Mobile SMS survey data management and preservation

Inna Kouper

Charitha Madurangi, Kunalan Ratharanjan, Tom Evans, Beth Plale

Indiana University

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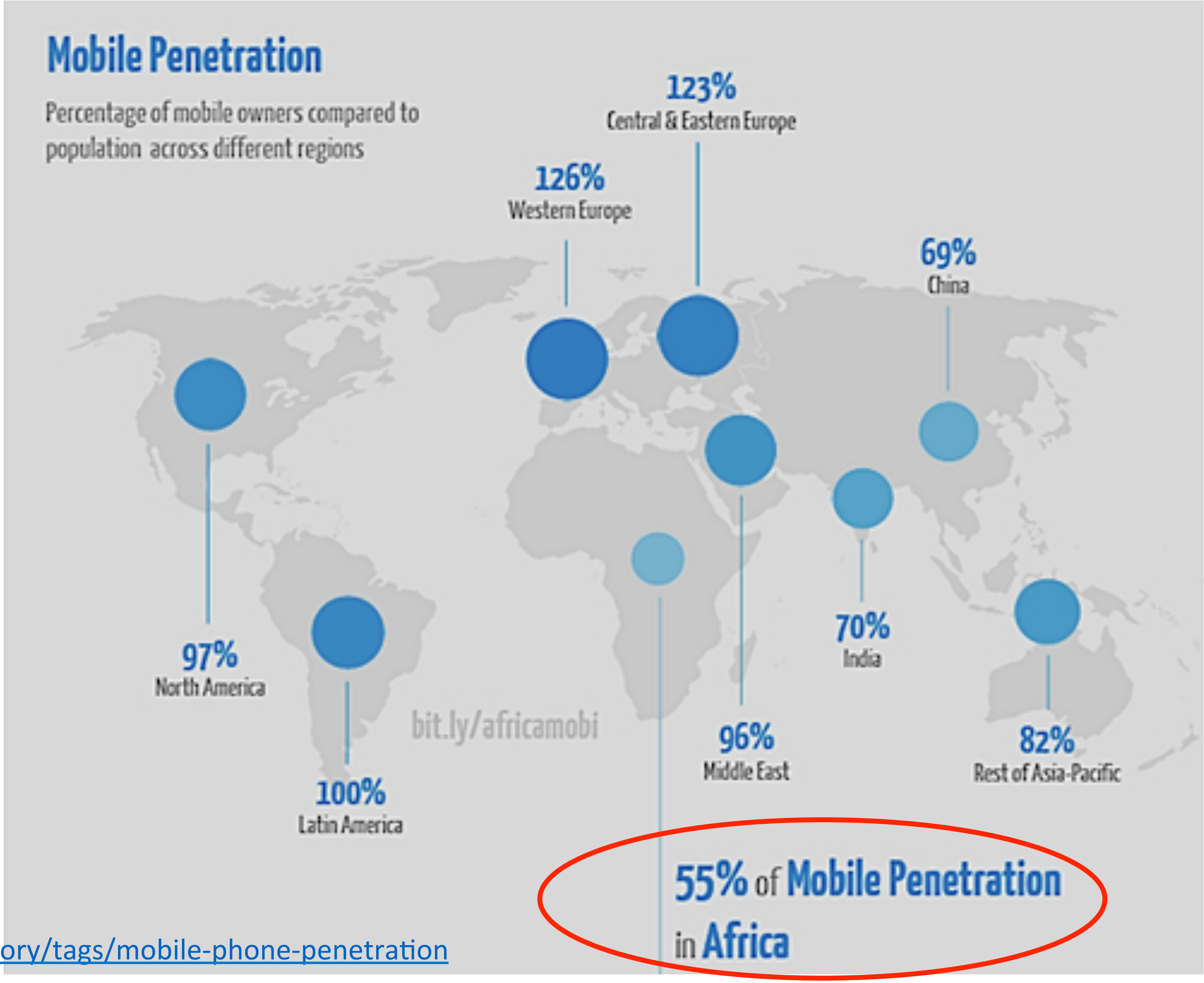
National Science Foundation
WHERE DISCOVERIES BEGIN

Mobile phone penetration

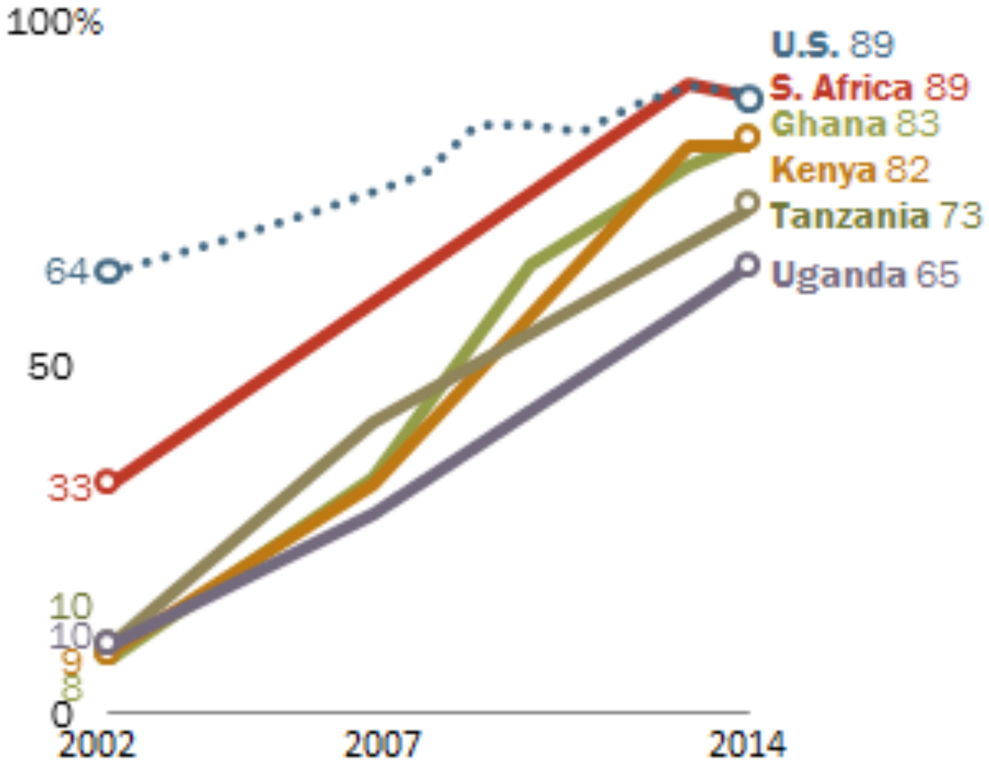


https://blogs.worldbank.org/category/tags/mobile-phone-penetration

Mobile phones in Africa

Cell Phone Ownership Surges in Africa

Adults who own a cell phone



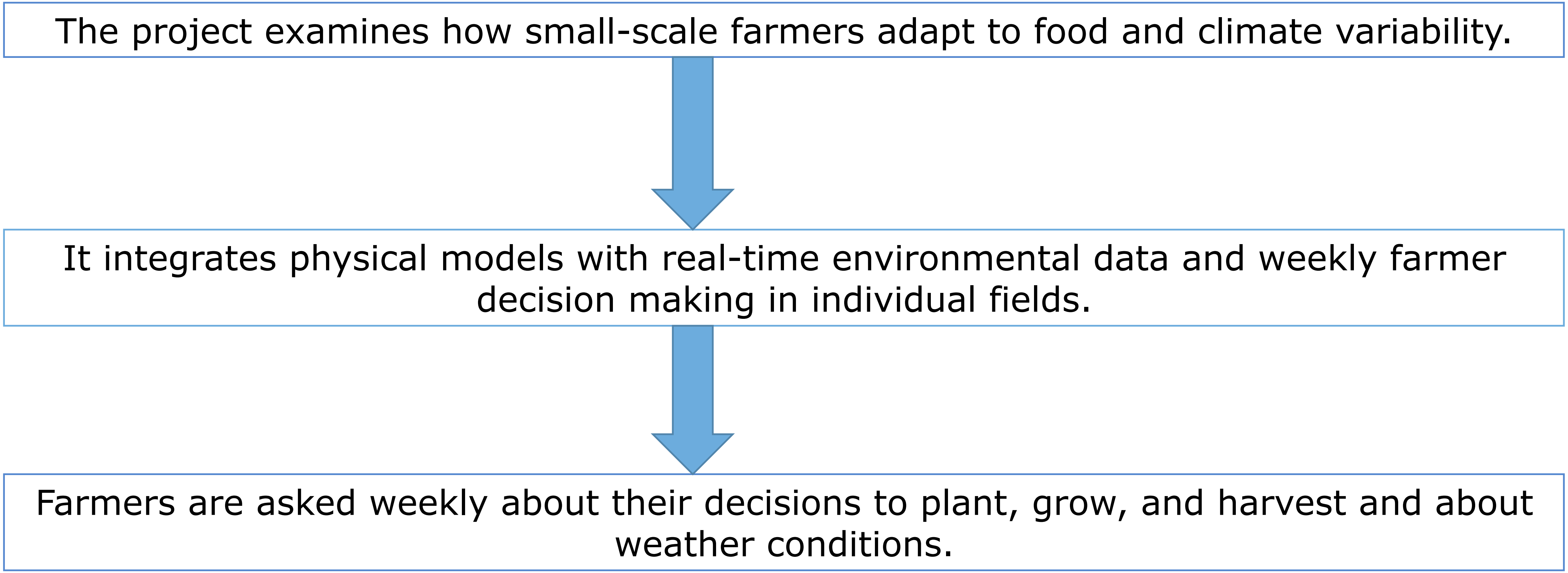
Note: U.S. data from Pew Research Center surveys.

Source: Spring 2014 Global Attitudes survey. Q68.

PEW RESEARCH CENTER

http://www.pewglobal.org/2015/04/15/cell-phones-in-africa-communication-lifeline/africa-phones-7/

Project: Agricultural Decision Making and Food Security in Africa

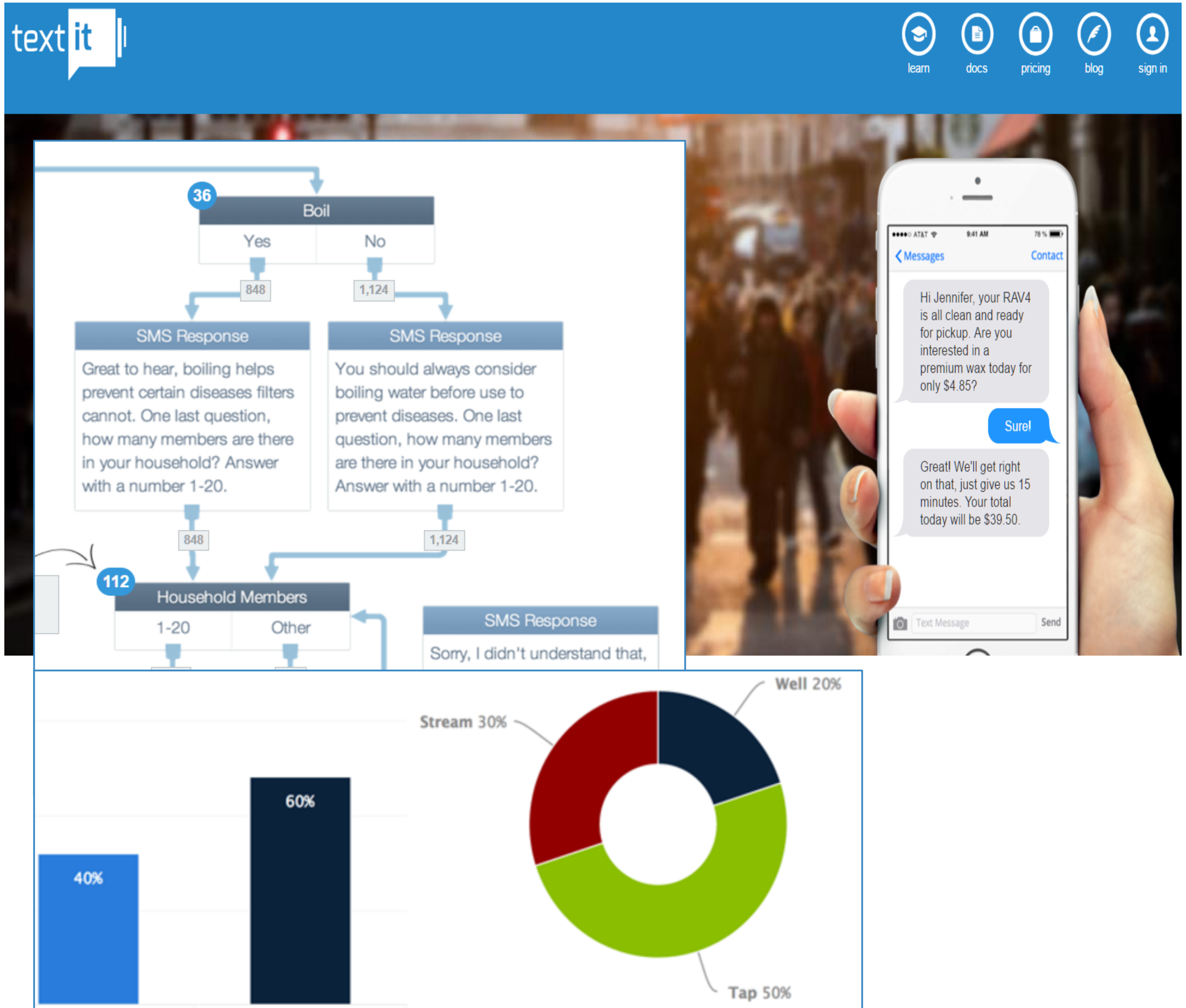


The project examines how small-scale farmers adapt to food and climate variability.

It integrates physical models with real-time environmental data and weekly farmer decision making in individual fields.

Farmers are asked weekly about their decisions to plant, grow, and harvest and about weather conditions.

TextIt SMS Platform



SMS Response

Great to hear, boiling helps prevent certain diseases filters cannot. One last question, how many members are there in your household? Answer with a number 1-20.

SMS Response

You should always consider boiling water before use to prevent diseases. One last question, how many members are there in your household? Answer with a number 1-20.

SMS Response

Sorry, I didn't understand that,

Hi Jennifer, your RAV4 is all clean and ready for pickup. Are you interested in a premium wax today for only $4.85?

Sure!

Great! We'll get right on that, just give us 15 minutes. Your total today will be $39.50.

- Cloud-based commercial SMS service
- Builds surveys through GUI
- Provides summaries and minimal analytics
- Data can be downloaded manually or via API

Text messaging (SMS) to collect data

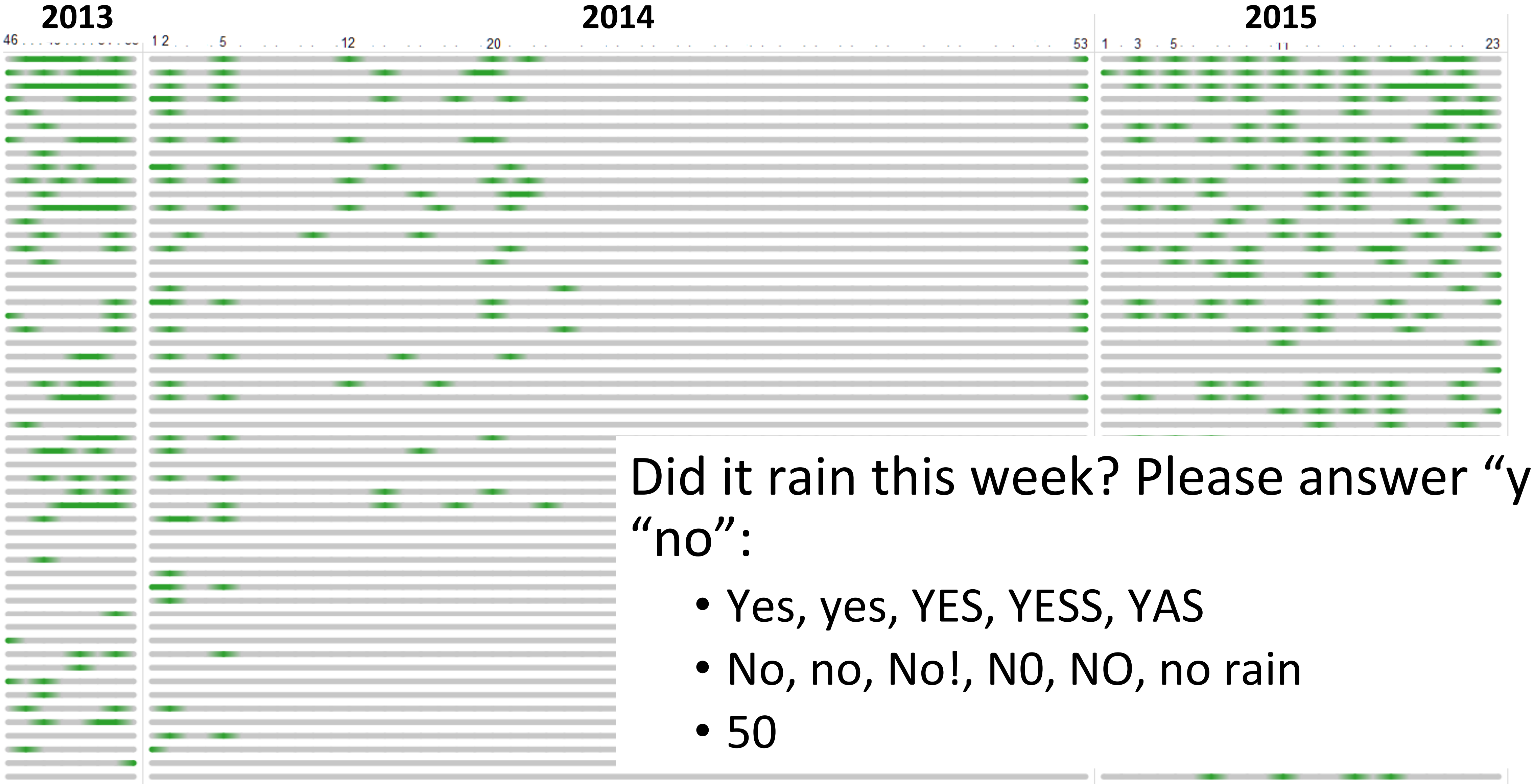
Pros

- High-frequency, automated data collection
- Large sample sizes
- Relatively low cost

Challenges

- Set up learning curve
- Data may be incomplete due to non-response or lack of SMS credits
- Typing increases errors
- Some programming expertise required
- Possibilities depend on platform

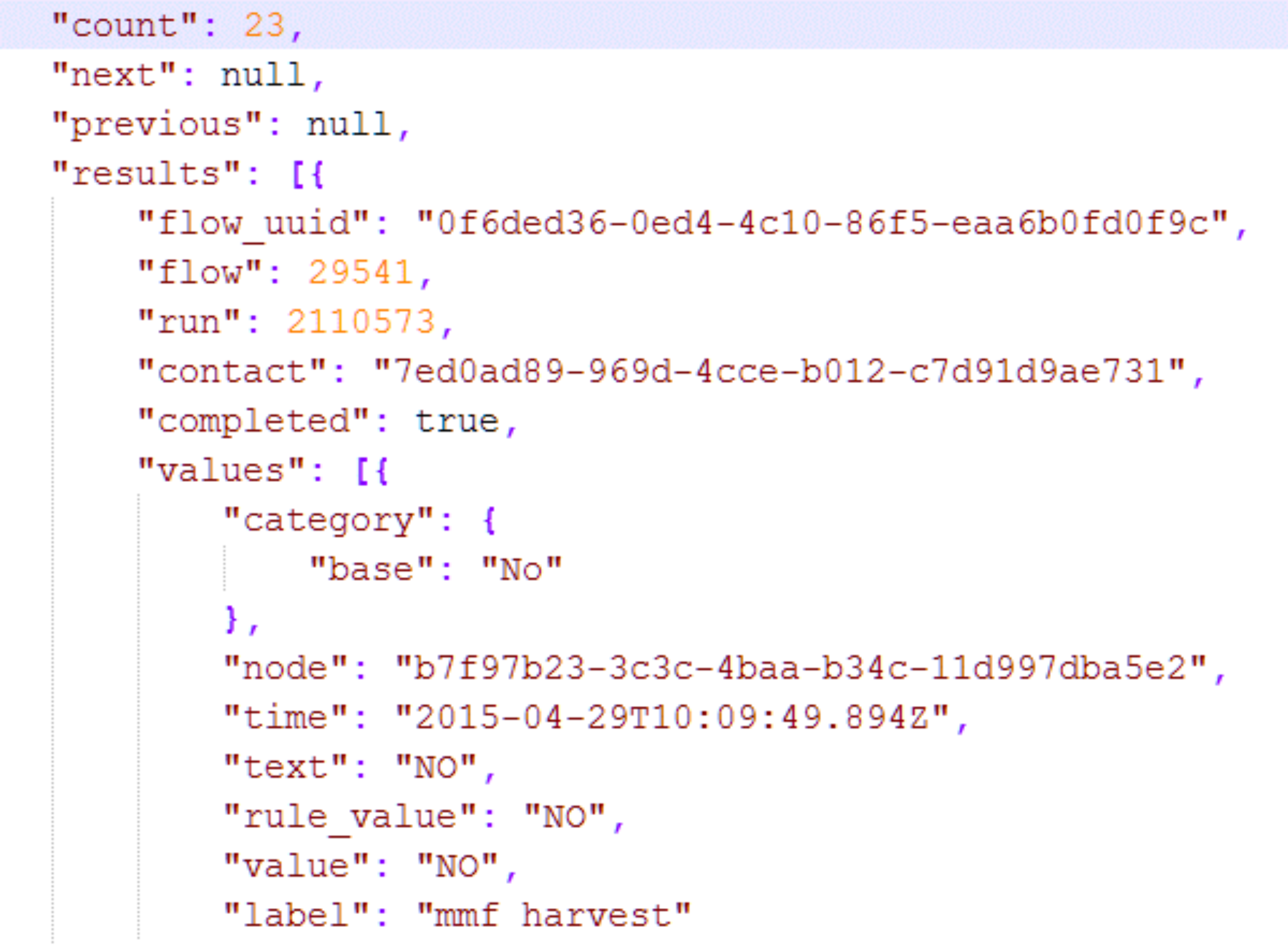
Data completeness and errors



Did it rain this week? Please answer “yes” or “no”:

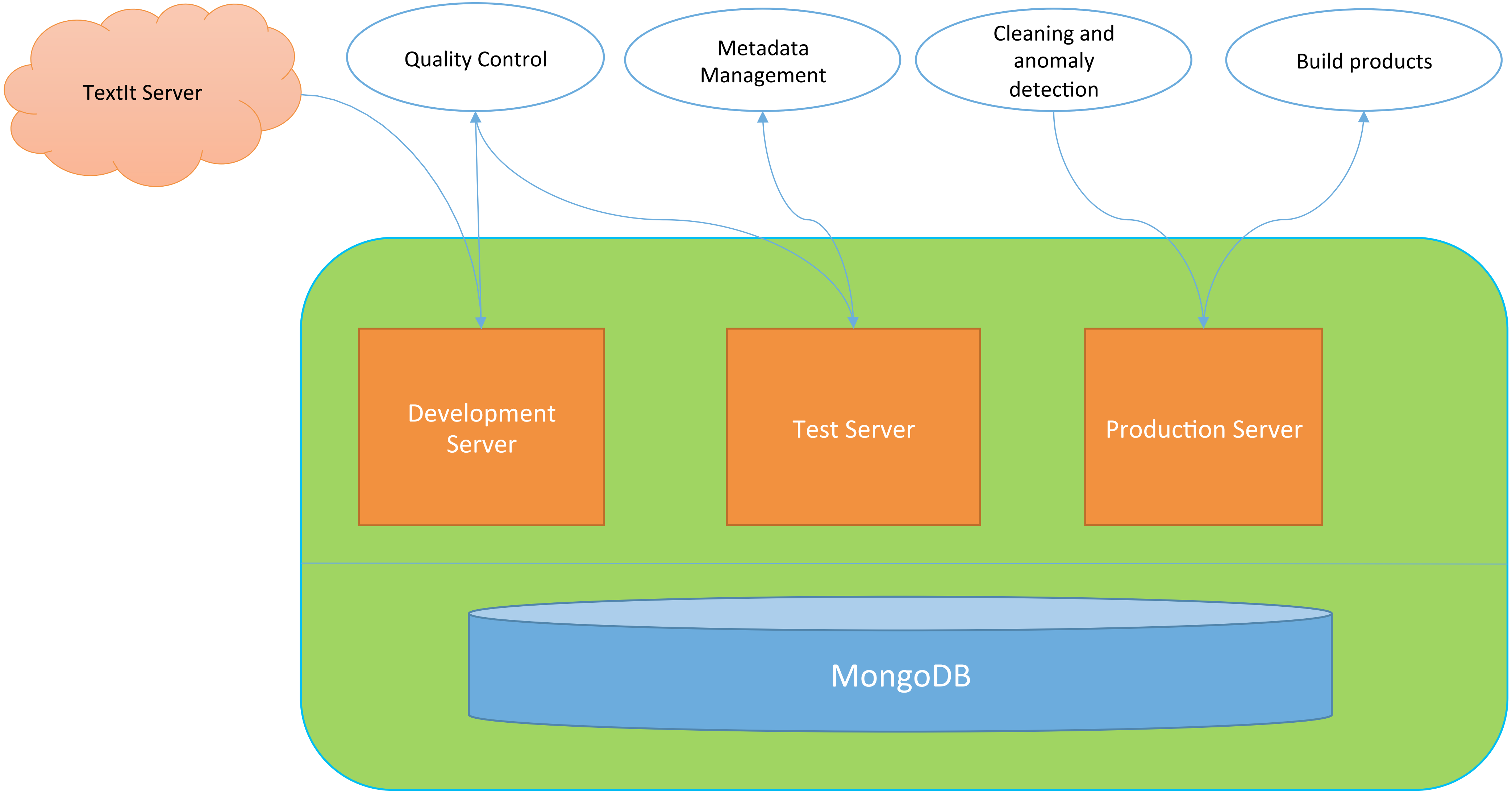
- Yes, yes, YES, YESS, YAS
- No, no, No!, N0, NO, no rain
- 50

Data retrieval via API

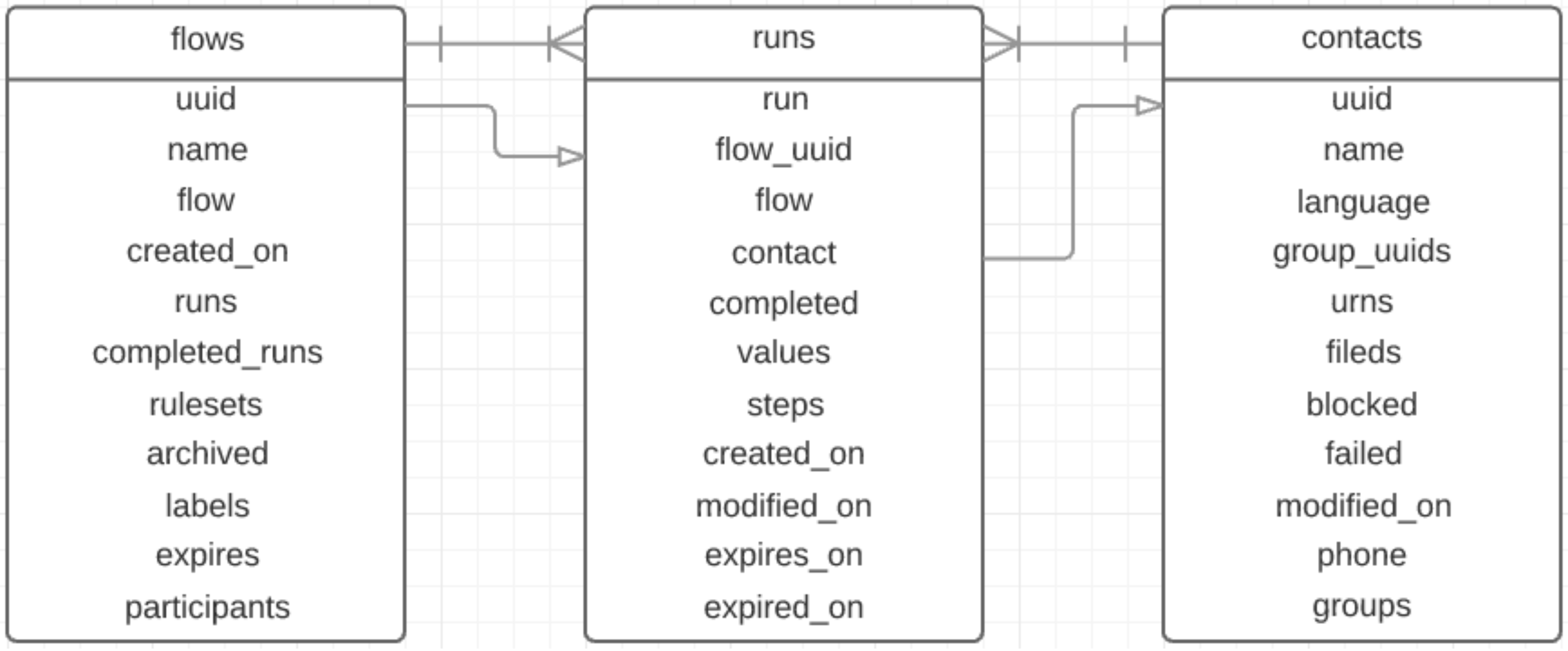


```
    "count": 23,
    "next": null,
    "previous": null,
    "results": [{
        "flow_uuid": "0f6ded36-0ed4-4c10-86f5-eaa6b0fd0f9c",
        "flow": 29541,
        "run": 2110573,
        "contact": "7ed0ad89-969d-4cce-b012-c7d91d9ae731",
        "completed": true,
        "values": [{
            "category": {
                "base": "No"
            },
            "node": "b7f97b23-3c3c-4baa-b34c-11d997dba5e2",
            "time": "2015-04-29T10:09:49.894Z",
            "text": "NO",
            "rule_value": "NO",
            "value": "NO",
            "label": "mmf harvest"
```

Our Approach: Data Management and Preservation Pipeline



Database Design



flows
- uuid
- name
- flow
- created_on
- runs
- completed_runs
- rulesets
- archived
- labels
- expires
- participants

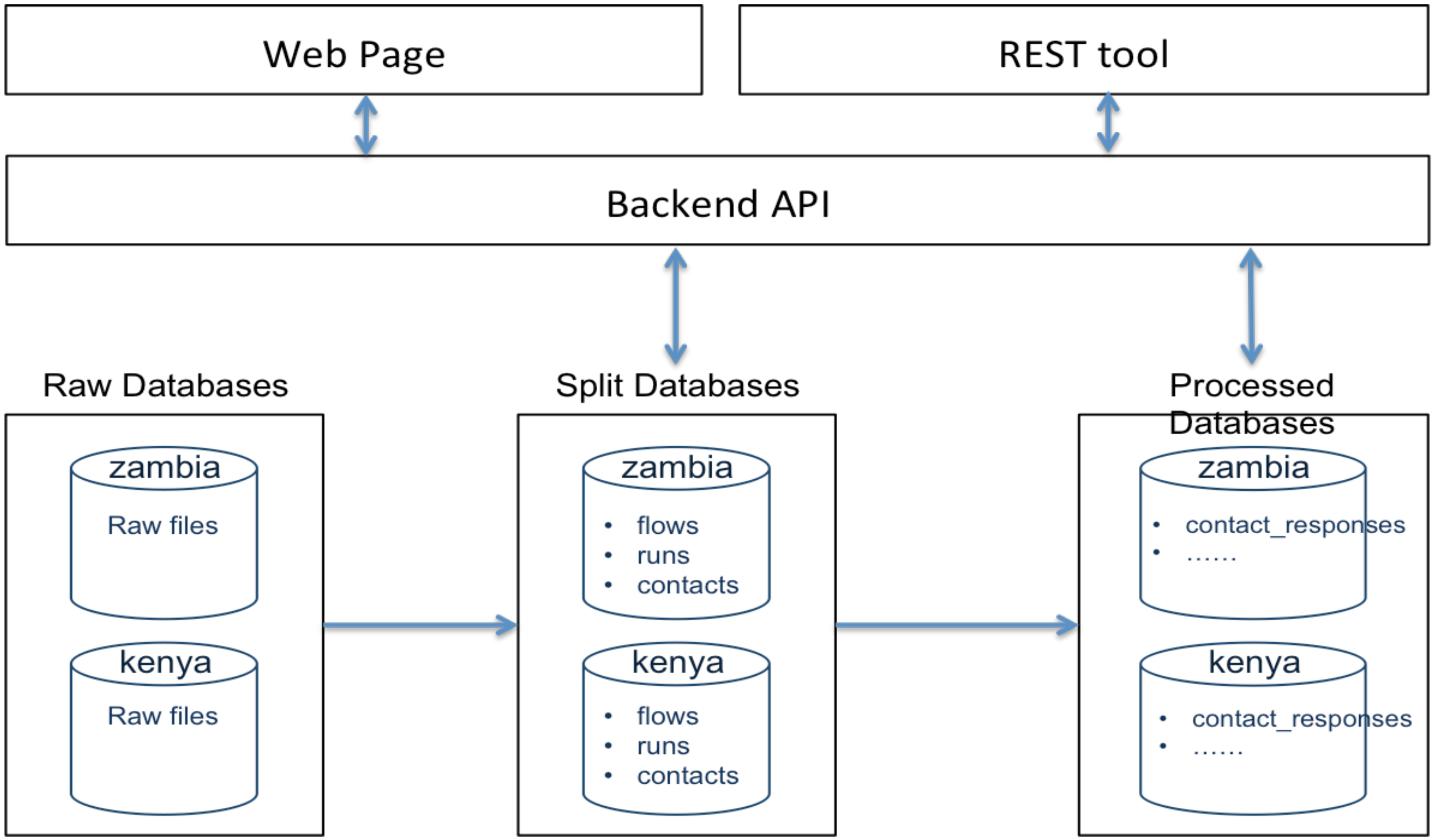
runs
- run
- flow_uuid
- flow
- contact
- completed
- values
- steps
- created_on
- modified_on
- expires_on
- expired_on

contacts
- uuid
- name
- language
- group_uuids
- urns
- fileds
- blocked
- failed
- modified_on
- phone
- groups

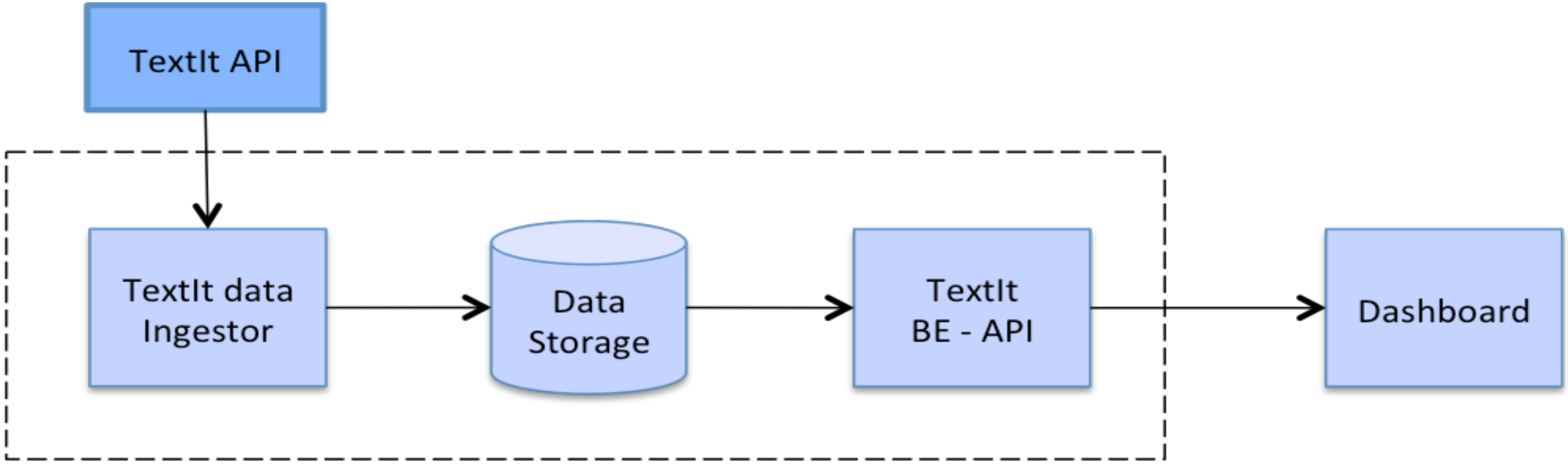
Data is organized into three collections – *Raw*, *Split*, and *Pre-processed* for two countries

- *Raw* preserves original data
- *Split* organizes data into flows (surveys), runs (responses within one survey) and contacts (respondents)
- *Pre-processed* minimizes workload for queries

Storage and Access Architecture



Data Retrieval Pipeline



- Pipeline is fully automated
- Data from TextIt is ingested weekly
- Metadata from TextIt is stored in addition to data (survey responses)
- Data is restricted to users within university
- Data can be downloaded via dashboard or http request

Metadata Improvements

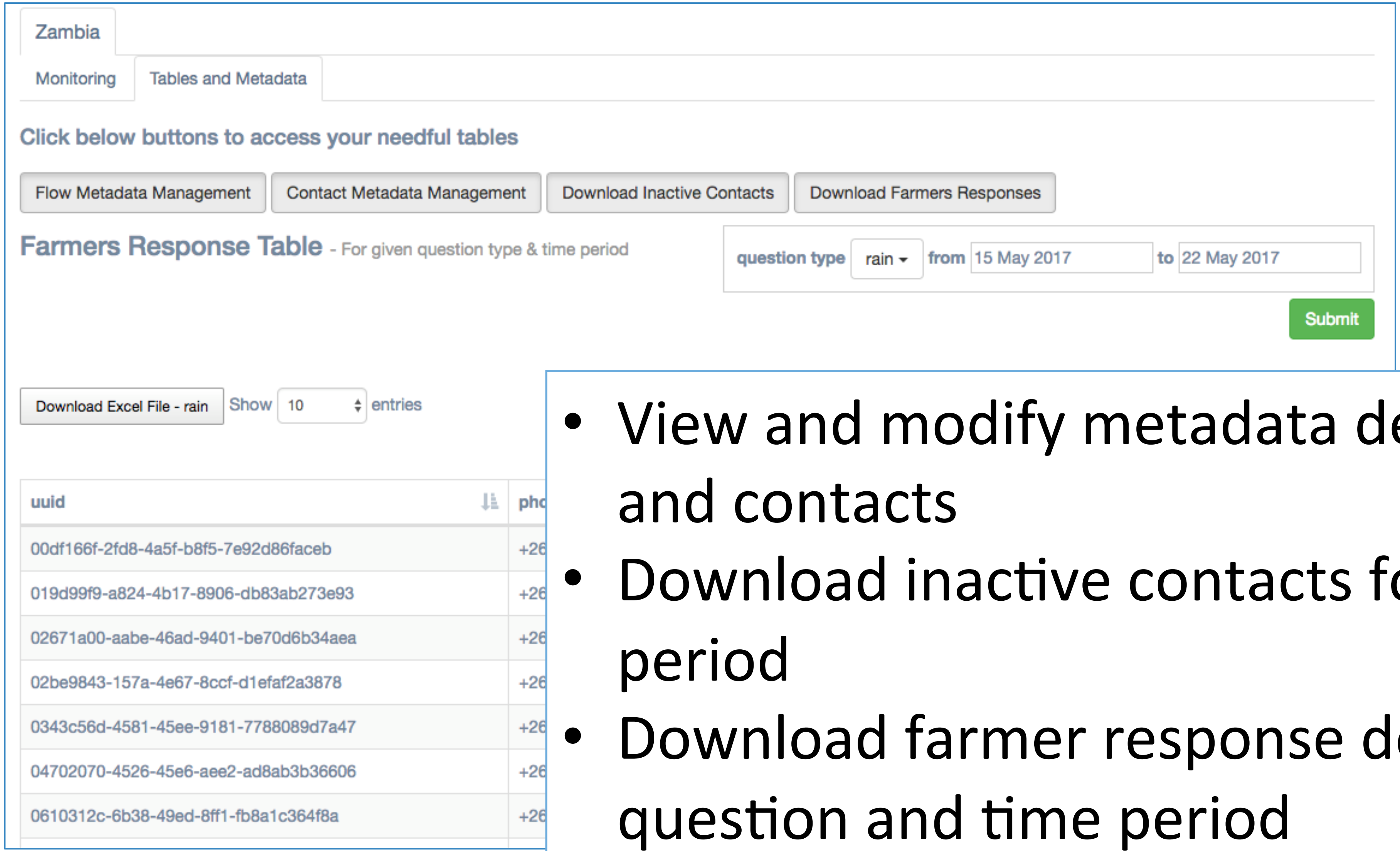
Retrieved from TextIt

- IDs
- Flow names
- Total number of runs (responses)
- Number of completed runs
- Variable labels

Added by the team

- Country
- Season
- Creator
- Date created
- Run start and end date / time
- Flow type
- List of questions
- Farmer contact and location

Data / Metadata GUI



Zambia

Monitoring | Tables and Metadata

Click below buttons to access your needful tables

Flow Metadata Management | Contact Metadata Management | Download Inactive Contacts | Download Farmers Responses

Farmers Response Table - For given question type & time period

question type: rain ▾ from 15 May 2017 to 22 May 2017

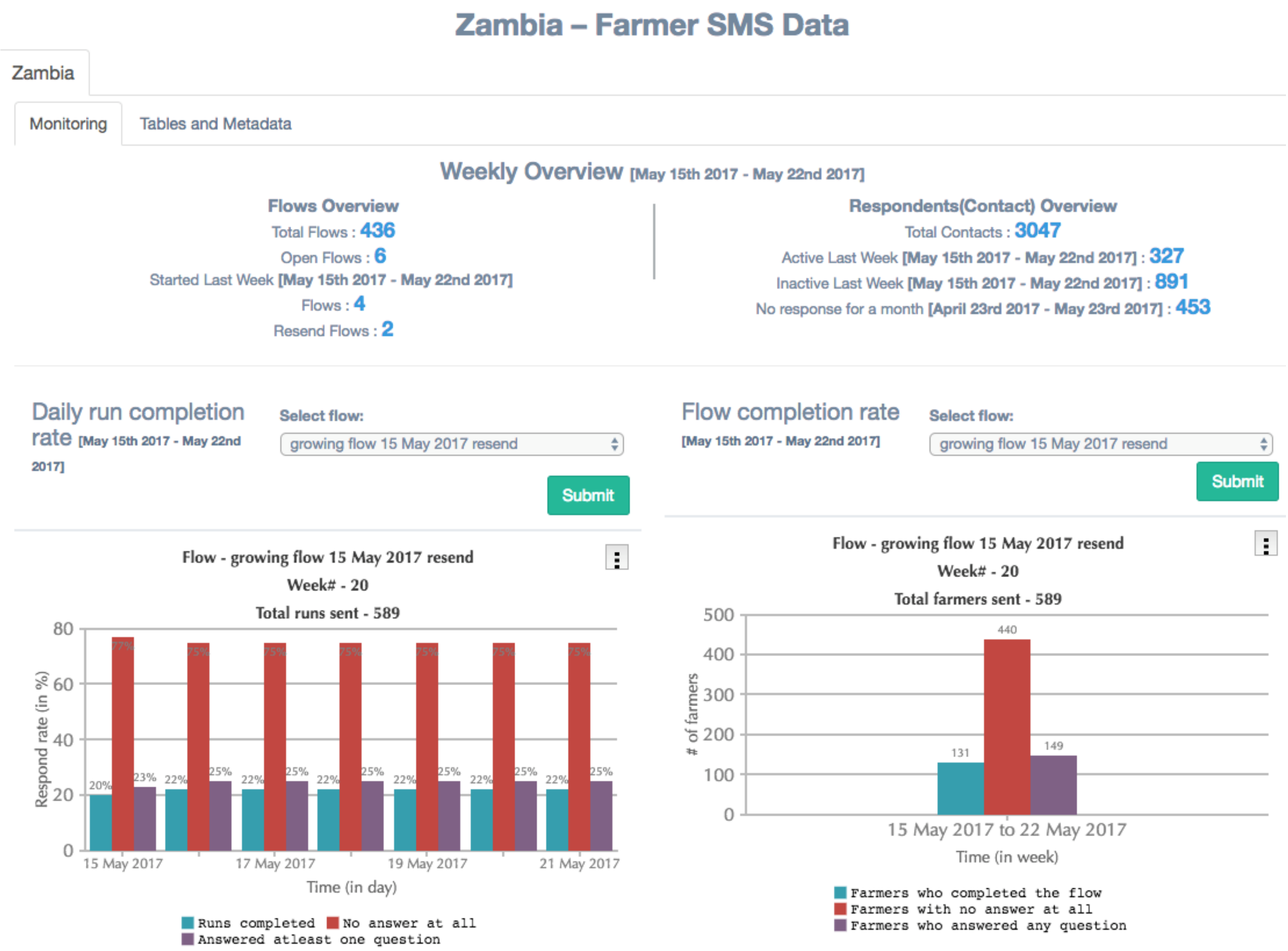
Submit

Download Excel File - rain | Show 10 entries

uuid	pho
00df166f-2fd8-4a5f-b8f5-7e92d86faceb	+26
019d99f9-a824-4b17-8906-db83ab273e93	+26
02671a00-aabe-46ad-9401-be70d6b34aea	+26
02be9843-157a-4e67-8ccf-d1efaf2a3878	+26
0343c56d-4581-45ee-9181-7788089d7a47	+26
04702070-4526-45e6-aee2-ad8ab3b36606	+26
0610312c-6b38-49ed-8ff1-fb8a1c364f8a	+26

- View and modify metadata details for flows and contacts
- Download inactive contacts for a given time period
- Download farmer response details for given question and time period

Monitoring Dashboard



Zambia – Farmer SMS Data

Weekly Overview [May 15th 2017 - May 22nd 2017]

Flows Overview
Total Flows : 436
Open Flows : 6
Started Last Week [May 15th 2017 - May 22nd 2017]
Flows : 4
Resend Flows : 2

Respondents(Contact) Overview
Total Contacts : 3047
Active Last Week [May 15th 2017 - May 22nd 2017] : 327
Inactive Last Week [May 15th 2017 - May 22nd 2017] : 891
No response for a month [April 23rd 2017 - May 23rd 2017] : 453

Daily run completion rate [May 15th 2017 - May 22nd 2017]
Select flow: growing flow 15 May 2017 resend

Flow completion rate [May 15th 2017 - May 22nd 2017]
Select flow: growing flow 15 May 2017 resend

Flow - growing flow 15 May 2017 resend
Week# - 20
Total runs sent - 589

Flow - growing flow 15 May 2017 resend
Week# - 20
Total farmers sent - 589

500
400
300
200
100
0
# of farmers
131
440
149
15 May 2017 to 22 May 2017
Time (in week)
🟦 Farmers who completed the flow
🟥 Farmers with no answer at all
🟪 Farmers who answered any question

- Flows details
- Farmer contacts details
- Flow completion rates
- Inactive / non-responsive contacts

What have we achieved?

Curation, curation, curation!

- **Automated pipeline** enables consistent long-term preservation of raw data and full control over it.
- **Pre-processing and transformations** help to quickly retrieve subsets of data for analysis.
- **Improved metadata** facilitates search, access, and future re-use.
- **Organized storage** enables future visualizations and integrations.
- **Interface and dashboard** makes interactions with data easier, no technical skill required

Challenges

Curation, curation, curation!

- **Security** – need to add proper authentication and access options for research team and the public
- **Data cleaning** – some can be automated, but most is still manual
- **Maintenance**
  - Changes in commercial platforms (e.g., APIs) require modifications of backend and data
  - Staff is needed for ongoing curation and technical maintenance
  - Data preservation is not central to research projects
- **Analysis and dissemination** – still done outside of the pipeline, not reproducible

Future Work (Questions)

- What standards in data documentation and preservation can help to improve this work?
- How can SMS data be integrated with other types of data (e.g., sensor data or household interviews)?
- What analytical products are most useful and for what types of stakeholders?
- **How can we measure the impact from curation?**