Use of GIS to Improve Client Database for Waste Services in Albania

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Context

The Albanian territorial reform of 2015 requires newly defined municipalities, e.g. Shkodra, to set up public services. In cooperation with Helvetas' Decentralisation and Local Development Program (dldp) and CSD ingénieurs, the municipality of Shkodra is building up waste collection services within the following context:

- Waste collection services exist only in the city and are scattered or do not exist in rural regions;
- Incomplete tariff collection data for waste services;
- Time-consuming and fragmented data collection process without reference to meet targeted improvements;
- Inefficient use of data distributed between municipal departments external service operators.

Methodology

- Assess available data and gaps through GIS;
- Clean and merge various data sources;
- Develop a data model to show connections between data and design an efficient storage scheme;
- Design of a GIS processing chain to estimate and visualize missing census data:
1. Option by Buildings: Where no survey data is available and buildings are known, there are potential clients.
2. Option by Individuals: Regression between the building surface and the individuals available from the census to estimate missing population.

System Actors and Data Diagram

Distributed data and multiple actors lead to confusion on which data is accessible. Clarifying the data organization and improving communication between the various actors is a crucial factor to integrate all available data and collect data more efficiently.
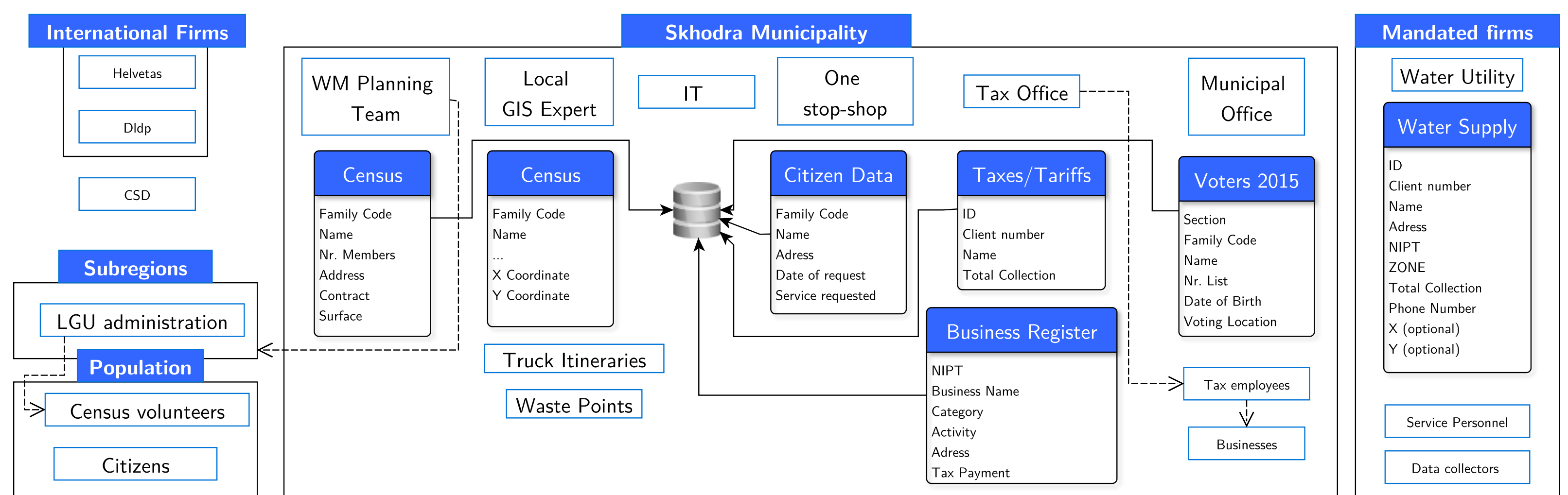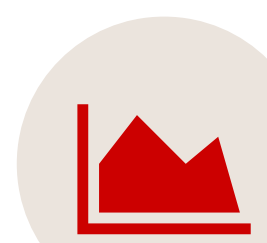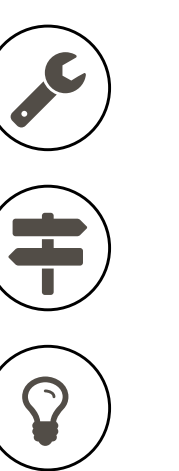

The diagram outlines actors at different levels of the hierarchy and the data they have access to.
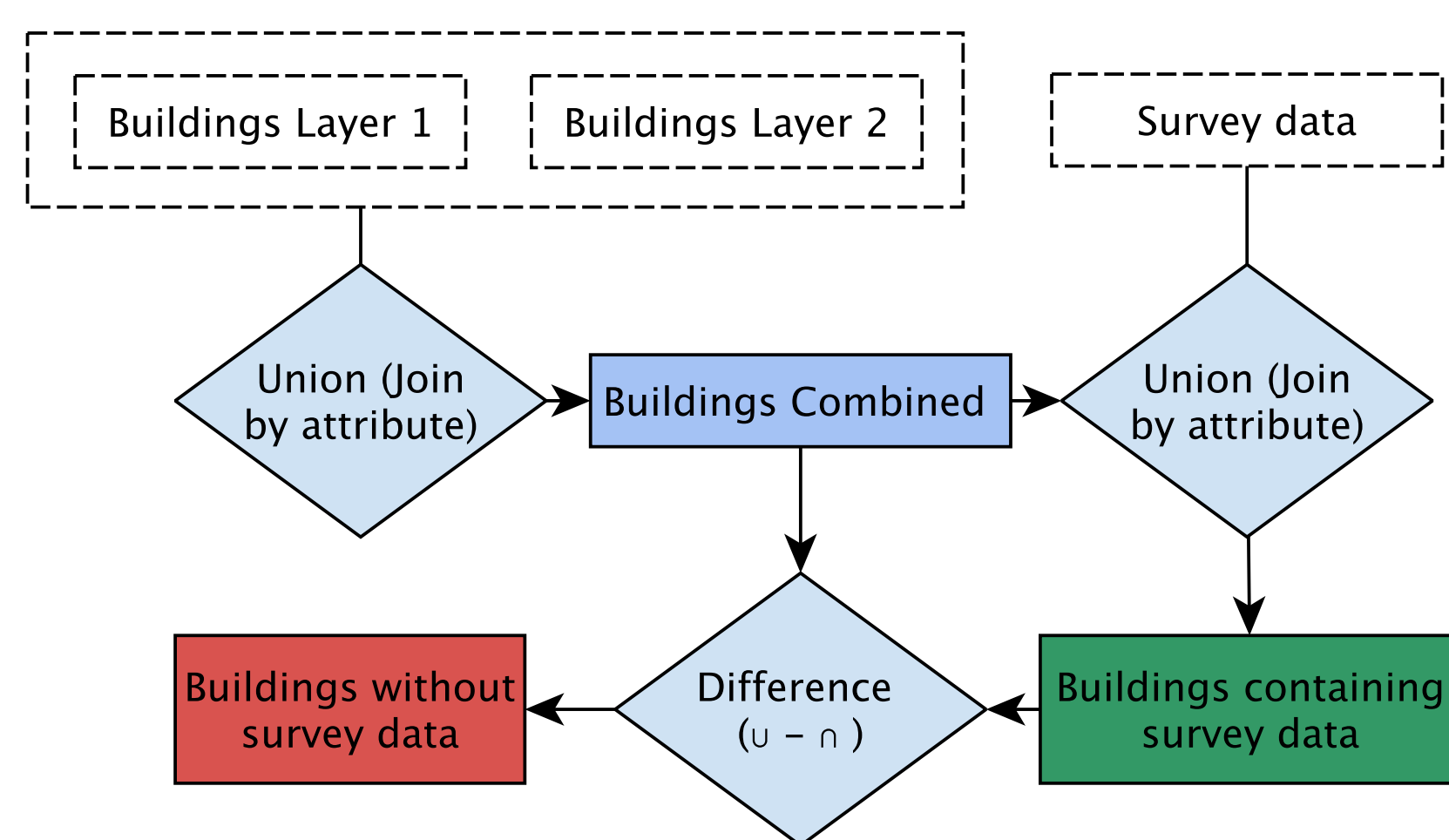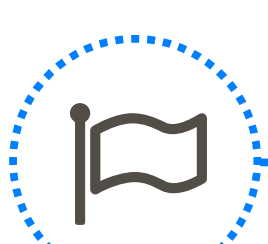
Objectives

Show how to improve tariff collection by:

Determining a toolchain to use existing data to highlight missing clients
Suggesting improvements to the data collection process
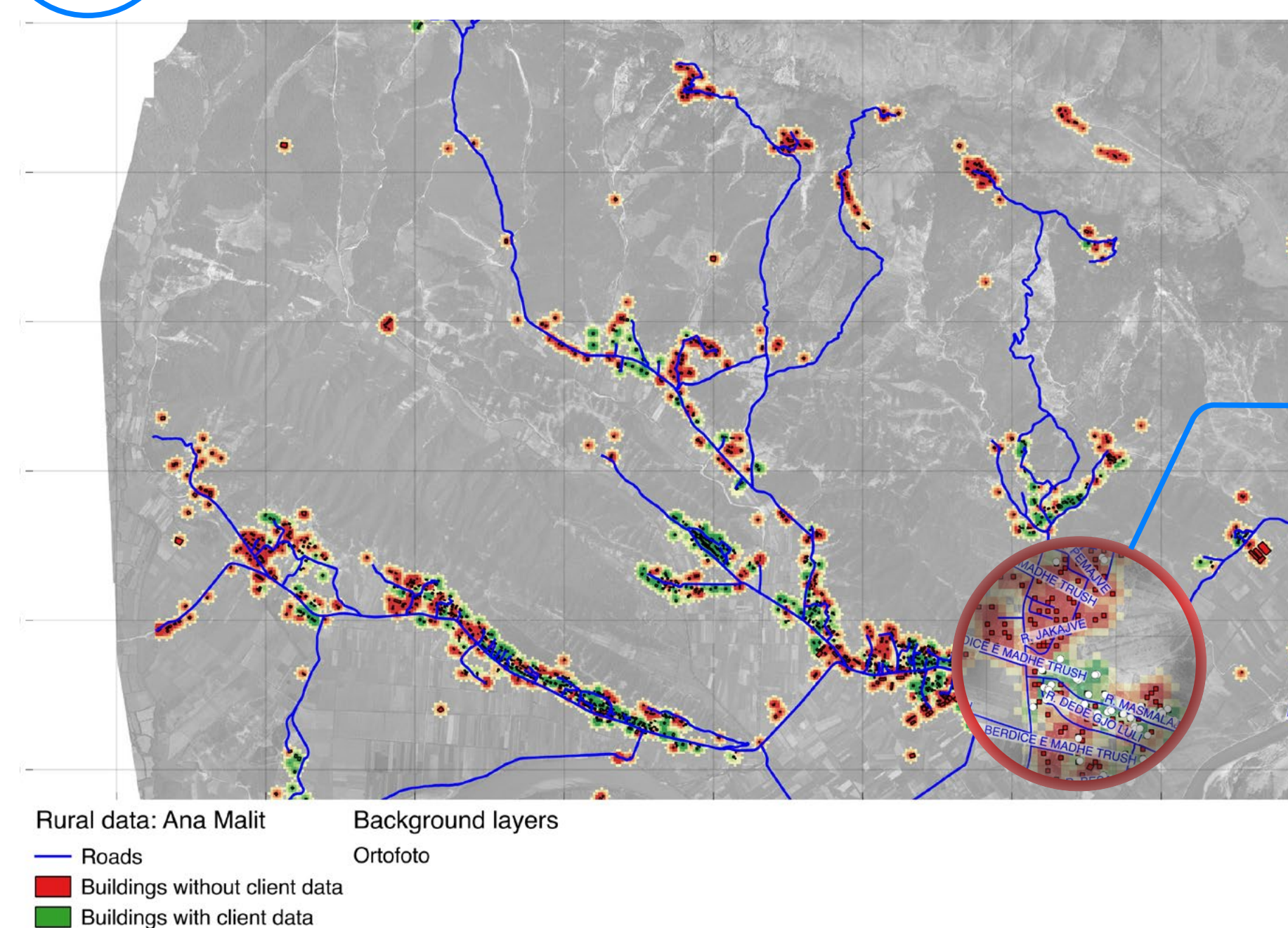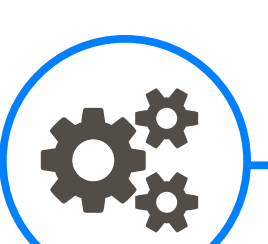Defining strategies to integrate and complete data

Results

1. Data Cleanup & Model

Schema of building-based visualization of missing clients

1 A data cleanup toolchain and model were proposed and the available data was summarized. For regions where census data has been collected, 26% - 38% of buildings are covered, corresponding to 44% - 74% of the population.

2. Storage & Vizualization

Rural data: Ana Malit — Background layers
Roads — Ortofoto
Buildings without client data
Buildings with client data

Regional heat map of census data coverage per building in Skhodra, Albania

2 The visualization of the available data enables finding spatial data gaps. Maps show clustering of the census points, with a sharp contrast of data availability between the town center and more remote sites. Only the building method was used, since the individual-based regression showed low R^2 ($< 15\%$).

3. Data Gaps Identification
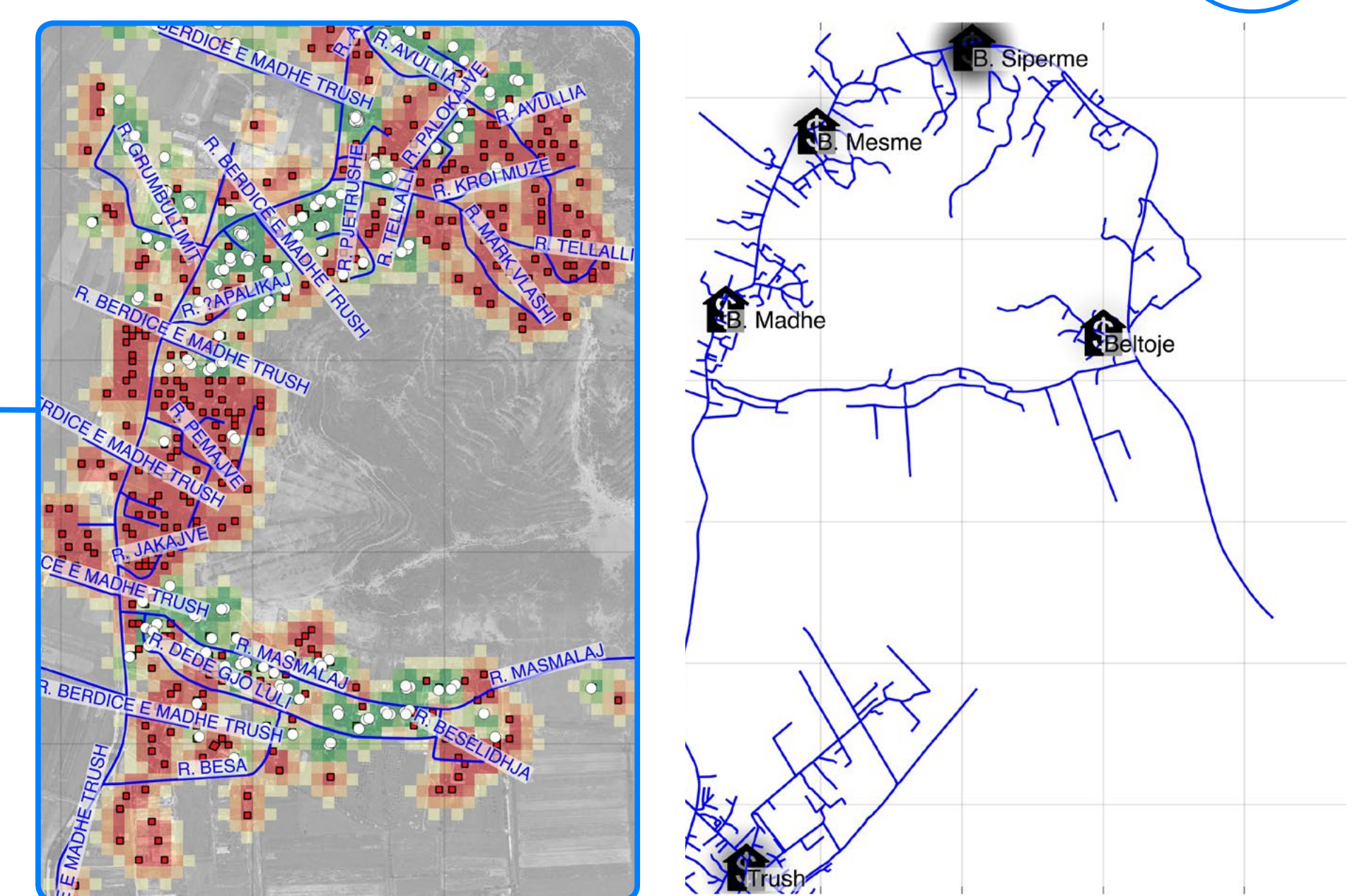
Local heat map zoom of census data coverage in Shkodra, Albania (left) and geocoded businesses (right)

3 Maps were created using database views: (a) Firstly, local zoom views help locate clusters of missing data (left) and secondly, businesses can be geolocated approximately (right). Since most businesses only have a road name, they are projected to the same coordinates, which can be visualized using a darker background.

Conclusions

GIS can be used to visualize where surveys have been gathered or are still missing. Optimally, survey gaps should be shown by comparing the survey data to a civil register. However, in the absence of such data, coverage of buildings is the next best proxy for missing clients. The high variation of the individuals per building do not justify an extrapolation based on the existing census data.

Imprecise address data of businesses can be geocoded with GIS to approximately show the location of businesses and to indicate business densities along certain roads.

These GIS methods along with the recommendations on tracking progress of data collection and integration help complete not only data on tax clients but also improve population data for other municipal services.

Key Recommendations

Short-term Data Collection
☑ Create a reference list of individuals from the most complete population data source ("Voters list") to track census data gathering process
☑ Visualize data to monitor data collection progress
☑ Take action at hotspots with data gaps

Long-term Action:
☑ Make registration of residency mandatory to replace the census
☑ Document data fielmethodology and plans for the data gathering progress and future steps in tariffing to reduce uncertainty
☑ Integrate spatial data into DB
☑ Integrate all data accross departments on one server