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EnCLOD

Data usage for city-region planners: preliminary guidelines

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EnCLOD preliminary guidelines for usage of OD and IoT in local governance

1. Overview - Starting guidelines

Municipalities in Central Europe have been facing various challenges these days.

- Lack of affordable living causing natural move of people to suburban areas, commuting to the metropole every day, challenging the roads and parking capacities, worsening air quality and traffic safety, mainly of vulnerable users,
- related climate change impacts like lack of green spaces causing heating islands, floods and storms,
- energy poverty related with fossil fuels consumption, low readiness for green deal investments
- water management related to droughts and expected drop of water availability due to climate change,
- sustainable waste management and circular economy
- but mainly cross sectoral cooperation, investment projects synergies and evaluation of the change made by an implemented measure.

All these challenges require a wiser approach to urban planning and faster reaction to the threats. More the demand for green deal investments is rising and digitization is a necessary presumption for their success. So, the digital urban planning (DUP) can be supported by opening static as well as collecting dynamic data from IoT sensors to provide a digital twin of a territory.

One of the main goals of the EU is twinning green and digital transition. This is particularly reflected in DUP. Digital urban planning is a set of digital services for urban planning profiting from open data, dynamic IoT sensors data, machine learning and artificial intelligence to support green transition investments planning, tackling socioeconomic impacts in FUAs. So, the digital transition in urban planning can be interpreted as a holistic view on deployment of sensors to provide open data, reflecting the needs of various sectors as well as territories.

The biggest challenge of municipalities regarding this digital transition is how to pick up right places, how to deploy sensors right to deliver reliable data, what standard the data should respect and how to publish it as open data, what quality and reliability the sensors should comply and how to procure such a service, and how the urban planning digital services work. The final guidelines will provide a comprehensive insight to answer these.

The pilot areas' current state of Open Data usage reflects its potential for advancing urban planning and governance through digital solutions. **Activity 1.2** identified several key features, challenges, and opportunities:

City planners and urban administrators should understand several vital aspects of using **open data** to improve urban governance, enhance planning, and engage the public effectively.

1.1 Definition and Purpose

- **Open Data** refers to datasets made freely available to the public without restrictive licenses. It enables transparency, innovation, and collaboration.
- Its applications in urban planning include mobility **transportation**, **infrastructure**, **public services**, **zoning**, environment, climate change and **community engagement.**

1.2 Benefits of Using Open Data

1. **Transparency and Accountability**:
   - Allows citizens to monitor government projects and decision-making.
   - Builds trust in governance.
2. **Enhanced Planning**:
   - Provides insights into real-time and historical patterns (e.g., traffic flow, public space usage).
   - Facilitates data-driven decision-making.
3. **Community Engagement**:
   - Involves citizens in the planning process through participatory tools.
   - Encourages crowdsourcing ideas for urban challenges.
4. **Economic Development**:
   - Supports startups and businesses leveraging data to create innovative services (e.g., mobility apps).
   - Reduces reliance on costly proprietary data.
5. **Efficiency and Cost Savings**:
   - Streamlines resource allocation.
   - Reduces duplication of effort among government agencies.

2. Methodology of OD and IoT in Local Governance Insights from the State-of-the-Art Analysis

2.1 Key findings of D.1.1.1

The data showcased the importance of criteria such as scalability, sustainability, and stakeholder engagement in evaluating effective practices. The findings aim to inform future guidelines and local action plans for better governance through data-driven solutions.

Criteria for Success:

- **Scalability:** The ability to expand solutions across different contexts.
- **Sustainability:** Long-term viability of implemented practices.
- **Stakeholder Engagement:** Involvement of community and civil society in data initiatives.
- **Data Quality:** Ensuring high standards in data collection and processing

Challenges in data quality:

- **Data Quality and Accessibility:** Ensuring the quality and accessibility of open IoT data is a significant hurdle. Poor data quality can lead to ineffective decision-making and undermine public trust in IoT implementations.
- **Integration with Existing Infrastructure:** Integrating new IoT systems with existing urban infrastructure can be complex and costly, requiring careful planning and coordination among various stakeholders.

- **Security and Privacy Concerns:** The deployment of IoT devices raises concerns about data security and privacy, as cities must protect sensitive information from cyber threats while complying with regulations.
- **Funding and Resource Allocation:** Securing adequate funding for the initial setup and ongoing maintenance of IoT systems can be challenging, particularly in cities with limited budgets.
- **Stakeholder Engagement:** Engaging citizens and stakeholders in the planning and implementation of IoT projects is crucial but can be difficult, especially if there is a need for more awareness or understanding of the benefits of such technologies.
- **Scalability Issues:** Designing scalable IoT solutions to accommodate future growth and technological changes is essential but often overlooked during initial deployments.

An outstanding example is IPR Praha. The Prague Institute of Planning and Development develops and manages Prague's geographical data and performs spatial analyses of traffic accessibility, ownership relations within the city, and the structure of built-up areas, among others. Based on long term work on data they are now working with a 3D model with many data layers experimenting with AI (https://geoportalpraha.cz/en/data-and-services/articles-and-projects/3D-model/3D-model-digitalni-dvojce)

2.2 Key findings of D.1.2.1

- **Environment and Traffic**: Ideal for open IoT data implementation without personal data concerns. A holistic approach should be adopted, demonstrated by a citywide IoT sensor map for traffic and environmental monitoring, with Olomouc as the pilot.
- **Drinking Water Data**: This can be openly accessed but should be aggregated by location and time to minimize misuse. A questionnaire targeting water companies will gather data for the Local Action Plans.
- **Wastewater Management**: Offers significant energy savings and demand for IoT solutions, but opening data access may present challenges. A questionnaire will be sent to wastewater companies to address this in the Local Action Plans.
- **Energy Data**: Currently difficult to open, but the Local Action Plan should explore ways to make some energy data accessible. This will be a lower priority and categorized as a "nice to have" component.
- **IoT Open Data Strategy**: Necessary for holistic IoT data provision. A micro zoning map will be created as a guide, building on best practices from Olomouc.
- **Sustainability of Data Sources**: Critical for overcoming barriers like low data quality and accessibility issues. The project will develop a strategy, technical standards, and a public dashboard for IoT open data.
- **IoT Operation Continuity**: Policy-level strategies and business models for long-term IoT operation as a public service will be developed as an outcome.
- **Sensor Placement**: The Olomouc case provides guidance for proper sensor placement, including traffic and heat island monitoring, with potential technical standards being explored by Czech partners.
- **Data Quality Monitoring**: Essential for ensuring accurate data, with a service for data quality monitoring being considered, including requirements and costs.
- **Data Storage and Publication**: Clear terms for third-party access must be established, and a service for the publication of IoT open data will be created based on a policy-level analysis and Olomouc case study.
- **Public Engagement**: Tools for citizen interaction with IoT systems will be developed, including opportunities for citizen participation and a public dashboard displaying localized open IoT data.
- **City/Regional Needs**: Each pilot area should prioritize gathering needs based on a gap analysis and engage city staff to align the project with the city's agenda. A table of key use cases will guide the development of future software tools to support these needs.

This overview highlights the project's readiness for IoT-driven solutions while pinpointing specific areas for improvement. These findings will directly inform the guidelines for implementing Open Data initiatives in alignment with local priorities and the broader project goals.

2.3 Guidelines and the main OD issues through various levels

Purpose

To define tasks, responsibilities, and timelines for advancing the IoT and open data agenda in local action plans, supporting sustainable urban development and smart city governance. This document serves as a roadmap for developing local action plans.

*Open data initiatives are evaluated across 4 levels - (political, technical, expert and organizational level) and five key dimensions: **Data Quality**, emphasizing accuracy, completeness, and security compliance; **Accessibility**, ensuring user-friendly formats, regular updates, and easy access; **Interoperability**, promoting standardized formats and user engagement; **Governance**, focusing on clear policies, leadership, and stakeholder involvement; and **Impact**, highlighting economic, social, and environmental benefits, along with innovations driven by open data. These principles collectively enhance transparency, usability, and societal value.*

2.3.1 Political level

Objective

Develop a long-term strategy for IoT deployment, focusing on digital urban planning and alignment with the European Green Deal.

2.3.1.1. Governance and policy

This dimension evaluates the governance and policy framework supporting open data.

- **Policy Framework:** Existence of policies supporting open data (e.g., open data policies, data privacy policies)
- **Leadership and Management:** Clear leadership and management structure for open data initiatives
- **Data Standards:** Adoption of data standards and interoperability protocols
- **Stakeholder Involvement:** Engagement with key stakeholders (government agencies, private sector, academia, civil society)

2.3.1.2. Impact

This dimension evaluates the impact of open data initiatives.

- **Economic Impact:** Evidence of economic benefits derived from open data (e.g., job creation, business development)
- **Social Impact:** Examples of social benefits (e.g., increased transparency, improved public services)
- **Environmental Impact:** Contributions to environmental sustainability and monitoring
- **Innovations and Improvements:** Notable innovations and improvements in services or governance enabled by open data

Key stakeholders:

Local government leaders, regional representatives, and policymakers will champion the strategy, ensuring alignment with national and EU priorities while actively engaging citizens in the planning process.

2.3.2 Technical level

Objective

Ensure IoT data reliability, accessibility, and interoperability to support cross-sectoral urban management.

2.3.2.1. Data quality

This dimension evaluates the quality of the data provided.

- **Accuracy**: Correctness and reliability of the data
- **Completeness**: Coverage and comprehensiveness of the datasets
- **Consistency**: Consistency of data across different datasets and sources
- **Metadata:** Availability of comprehensive metadata describing the data

· Ensure accuracy, timeliness, and completeness.

· Validate sources to maintain reliability.

- **Privacy and Security**:

· Anonymize sensitive data to protect individual privacy.

· Follow legal frameworks such as GDPR (General Data Protection Regulation).

Key stakeholders:

IT specialists, IoT providers, and technical teams will oversee the deployment, management, and maintenance of the IoT network and associated platforms.

2.3.3 Expert level

Objective

Address climate and traffic challenges using IoT-driven, holistic approaches that prioritize solutions requiring minimal personal data protection.

2.3.3.1. Accessibility and Availability:

This dimension evaluates the extent to which data is available for use by the public.

- Provide **user-friendly formats** (e.g., CSV, APIs).
- **Avoid overly technical interfaces** to ensure inclusivity.
- **Datasets Published:** Number and variety of datasets published
- **Frequency of Updates:** Regularity and frequency of data updates
- **Accessibility:** Ease of access to the data (APIs, portals)

Key stakeholders:

Urban planners, environmental specialists, and data analysts will lead the technical and strategic deployment of IoT solutions in their respective domains.

2.3.3.2. Completeness:

This dimension evaluates the share of the coverage of IoT sensors in operation /other data sources on a holistically designed IoT sensors deployment.

- Provide **the city and the community** with potential targets as well as a state of the art of the IoT sensors coverage
- **Provide a survey of** the most used data/sensors and related/potential portfolio of digital services.
- **Provide an insight on which staff/departments** are advanced in using digital tools
- **Support synergies in using as well as funding** open IoT data

2.3.4 Organizational level

Objective

Foster a local open IoT data ecosystem that encourages collaboration, innovation, and public awareness.

2.3.4.1. Interoperability and Data Use:

This dimension evaluates the extent to which the public uses data.

Use standardized data formats for seamless integration across platforms.

- **User Engagement:** Number and diversity of data users (citizens, businesses, researchers)
- **Applications Developed:** Number and impact of applications or services developed using the data **Case Studies:** Documented use cases demonstrating the data's utility
- **Governance and Policy**:

· Define clear policies for data sharing and usage.

· Set up an open data portal to centralize access.

· This dimension evaluates the governance and policy framework supporting open data.

2.3.5 Urban branding

Urban branding refers to the strategic process of creating a unique and compelling identity for a city or urban area. It involves leveraging a city's characteristics, culture, history, and aspirations to promote its distinctiveness and enhance its reputation. Urban branding is often used to attract tourists, investors, businesses, and new residents, as well as to strengthen the sense of identity and pride among current residents.

Key Components of Urban Branding:

1. **City Identity**: Highlighting the unique traits of a city, such as its architecture, cultural heritage, or natural landscapes.

2. **Vision and Narrative**: Crafting a story or message that reflects the city's values, aspirations, and future direction.

3. **Stakeholder Engagement**: Collaborating with local communities, businesses, and policymakers to ensure the branding aligns with the city's authentic character.

4. **Visual and Verbal Elements**: Designing logos, slogans, and other visual representations that embody the city's essence.

5. **Targeted Campaigns**: Using media, events, and marketing initiatives to communicate the brand to specific audiences, such as tourists, investors, or residents.

Benefits of Urban Branding:

- **Economic Growth**: Attracts businesses, tourists, and investments by showcasing the city's potential.
- **Cultural Promotion**: Enhances global awareness of the city's cultural and historical assets.
- **Community Cohesion**: Fosters a sense of belonging and pride among residents.
- **Global Competitiveness**: Helps the city stand out in a globalized world by emphasizing its unique selling points.

Urban branding is increasingly seen as a vital tool for cities to compete and thrive in a dynamic global landscape, blending marketing strategies with urban development goals.

3.Orienting the Open Data in the Pilot Areas

Strategy for the Use of Open Data (Based on Activities 1.2 and 1.3)

Developing a strategic orientation for Open Data in the pilot area requires aligning its application with local priorities and challenges, as identified in **Activities 1.2 and 1.3**. The strategy focuses on establishing a robust framework to guide data use in support of urban governance and sustainability goals.

1. **Strategic Objectives**
    - **Enhancing Decision-Making:** Use Open Data to inform policies in key areas, such as traffic management, environmental monitoring, and urban planning.
    - **Promoting Transparency:** Ensure that datasets are accessible, fostering trust among citizens and stakeholders.
    - **Enabling Innovation:** Encourage public and private sector innovation through the availability of high-quality, interoperable datasets.
2. **Key Pillars of Strategy**
    - **Data Governance:** Define clear policies for data ownership, management, and sharing to ensure consistency and accountability.
    - **Data Accessibility:** Prioritize the publication of datasets in user-friendly formats (e.g., APIs, CSV) with regular updates and comprehensive metadata.
    - **Stakeholder Engagement:** Establish partnerships between government, businesses, academia, and civil society to co-create solutions based on Open Data.

- **Technical Enablement:** Build technical infrastructure to support IoT integration and interoperability across sectors.

3. **Alignment with Pilot Area Needs**
    - **Mobility and Climate Focus:** As identified in Activity 1.2, traffic and environmental data should be prioritized for immediate action, possibly leveraging existing sensor networks. The Green Deal agenda can profit from the available open data and can become the main lever for open IoT data. (Ponti et al., 2024) (https://publications.jrc.ec.europa.eu/repository/handle/JRC139026)
    - **Scalability and Transferability:** Develop solutions that can be adapted to other contexts and scaled to larger regional or national initiatives.
    - **Citizen-Centric Approach:** Incorporate citizen feedback through participatory methods, such as workshops and hackathons, to identify priorities and improve engagement.
4. **Immediate Actions**
    - Design a microzoning and holistic design of environment IoT sensors network to open a discussion on potential need of sensing (a logical model)
    - Conduct stakeholder workshops to identify data priorities and gaps as well as existing technologies/potential open data sources on spots, identified by the logical model
    - Initiate pilot studies focused on traffic and climate data collection, ensuring compliance with privacy regulations.
    - Design communication strategies to promote the benefits of Open Data and address resistance among stakeholders.

This strategy serves as a roadmap to integrate Open Data into each pilot area's governance structure, ensuring its utility for current needs while laying a foundation for future advancements.

4.Actions Towards the Advancement of Open Data

Advancing the use of Open Data (OD) in the pilot area requires a combination of targeted actions aimed at capacity building, tool development, and public engagement. These initiatives, rooted in insights from Activities 1.2 and 1.3, will create a strong foundation for effective Open Data usage and foster long-term sustainability.

4.1 Training and Capacity Building

- **Workshops for Local Stakeholders:** Organize training sessions to familiarize city-region planners, public officials, and private actors with Open Data principles, tools, and best practices.
    - Topics: Open Data management, IoT integration, and data-driven decision-making.
- **Technical Skills Development:** Offer hands-on training on data analysis and visualization tools to empower stakeholders to derive insights from Open Data.
- **Public Awareness Campaigns:** Educate citizens about the benefits of Open Data through targeted initiatives, such as open houses, social media outreach, and community events.

4.2 Development of Tools and Platforms

- **Open Data Platform:** Design and launch a user-friendly platform to host datasets, ensuring accessibility through APIs and other standard formats.

- **Interactive Dashboards:** Develop dashboards for real-time data visualization, focusing on key areas like traffic flow, air quality, environment, aggregated water consumption, and aggregated energy consumption.
- **Data Quality Monitoring Tools:** Implement automated systems to validate and improve data quality, ensuring accuracy, consistency, and reliability.

4.3 Public and Collaborative Initiatives

- **Hackathons and Innovation Challenges:** Encourage collaboration among local stakeholders, startups, and developers to create innovative solutions using Open Data.
    - Themes: Smart mobility, climate resilience, green deal and digital urban planning.
- **Pilot Projects:** Launch small-scale pilot initiatives to demonstrate the potential of Open Data in specific areas, such as traffic optimization / safety, parking policy or climate monitoring.
- **Citizen Feedback Mechanisms:** Introduce participatory tools, such as surveys and online platforms, to gather public input on Open Data priorities and applications.

4.4 Strengthening Partnerships

- **Public-Private Collaborations:** Engage businesses, academic institutions, and NGOs in partnerships to share expertise and resources for Open Data projects.
- **Regional Cooperation:** Foster collaboration with neighboring cities or regions to exchange knowledge and develop transferable solutions. Support a natural cooperation of a region and its metropole on open data agenda

4.5 Example areas for the use of OD

1. **Traffic Management**:
    - Use open data for real-time tracking of congestion and optimizing road networks, traffic safety at the crosswalks, parking policy etc.
2. **Public Transportation**:
    - Publish schedules and GPS data for apps and predictive tools, enhance bigger employers to their company mobility plans, learning their true modal split and supporting sustainable mobility through employees' benefits
3. **Land Use and Zoning**:
    - Analyse spatial datasets to design better zoning regulations.
4. **Environmental Monitoring and Climate Change**:
    - To design sustainable cities, leverage air quality, noise, and green space data.
5. **Smart Governance**:
    - Combine IoT data with open platforms to monitor city infrastructure (e.g., smart lighting), enhance hackathons to deliver digital services based on IoT open data and provide testing/training on municipal staff to address their real needs.

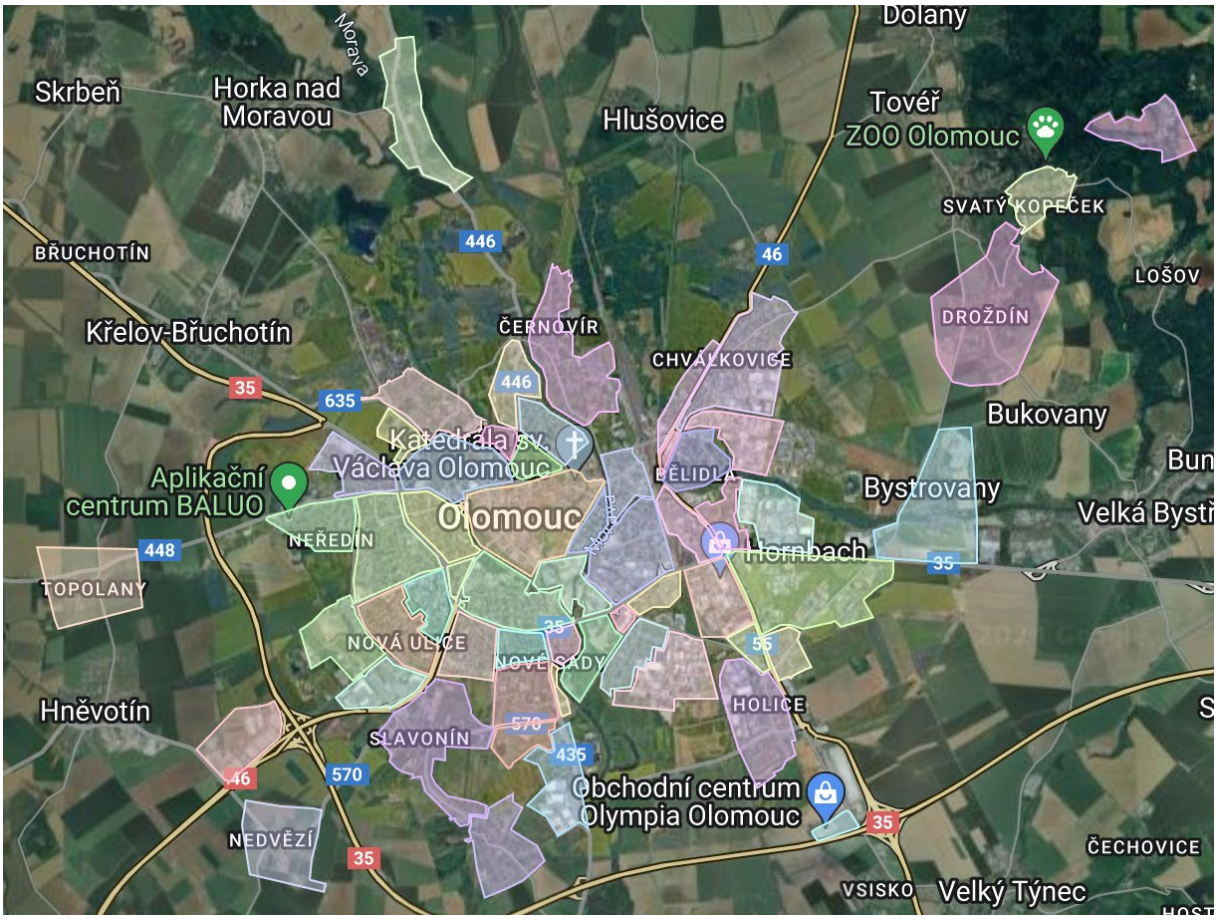
These actions aim to build an ecosystem that supports the effective use of Open Data, drives innovation, and strengthens trust and engagement among all stakeholders

4.6 Usual challenges

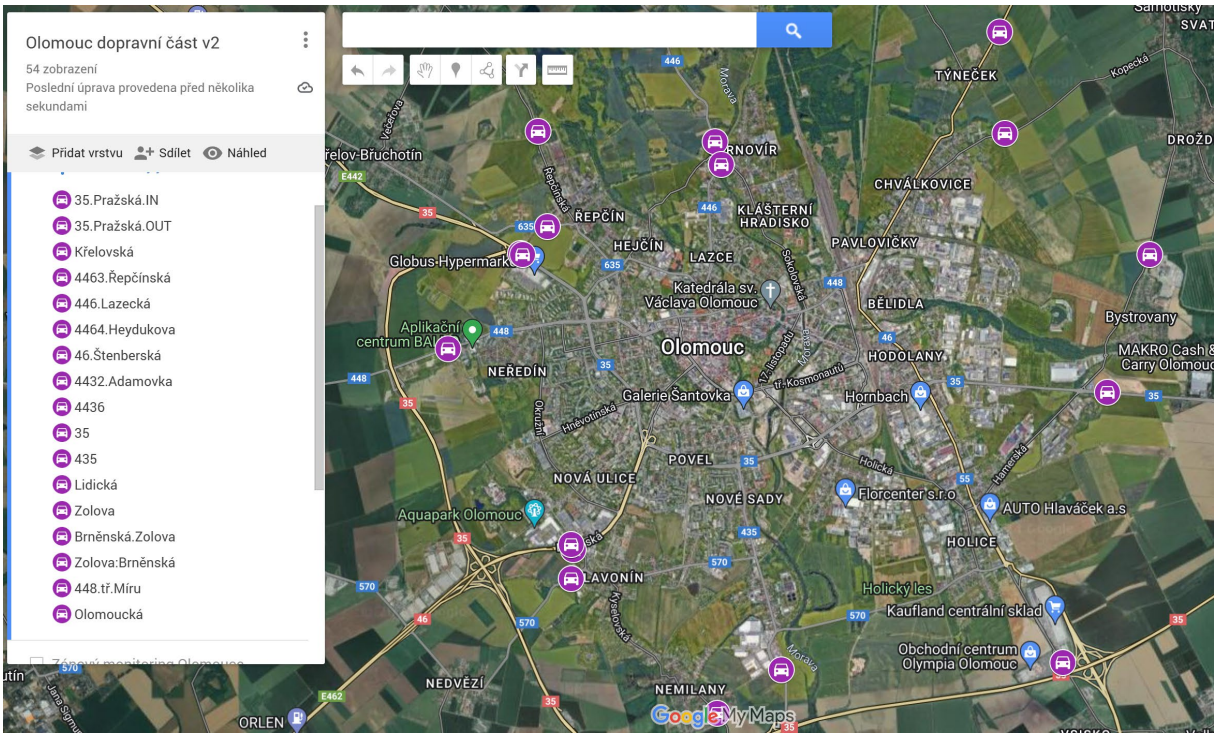
1. Lack of awareness or technical expertise among stakeholders.
2. Lack of a logical model/holistic approach on IoT sensors deployment based on the needs and microzoning
3. Inconsistent data formats and incomplete datasets.
4. Resistance to sharing data due to political or bureaucratic constraints.
5. Ensuring the sustainability of open data platforms and IoT system operation.

Good practice example: Holistic Design Framework for Olomouc

1. **Holistic Design**
   - **Microzoning**: Identifying what and where data is needed and so designing zones for optimal data collection respecting census data units. Microzones can become a new statistics unit for urban development/digital urban planning.
   - **Match Mapping**: Analyzing existing technologies, identifying their data output capabilities, and pinpointing the organizations operating these systems to leverage open data opportunities.
   - **Pilot Actions**: Outlining what EnCLOD is deploying and identifying gaps or remaining steps.
   - **Sensing Priorities**: Focusing on key areas like climate and traffic sensing while considering the logical cost models for citywide sensor deployment.



2. **Microzoning in Olomouc**
    - The city has been divided into **60 zones**, aligned with national statistical cells (e.g., Census blocks).
    - This zoning provides a **logical foundation for a citywide IoT network design**, integrating other data sources such as local research and questionnaires.
    - Zones offer the potential for comparison based on metrics such as population, temperature, traffic, and other factors (e.g., number of registered dogs).
    - **Purpose**: Microzoning enables targeted data collection to provide actionable insights (e.g., heatmaps), facilitating research and future app development. For instance, UPOL is researching night parking in these zones to assess the number of cars, vans, and bikes, with a focus on their impact on traffic—a key preparation step for upcoming hackathons and applications.
3. **Examples of Practical Implementation**
    - **Match-Making Existing Systems**:
      Example: A hospital operates a barrier entrance system that is situated at the border of a zone. The task is to explore whether the system operator can create a non-personal open database from already collected data to contribute to Olomouc's future digital twin. This eliminates the need for additional sensors while providing valuable data for applications like a hospital mobility plan, parking policy or traffic management.
    - **Funding Diversification**:
      The holistic design approach identified potential for **traffic geofencing**, particularly on regional/state roads. An action plan item is to investigate whether the regional authorities could fund geofencing technologies or contribute with data from existing systems. This aligns with the broader goal of creating a cost-efficient digital twin for the city and represents a showcase of close cooperation of a region and its metropole.



By aligning microzoning, existing resources, and funding strategies, Olomouc is laying the groundwork for a data-driven, sustainable urban future.

5. The future of Open Data in the Pilot Area Steps for Implementation

A forward-looking vision for Open Data in the pilot area involves embedding data-driven practices into the fabric of urban governance and community life of each pilot area. This vision recognizes the transformative potential of Open Data to address complex urban challenges, foster innovation, and enhance citizen engagement.

5.1 Short-Term Goals (Implemented within EnCLOD)

The project's short-term goals are to build stakeholder capacity through workshops, launch a basic Open Data platform with pilot projects for traffic and environmental monitoring (with a design of a logical model based on various stakeholders needs), improve data quality, engage the community through participatory tools, and establish initial partnerships with local and regional collaborators.

5.2 Long-Term Goals (Wider Municipality strategy)

Integrated Digital Urban Governance: Transition towards a fully digital governance model where Open Data and IoT technologies are central to decision-making processes across all sectors.

Digital transition: IoT open data can become a stable source for new digital services and apps as a bottom-up approach for digital transition of municipalities regardless on their size or position (e.g. frost predictor service can become a universal service)

Sustainability and Resilience: Leverage Open Data to support the Green Deal agenda by enabling data-driven policies for climate action, resource management, and environmental monitoring.

Enhanced Citizen Empowerment: Foster a participatory culture where citizens actively contribute to and benefit from Open Data initiatives, creating a more inclusive and transparent governance framework.

5.2.1 Key Enablers for Advancing Open Data

Policy Support: Develop and adopt policies that prioritize Open Data as a key pillar of urban development, with clear guidelines for data sharing, privacy, and security.

Capacity Building: Maintain ongoing training programs for stakeholders to ensure technical expertise and awareness keep pace with technological advancements.

Technological Innovation: Continuously upgrade data infrastructure, focusing on interoperability, scalability, and the integration of AI-driven analytics for predictive and real-time insights.

Funding and Resources: Secure sustainable funding models to support Open Data platforms, including public-private partnerships and grants from regional or EU-level programs.

Green and digital twinning: the city open IoT data policy can require that all Green Deal investment projects contain digital layers based on IoT sensors operation to fulfil EU green and digital twinning goals

5.2.2 Expanding Applications (if applicable)

Smart Cities and IoT Ecosystems: Broaden the use of IoT sensors and Open Data platforms.

Regional Data Hubs: Position the pilot area as a regional leader in Open Data by creating hubs that aggregate and share data across city and regional boundaries.

Data-Driven Innovation: Cultivate a thriving ecosystem of startups and businesses that use Open Data to develop new products and services tailored to local needs as well as universal tools to support the scale-up of the digital economy.

5.3 Measuring Success

Key Performance Indicators (KPIs): Establish metrics to track the impact of Open Data initiatives, such as increased dataset availability, higher citizen/stakeholders engagement, digital services/digitized city agendas, and tangible economic or environmental benefits.

Continuous Feedback Loops: Use feedback from stakeholders and citizens to iteratively improve Open Data strategies and align them with evolving priorities.

This integrated strategy aims to build a robust Open Data ecosystem, driving innovation, strengthening trust, and fostering engagement among all stakeholders. By addressing existing gaps and leveraging opportunities, the pilot area can become a model for sustainable, data-driven urban governance.