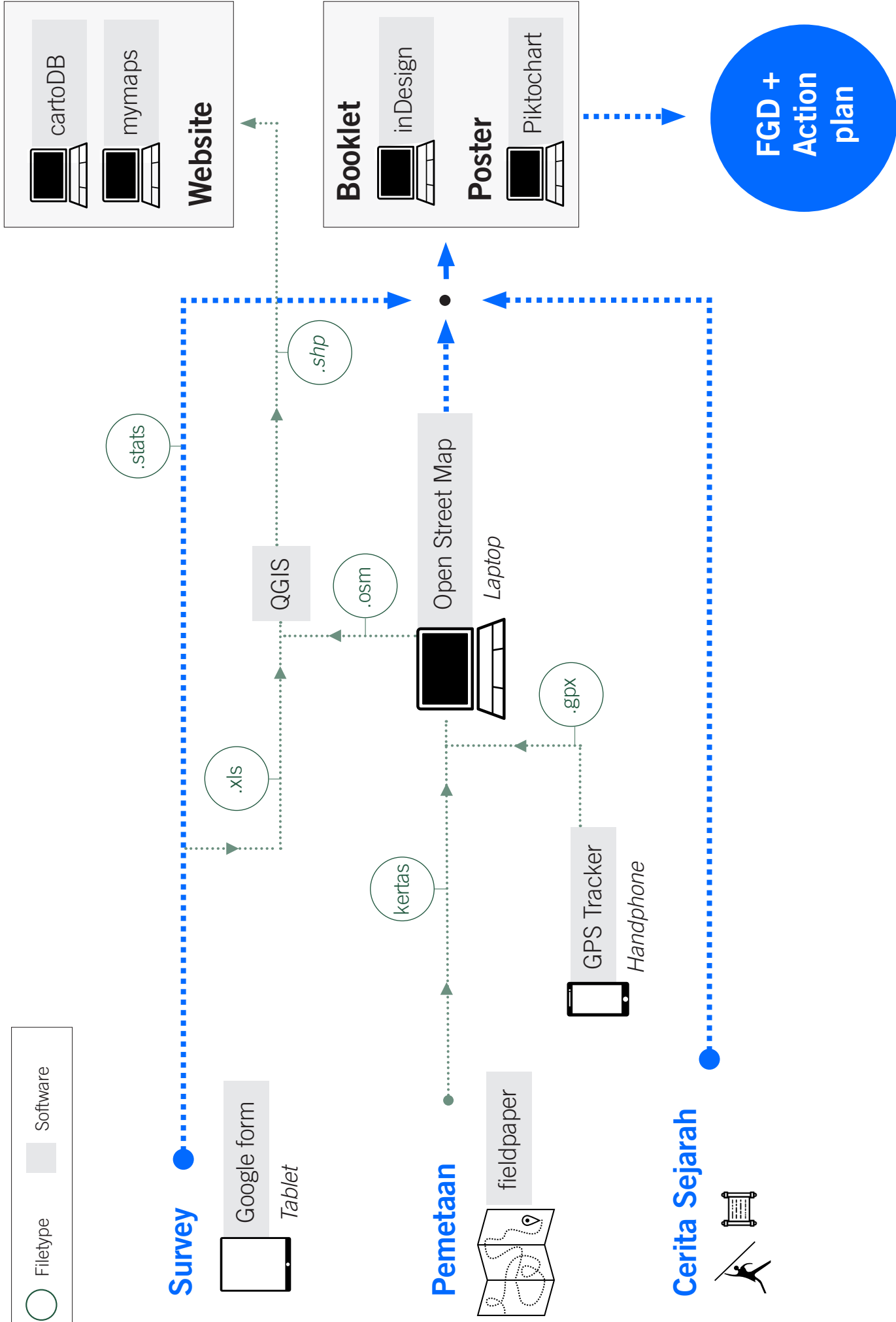
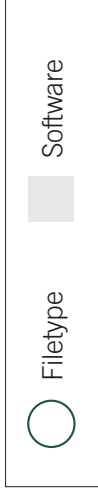
UPC will decide what indicators the visualizations highlights due to their expertise in handling data, although this is open to further discussion. This process and its choices can be transferred to the community.

## POTENTIAL PAIN POINTS

There can be disagreements on how to consolidate data, its format and its ownership. There are both advantages and disadvantages to leaving the data within OSM.

**This should be up to the community to decide.**





## STEP 5:

# Conclusion



**Following data collection and initial analysis, invite the community to a “prioritisation exercise.” This is to promote data-informed conversations about local vulnerabilities and what development programs should be prioritised to address these issues.**

## Post-Analysis: Community Discussions

### What and why

In the process of engagement, the community members should come to an agreement. They must discuss the various points of analysis and which data can be published. This is also the stage where volunteers formulate actions to address their problems.

For the data collection to have meaning it must be used to make positive changes in the community. This is what UPC wants to see.

The point of the data collection is to help villagers be prepared for problems they may face, and to smoothen the development of their community. “Sedia payung sebelum hujan”, meaning “prepare the umbrella before it rains”, is a famous Indonesian idiom that well describes these objectives. We do not want to wait until the villagers are relocated due to flooding, or some other reason. We want to be prepared for these contingencies in advance.

Among some communities there is a certain level of “knowledge” as to the issues they face. Often they do not see their condition as a problem. But UPC wants to allow communities to realise the problems they face and to empower them collectively to find solutions.

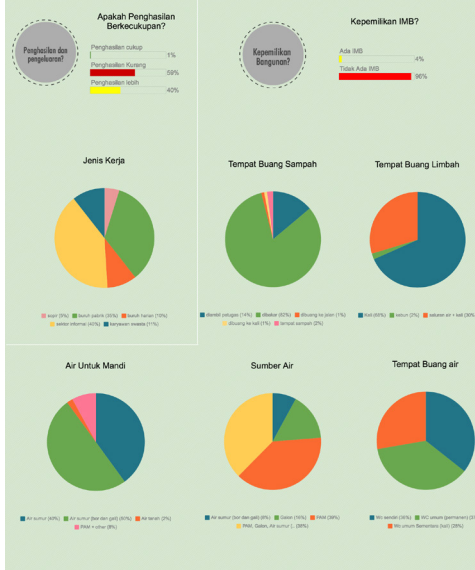
### How to facilitate

Discussions are held based on issues/thematic areas such as education, health, water, etc. The discussions begin with a question and the answer is written once everyone has agreed upon it.

In finding solutions they must create a timeline and groups/teams to effect outcomes.



## 2. TEMPAT TINGGAL



**For example:** Budi Dharma village lacks sources of drinkable water. They wanted to know more about a program that could help to provide them with more clean water. And so they create a schedule to meet and discuss a solution — initiated by themselves. This is key: the decision to act has to be lead by community and not the facilitators. The community should be encouraged not to wait for UPC and to take the initiative.

## TIPS & LINKS

One critical part of the methodology is the focus group discussion at community level. This step in the consultation must not be skipped. Community data, and preparedness, including perceived threats and perceived solutions, and possible ways forward, cannot be separated from a 'baseline data' of households.

Combining and representing household data with infographics helps facilitate focus group discussion and also triggers descriptive analysis of the outcomes from the data collecting. This can also quickly raise awareness.

For example, 75% of people may say that their quality of water is unsatisfactory, and that the source of most water is from a communal well. The facilitator could then fish for a communal answer as to whether or not the urban village (kampung) residents are happy with these conditions, and what they think are the possible further actions that could be taken.

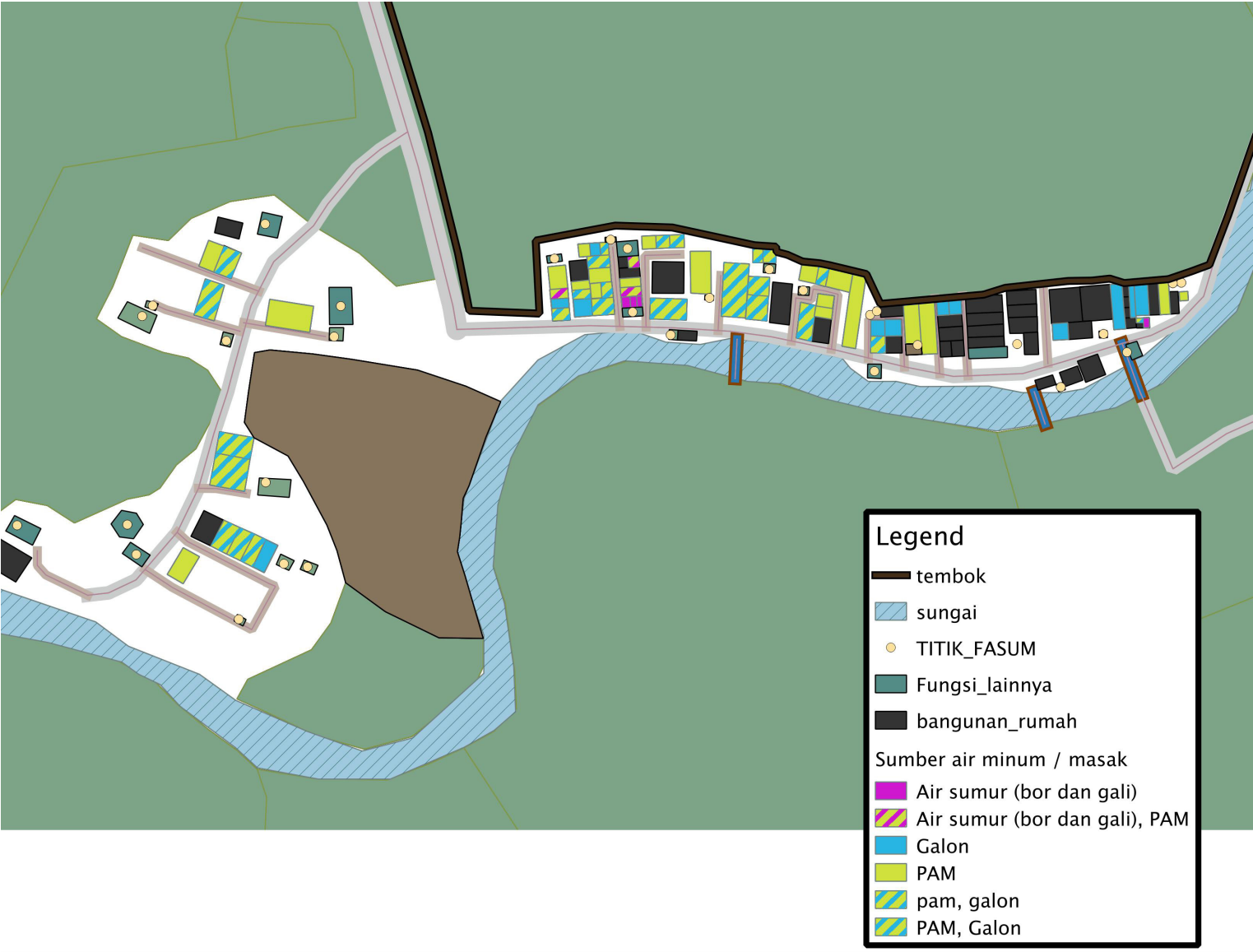
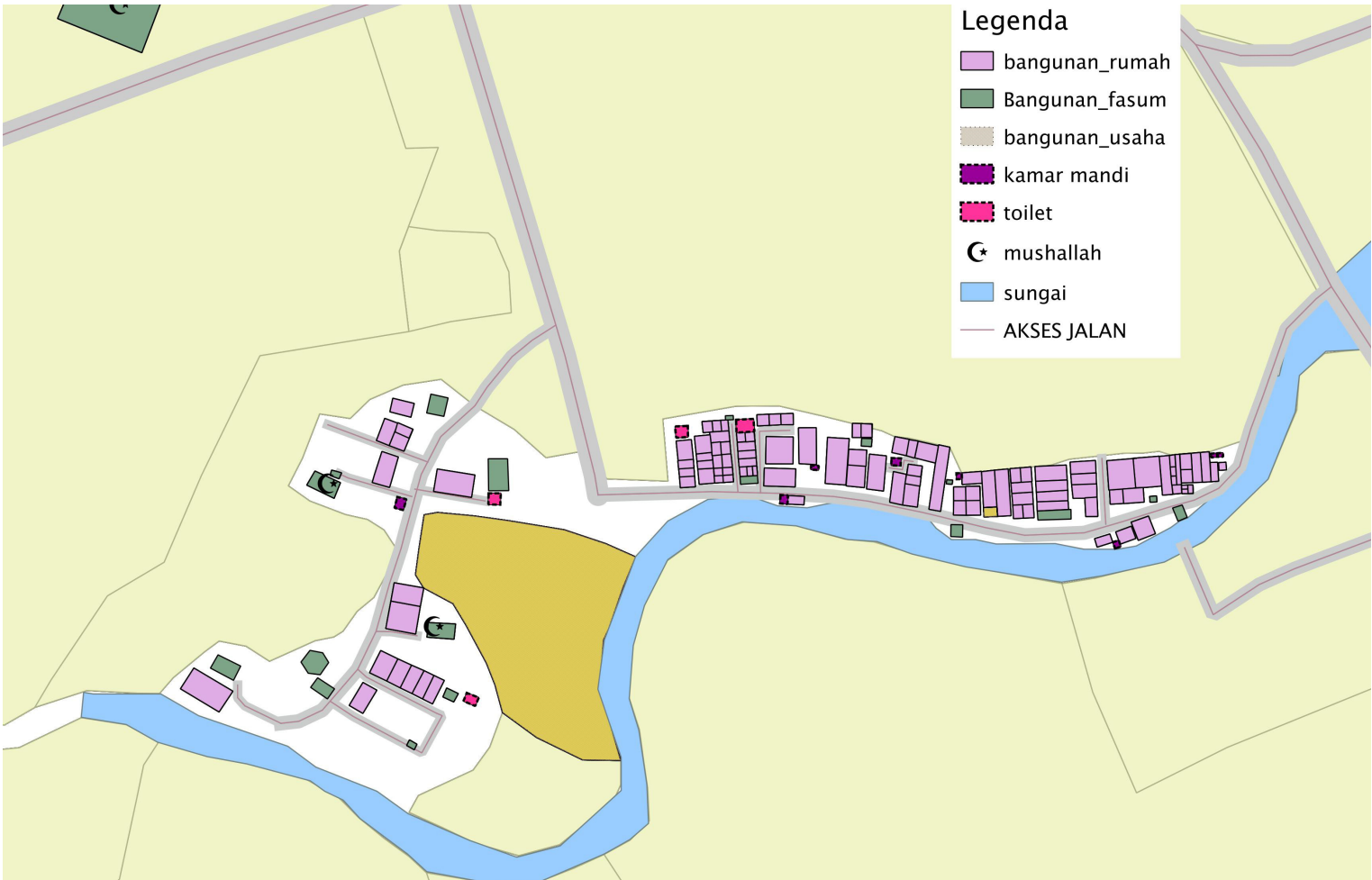
This approach is proven to empower people to think together about what can be done to change their situation at kampung scale. If the community can calculate, for example, that four drinking towers would be enough to supply them with safe drinking water — then this perception of need can be linked to programs that fund relevant development projects.

This **maximizes participation by crowdsourcing, while minimizing behind-the-scenes work or computation, relying on easy-to-access user-friendly software on basic smartphones.** Through this method, as much data as possible can be input by the community members themselves, increasing their sense of ownership.

If the software is open access and easy-to-use, the community can continue to manage their own data in the future, without facilitators.

### 3. BENCANA : BANJIR DAN PENGGUSURAN







The background of the slide is a solid blue color. On the left side, there is a white line-art illustration of a city skyline with several buildings of varying heights. On the right side, there is a white line-art illustration of a globe showing continents and latitude/longitude lines.

# Future Improvements & Considerations

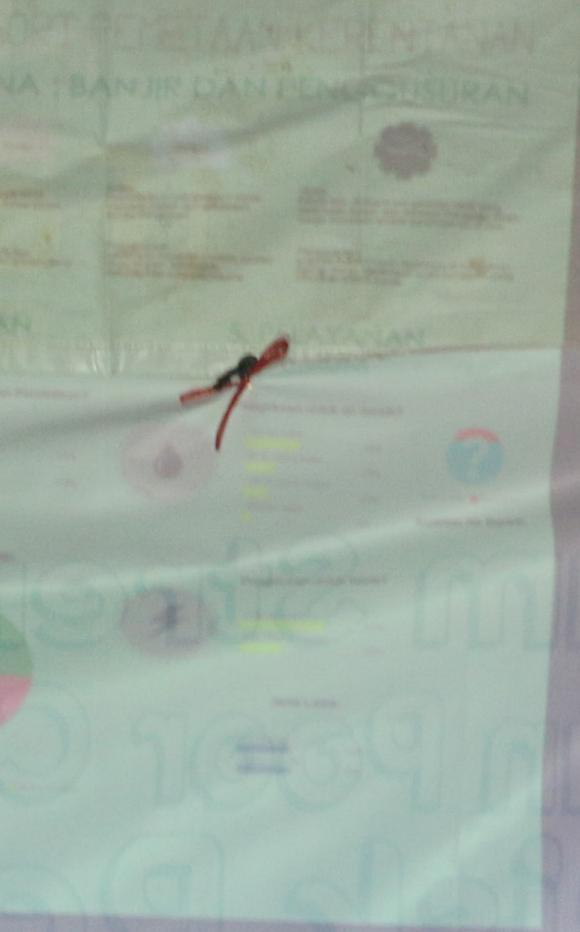
The project must be supported by number of trained and reliable facilitators. At the same time, a strategy for dealing with large communities must be devised. Our method worked best with a community of 30-40 families. Surveying larger numbers presents greater challenges.

There are also considerations of data security and privacy. It is important that community members are able to see, edit and update their own data, but should it be under the supervision of an authorized facilitator? What if someone wiped the database clear or decided to fill it with erroneous data? How can the security of the data be ensured? For these questions to be answered there need to be innovations in community-led data protection and ownership.

















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of the Government of Australia