Open framework for boosting EU High Value Datasets from Public Sector

beopen-dep.eu

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D4.2 Validation report (first version)

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Abbreviations and Acronyms

ACRONYM	Definition
AI	Artificial Intelligence
APA	Portuguese Environment Agency
API	Application Programming Interface
EFFIS	European Forest Fire Information System
EO	Earth Observation
GIS	Global Information System
HVD	High-Value Dataset
IPMA	Portuguese Meteorological Agency
KPI	Key Performance Indicator
LED	Light-Emitting Diode
LEZ	Low-Emissions Zone
NdR	Mobility management
NOA	National Observatory of Athens
PUMS	Urban Plan for Sustainable Mobility
ROI	Regions of Interest
SVARH	Water Resources Monitoring and Alert System
UAV	Unmanned Aerial Vehicle
UC	Use Case

1. Introduction

1.1. Purpose and Scope

Public administrations face the challenge of digitisation with the sole objective of improving public service. Actions on safety, mobility or health effects are clear examples of truly meaningful applications to address decision-making based on data and evidence, never on intuition. A set of pilots that address the way in which the administration must face challenges based on evidence, guaranteeing good governance based on efficiency not only in results but also in public spending, optimising actions based on impact and investment, which is only possible with the management of the available quality information.

In the BeOpen Project there are a set of demonstrative pilots where the aim is to validate the effect and benefits of the use of high value data within public activity by contrasting the effects of decision making based on the responsible use of data.

The pilots must demonstrate the effect that the effective use of these data sources has on their organisation, and see how a continuous process of improvement is initiated. With this objective in mind, the monitoring and evaluation activity of the use cases is developed from the starting point to their implementation, verifying the results obtained in the measures adopted, which in the end are effective public policies.

To ensure this monitoring and control activity, this document defines the different use cases to be monitored with characteristics and objectives and the baselines as a starting point for evaluation, defining a set of quantitative and qualitative KPIs for their measurement. Once these indicators are communicated, a real picture will be obtained not only of the truly effective use of quality data, but also of the real impact of the demonstrator.

It is at this stage that the monitoring procedure is established, which will lead the pilot cities to take corrective action in the future by monitoring the effect of the measures taken and providing feedback to ensure continuous improvement of public management.

1.2. Structure of the Document

This document is structured in seven different chapters where the use cases are described, their characteristics, objectives, their indicators, and starting point.

To meet this objective, the document is structured as it follows:

Chapter 1, introduction and objective, where the scope of the document is described, its contextualization in the BeOpen Project and the objectives aimed at a correct monitoring and follow-up of the use cases.

Chapter 2, justifies the evaluation and the methodology used to carry the impact assessment based mainly on available data and its processing.

Chapter 3, addresses the definition of the 15 use cases being developed within BeOpen, their particularities and common characteristics This is the preparatory activity to start the monitoring of these activities. A general description of the use case is made, including a description of the available digital services and the set of available data. As a starting point, the baseline is set with its indicators, the expected benefits as well as a conclusion on the proposed use.

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Chapter 4, provides an overview of the HVDs provided for the BeOpen project baseline and the importance of their application.

Chapter 5, presents the comparison between the different baselines, providing an overview of the use cases, individually and together.

Chapter 6, a final conclusion of the set of demonstrators based on the results from the different use cases.

Chapter 7, with a set of final annexes complementary to the activity.

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2. Rationale for the Impact assessment

The evaluation of a use case based on the use of data to improve governance and decision-making in a public administration is a difficult and complex challenge, as it must include both quantitative and qualitative data, often based on the perceptions and evaluations of each individual user involved, conveying these uncertainties into the indicators. It is important to measure and quantify the real impact of the project on the different organisations present, the different pilots, which is why this methodology for evaluating this impact has been developed. With this evaluation, a double objective is achieved: on the one hand, to evaluate the impact on the organisations present, and on the other hand, the evaluation is a fundamental tool to ensure the replicability of these good practices.

What is really intended is a change in the traditional working practices when dealing with the needs of the municipalities, for this reason it is necessary to have an important and representative group of users for the management of these use cases.

Once what is to be evaluated is known, in this case the different use cases, the representative indicators of the specific activity must be defined. With this map of indicators, a baseline is generated with which the implementation of the use cases with the use of the different digital components can begin.

It is important to use a series of specific indicators developed for each use case as they contemplate different and unique characteristics of each one of them, which although they may have common aspects, their singularities make the use of common indicators unfeasible. These indicators will be reported by the different use cases, pilots, being the quantitative ones in a direct way and the qualitative ones through the results of different surveys to the defined users.

Once indicators have been defined, the baseline is developed, with which the evaluation and monitoring of the impact of the use of digital content in the different use cases, and ultimately in the administration, will begin.

Finally, in the evaluation it is important to introduce some conclusions of the use cases themselves, of the municipalities themselves in terms of their experience in the use of these digital contents and how they are incorporated in their organisation.

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3. Pilot use cases: the baseline

3.1. Attica

3.1.1. Overview of use case

The main objective is to conceive a “shield” from natural disasters for Attica region’s citizens and environment, identifying hazards, assessing risks and mitigation measures. The scope of the use case is to improve wildfire detection, response and management, utilising crowdsourced data and EO data. The use case addresses the critical challenge of increasing frequency, severity and impact of forest fires in the Attica region. This use case will focus on analysing social media content and extracting insights with the support of earth observation data creating a fire event detection module to improve the response mechanisms during wildfire incidents.

The Attica BeOpen Pilot seeks to assist emergency decision-making teams in the Region of Attica by enhancing emergency management and data-driven decision-making during wildfire response efforts.

By utilising High-Value Datasets (HVDs), the pilot aims to support more informed and timely decisions, improving the efficiency and effectiveness of response actions. The planned integration of real-time data into digital services will provide comprehensive situational awareness, ensuring critical resources are allocated to areas where they are needed most.

3.1.2. Use case rationale: digital service, HVD and intended impact

3.1.2.1. The challenge: pre-intervention situation in pilot site

Some of the key challenges that the region of Attica in Greece faces are Natural Disasters, such as earthquakes, floods, and forest fires. Preparedness, planning, and response mechanisms are critical for minimising the impacts of such events on the population and infrastructure. To address these urgent challenges, coordinated efforts from local and national governments, communities, businesses, academia/research, and other stakeholders are required. Forest fires are a significant concern for the Attica Region and the surrounding areas in Greece, especially during the hot and dry summer months. The urgency of the forest fire problem for Attica depends on various factors, including: 1) Frequency of fires, 2) Magnitude of fires, 3) Proximity to Urban Areas, 4) Ecosystem and Biodiversity Loss, 5) Economic Impact, 6) Climate Change by increasing temperatures, prolonging droughts, and creating more favourable conditions for fire ignition and spread, and above all 7) imminent threat to human life.

Before implementing the BeOpen project framework, digital services, and pilot testing, it was crucial to thoroughly assess the situation at the pilot site. Understanding the pre-intervention context was essential not only for tailoring the digital services to better address stakeholders’ needs but also for evaluating the anticipated impact of the BeOpen project.

To achieve this, and considering the proposed use case, NOA identified key stakeholders, including the Civil Protection Authority of the Region of Attica, the Hellenic Fire Brigade, and the Hellenic Rescue Team, a group of volunteers. While these

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stakeholders were engaged specifically for the BeOpen project, NOA has maintained long-standing relationships with them.

From this long lasting relationship, NOA knew that the issue that need to be addressed by the pilot is the need for accurate identification of the ignition point of fires: Timely and precise identification of the fire's starting point is critical for rapid response and containment efforts, enabling firefighting teams to act promptly before the fire spreads uncontrollably.

To help with this issue, we propose the development of a single digital service for the near real time fire detection with social media: fire event detection and monitoring of fire-related geolocated posts referring to the same incident using location and time.

3.1.2.2. The prospected solution: digital services and HVDs

To address the identified challenges, the Attica Pilot focuses on the development of a **Digital Service for near real-time fire detection and monitoring,** combining social media insights with Earth Observation (EO) data. This service aims to provide a dual perspective: high-quality EO imagery offers insights into affected areas, while social media data provides citizen-driven, enriching and validating EO findings with localized context.

The service detects wildfire events by identifying unusual patterns in data streams. Social media posts are initially analyzed using a density-based clustering algorithm to identify potential incidents. Given a set of points in some space, it groups together points that are closely packed. These detections are then verified with Sentinel-5P EO measurements, through air pollutants level analysis, using temporal and spatial outlier detection methods for additional validation.

The HVD collection includes metadata derived from geolocated social media posts, relevance scores, visual concepts, and geospatial data. The HVD datasets support detailed fire analysis, enabling precise localization, intensity assessment, and progression monitoring. The processed data is subsequently used for visualization and decision-making support.

In alignment with BeOpen objectives, the above-described **Attica Pilot Digital Service will re-use five** HVDs.

■ Table 1 – Dataset selection for Attica Pilot Digital Service.

# Dataset	Dataset designation
DATASET_ATTICA_1	Historical EO Fires Dataset
DATASET_ATTICA_2	Social Media Posts Related to Fires
DATASET_ATTICA_3	Predicted Fire Danger Levels Using EFFIS Data
DATASET_ATTICA_4	Social Media Events Related to Fires

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DATASET_ATTICA_5	Copernicus Data Space Ecosystem Satellite Data

3.1.2.3. The result: expected outcomes

Attica Pilot's benefits are the following:

- **Timely Information in Areas with Limited Official Detection Systems:** Social media posts can provide early alerts about fire incidents, especially in remote or underserved areas where traditional detection systems (like satellite-based or ground-based sensors) may not be available or may have delays. This can significantly reduce the time between fire ignition and the initiation of response efforts.
- **Historical EO fire data for Recovery and Prevention Planning:** Burned scars provide a visual representation of affected areas, aiding stakeholders in assessing the severity of past incidents and planning recovery efforts or preventive measures for future wildfire risks.
- **Enhanced Situational Awareness:** By collecting and aggregating posts from multiple users in the affected area, emergency services can gain a clearer picture of the fire's spread, intensity, and potential impact. This crowdsourced information supplements official data and can help identify areas requiring immediate attention.
- **Crowdsourced Data as a Supplemental Layer:** Social media provides a wealth of user-generated content, including images, videos, and text descriptions. This data can serve as an additional layer of information, particularly useful in fast-evolving scenarios where traditional monitoring tools might lag.
- **Providing Real-Time Information:** Social media operates in real time, offering updates as events unfold. This continuous stream of information can help responders adapt their strategies dynamically, improving their ability to contain the fire and mitigate damage.
- **Community Engagement and Awareness:** Social media fosters public involvement by allowing individuals to report fires and share updates. This engagement not only empowers communities but also helps raise awareness about fire safety and response measures.
- **Cost-Effectiveness:** Leveraging existing social media platforms is a cost-efficient way to complement traditional fire detection systems. It reduces the need for additional infrastructure while enhancing detection capabilities.
- **Insights for Post-Incident Analysis:** Aggregated social media data can be analyzed after the fire to evaluate the response, understand public sentiment, and identify potential improvements in communication and management strategies.

3.1.2.4. The stakeholders: engagement and inputs

As discussed above, the Attica use case involves several key stakeholders critical to effective emergency management and wildfire response. These include:

Civil Protection Authority of the Region of Attica: This authority is responsible for overseeing disaster preparedness, response coordination, and recovery efforts within the region. It serves as the central body for implementing policies, allocating resources, and ensuring that emergency operations are executed efficiently during crises, including wildfires.

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The Hellenic Fire Brigade: The Hellenic Fire Brigade plays a frontline role in combating wildfires across the region. It is tasked with fire suppression, evacuation support, and protecting lives and property. The brigade's expertise, equipment, and rapid response capabilities are vital to managing fire incidents and mitigating their impact.

The Hellenic Rescue Team: This group of dedicated volunteers actively participates in emergency response efforts, offering additional support during crises. They contribute to various activities, including search and rescue operations, first aid, and logistical assistance. Their flexibility and local knowledge make them an invaluable part of the region's disaster management framework.

3.1.3. Baseline assessment

3.1.3.1. Rationale

The baseline assessment acts as a reference point for understanding the prior-intervention status for Attica Pilot, the stakeholders' needs, and their expectations. It sets a foundation from which you can adapt the project objectives to the real challenges in Porto city management and decision-making, specifically emergence management, measure progress and determine our success indicators (KPI).

The data collection activities are summarised to the following table.

■ Table 2 – Baseline assessment: data collection activities description.

Activity	Description	Type of info / means of verification
Surveys	Development of surveys	Surveys (qualitative/quantitative info)
Internal analysis of BeOpen metrics	Analysis of quantitative information to help measure KPI	Quantitative information
Meetings with the Region of Attica	Meetings with end-users	Project logs (meetings' minutes)

3.1.3.2. KPI selected

For the impact assessment task, Attica selected 18 KPIs related to Use Case 1 from the extended list of KPI proposed in Deliverable 4.1 – Validation Methodology & KPI, that intend to produce an overall impact analysis of BeOpen project in terms of Data usage, Data availability, Data accessibility, Data quality, Stakeholder engagement.

These KPIs were constructed and measured using information obtained from various data collection activities previously described (e.g., project logs, surveys, and BeOpen metrics). Table XX provides a comprehensive description of each KPI, including the source (e.g., survey, project logs, BeOpen metrics), metrics, metric units (e.g., Likert scale, number, percentage), measurement phase (baseline and/or impact assessment), and final measurement.

The KPIs can be seen in the table below.

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■ Table 3 – UC 1 – Attica pilot – Key Performance Indicators.

Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics
KPI_ATC_1	To what extent the quality of data has been improved to better manage emergency response and disaster management processes?	Degree of data accuracy and reliability achieved with BeOpen Framework adoption with respect to the current solution in place.	BeOpen metrics	Accuracy time/space (geolocation of tweets, when/where is the fire?)
KPI_ATC_2	To what extent the availability of HVDs has been improved to better manage emergency response and disaster management processes?	# of HVDs made available to the public through BeOpen Framework.	BeOpen metrics	Number of HVD made available through BeOpen Framework
KPI_ATC_3		% Percentage increase in the availability of high-value datasets through BeOpen Framework compared to the baseline.		Percentage increase in the availability of high-value datasets
KPI_ATC_4	To what extent the HVDs are better integrated and accessible to improve the management of emergency response and disaster management processes?	Perceived state of public services affected by HVDs before and after the adoption of BeOpen Framework.	Survey/Interviews	Degree of perceived state of public services affected by HVDs before and after BeOpen
KPI_ATC_5	Have new HVDs been made available to to better manage emergency response and disaster management processes?	# of new HVDs made available.	BeOpen metrics	Number of HVD made available through BeOpen Framework
KPI_ATC_6	To what extent have HVDs been made discoverable through European Union member states' open data portals to better manage emergency response and disaster management processes?	Ratio of BeOpen Datasets which will be made discoverable through the European Open Data Portal and member states' open data portals.	External/internal data sources	Ratio of BeOpen Datasets which will be made discoverable
KPI_ATC_7	To what extent has the BeOpen Framework increased the use of HVDs to better manage emergency response and disaster management processes?	Ratio of HVDs that are used by civil servants in their public services management activities after BeOpen compared to the current practices.	Survey/Interviews	Degree of usage of HVDs
KPI_ATC_8	Is there the potential for additional services being developed beyond the end of the BeOpen project to better manage emergency response and disaster management processes?	Perceived likelihood of further services being developed.	The consortium's exploitation report	Perceived likelihood of further services being developed.
KPI_ATC_9	Has scientific research related to BeOpen been produced to better manage emergency response and disaster management processes?	# of scientific papers produced by using data provided by BeOpen.	External data sources	Number of scientific papers produced
KPI_ATC_10	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to better	# of times HVDs accessed.	BEOPEN metrics	Number of HVDs accessed.
KPI_ATC_11		# of downloads per dataset.		Number of downloads per dataset.

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Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics
	manage emergency response and disaster management processes?			
KPI_ATC_12	Under what conditions can the BeOpen Framework be reused in other public services management processes of the same local areas to manage emergency response and disaster management processes?	Key characteristics of replicability scenarios	Survey/Interviews	Characteristics of replicability scenarios
KPI_ATC_13		Perceived usefulness of replicability scenarios in terms of technical, financial, skills and governance requirements		Usefulness of replicability scenarios
KPI_ATC_14	Under what conditions can the BeOpen framework be reused in the same public services management processes of other local areas to better manage emergency response and disaster management processes?	Key characteristics of replicability scenarios	Survey/Interviews	Characteristics of replicability scenarios
KPI_ATC_15		Perceived usefulness of replicability scenarios in terms of technical, financial, skills and governance requirements		Usefulness of replicability scenarios
KPI_ATC_16	Which are the current and planned HVDs that will be made available for public services management processes that use the AI-driven approach to better manage emergency response and disaster management processes?	# of HVDs integrated by BeOpen Framework that use AI	BeOpen metrics	Number of HVDs that will be used to AI models
KPI_ATC_17		# of them that are open to the public.		Number of HVDs open to the public.
KPI_ATC_18		Degree of capability to collect feedback from and provide insight to local communities with respect to the current practices.	Survey/Interviews	Degree of local communities' satisfaction

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3.1.3.3. Other data and physical measures

In the current baseline assessment phase, some KPIs were measured using BeOpen metrics. This was the case for the HVD score, which was obtained through the evaluation of these datasets using the Impact Assessment Tool and directly measured by Porto Digital's Data and Systems Architecture team.

In the impact assessment phase, scheduled for M30, the number of KPIs measured using BeOpen metrics will increase.

3.1.3.4. Result of the survey and Synthesis

The following tables show which stakeholders from the different departments answered the survey for Use case 1.

▪ Table 4 – UC 1 – Respondents to baseline survey.

Respondent	Organization	Role	Type of stakeholder
PERSON_ATTICA_1	Directorate of Civil Protection of the Region of Attica	Manager of Environment, Natural - Technological Disasters & Crises	Beneficiary / user
PERSON_ATTICA_2	Directorate of Civil Protection of the Region of Attica	Director	Beneficiary / user
PERSON_ATTICA_3	Directorate of Civil Protection of the Region of Attica	Crisis Manager	Beneficiary / user
PERSON_ATTICA_4	Directorate of Civil Protection of the Region of Attica	Supervisor	Beneficiary / user
PERSON_ATTICA_5	Hellenic rescue team	First responder	Beneficiary / user
PERSON_ATTICA_6	Hellenic rescue team	Project Manager	Beneficiary / user

•

This section analyses the outcomes of the survey. A total of 6 people have replied for the baseline assessment.

Current use of HVD

At present, most respondents in the Attica region (over 66%) indicate that geospatial data are either sometimes used or rarely used, while one-third of respondents confirm that they are frequently used. This can be taken as an initial observation, with changes to be assessed following the BeOpen project. Such a distribution of responses suggests varying levels of awareness among respondents regarding the data and datasets they use. It is likely that the data are available and used by certain stakeholders, but access and knowledge of such datasets are unevenly distributed.

A similar observation arises from the questions regarding Earth Observation and Environmental Data, as well as Meteorological and Climate Data.

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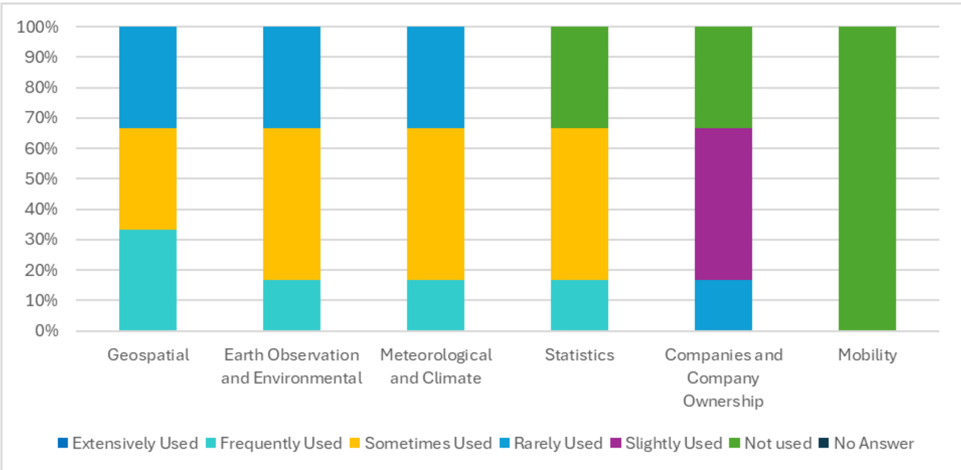
Only one respondent reports that statistics, including economic, social, and demographic data collected by national statistical agencies, are frequently used. This could indicate a lack of awareness or that the use of these sources is largely left to the initiative of individual departments within the Attica administration, rather than being guided by a comprehensive and shared strategy.

Companies and Company Ownership Data: This category includes business registers, ownership structures, and financial information, which are essential for understanding where the economic activities take place and relate them with disaster management. However, these data are rarely, slightly, or not used, highlighting a weak causal relationship with emergency response and wildfire management.

It is confirmed that mobility data are not currently used for the emergencies that the Attica use case focuses on.

Figure 1 – UC1 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your region management and operations previous to the BeOpen project experience?"



***Note: Geospatial Data:** Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. **Earth Observation and Environmental Data**: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; **Meteorological and Climate Data:** Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; **Statistics:** Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. **Companies and Company Ownership Data:** Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. **Mobility Data**: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Relevance of HVD for Smart City Management

In the next set of questions, the importance of such datasets is evaluated.

For the specific needs of Attica's emergency response and wildfire management:

Geospatial Data: Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. While these are considered very important for urban planning, navigation, and environmental monitoring, they are not yet deemed

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critical. This perspective may shift once the operations and potential impact of the digital service being developed are explained and demonstrated.

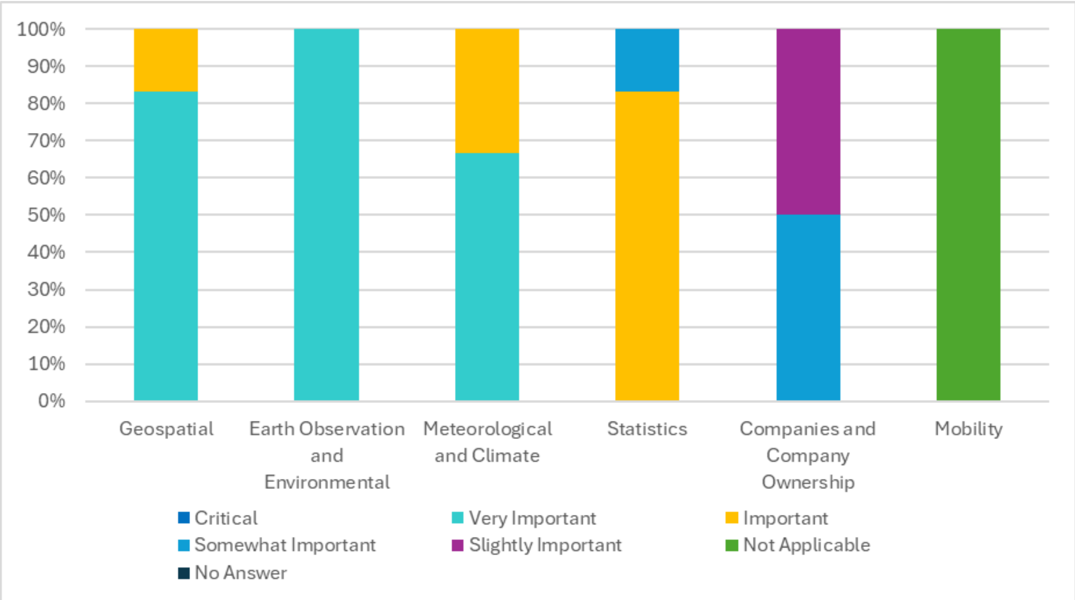
Earth Observation and Environmental Data: All respondents agree that these data are very important for emergency response.

Meteorological and Climate Data: This includes weather-related data such as forecasts, historical climate data, and real-time monitoring. The majority of respondents consider these datasets very important, as they play a crucial role in fire emergency response (e.g., assessing prevailing winds and rainfall). While the functional design of the digital service will determine their use, it is expected that these datasets will prove highly relevant once stakeholders are introduced to the digital services and their functions.

Economic and social statistics: as well as demographic data, are expected to be useful but not very important for the core functions of Attica's digital service. This is corroborated by stakeholders who also assess company data as non-critical.

Mobility data:Currently considered not applicable by stakeholders in the Attica pilot use case. However, this opinion may evolve if first response to fires requires traffic management and mobility optimisation for first responders, supported by the digital service being developed.

Figure 2 – UC1 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

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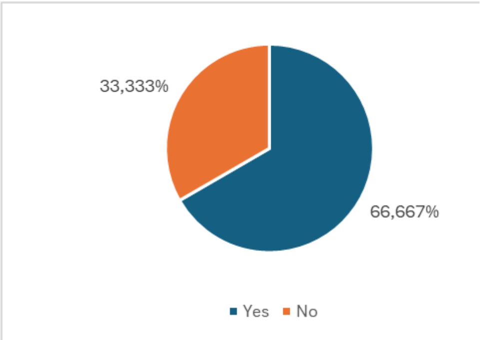
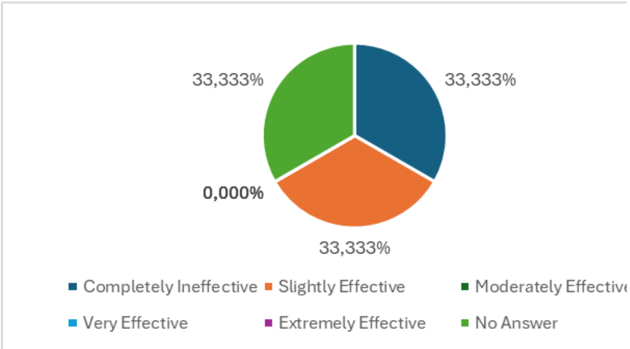
Data solutions in place and its effectiveness

The next set of questions examines the existence of **current data management solutions** to support wildfire response in Attica. The majority of stakeholders responded positively but judged these data management solutions as completely ineffective or only slightly effective (over 66%). The BeOpen digital services may alter this perspective and improve the stakeholders' evaluations, which currently view these solutions as largely ineffective.

Figure 3 – UC1 – Q3 "Are currently data management solutions in place to support the response to wildfires in Attica? If yes, the solution currently in use is:"





***Completely Ineffective** (No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Slightly Effective** (Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Moderately Effective** (Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Very Effective** (Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Extremely Effective** (Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

All stakeholders confirm that no high-value datasets (HVDs) are currently used to combat wildfires in the Attica region prior to the BeOpen implementation. With no HVDs in use, respondents expressed no opinions on the contribution of these datasets to fire management effectiveness.

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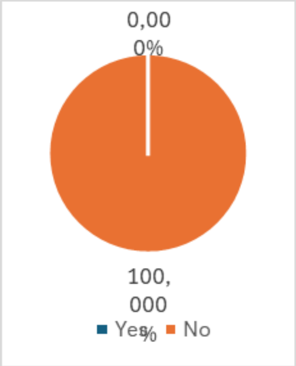
Figure 4 – UC1 – Q4 "Are there HVDs in use to counter fires in the Attica region, prior to the BeOpen implementation?"



Data quality and accessibility

Data quality in the Attica use case before the implementation of the BeOpen framework, in terms of accuracy, timeliness of updates, curation, and suitability for supporting decision-making processes, is unanimously rated as very poor or poor by 100% of respondents.

Figure 5 – UC1 – Q5 "How would you rate the data quality in the Attica use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"

Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Similarly, **data accessibility** in the Attica use case, assessed in terms of retrieval, ease of use, technical interoperability, and compatibility with existing systems, is also rated as poor or very poor.

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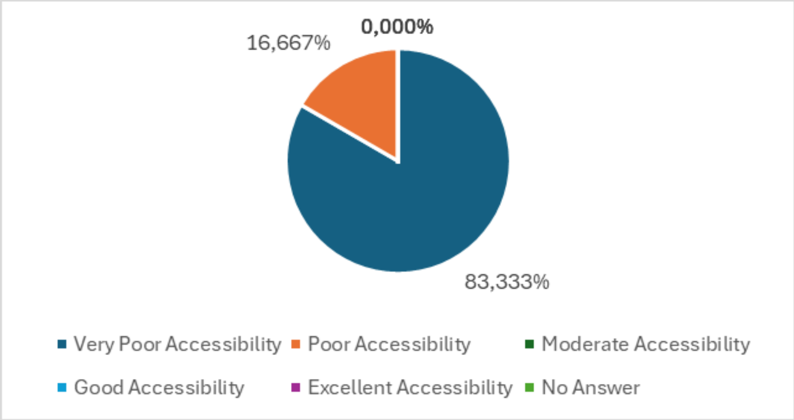
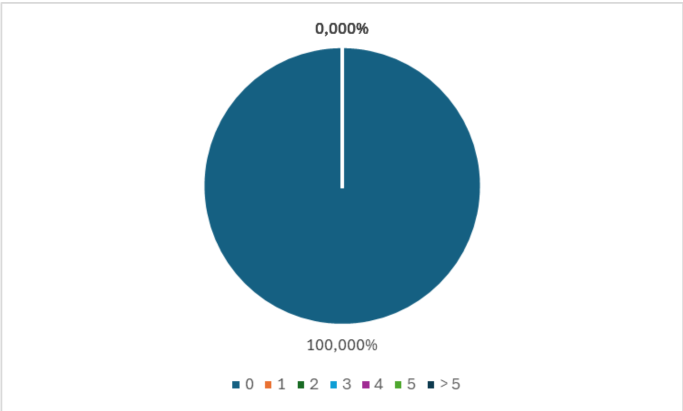
Figure 6 – UC1 – Q6 "How would you rate the data accessibility in the Attica use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Finally, regarding the **availability of datasets** for disaster management before the start of the BeOpen project, stakeholders confirmed that none were available.

Figure 7 – UC1 – Q7 "How many datasets were available for disaster management before the start of the BeOpen project?"



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3.2. Cartagena

3.2.1. Overview of use case

The municipality of Cartagena is located in the southeast of Spain, an area where the Mediterranean climate predominates, with an important military, industrial and tourist activity, which conditions the employment of its urban nucleus.

In the use case of Cartagena, three complementary actions are described which reflect the reality of the urban nucleus. With the use case proposed in the BeOpen Project, the municipality of Cartagena aims to enable and improve urban management focused on the management of both traffic safety and atmospheric pollution, heat islands and the introduction of LED technologies in public lighting with its possible impact on health. For this reason, different public services have been involved in the proposed use case.

The utilization of real-time information from different HVDs provides valuable insights for urban planning, environmental management, traffic management, and the adoption of long-term measures, primarily for climate adaptation. Real-time data allows various public services to respond effectively in emergencies, regardless of their nature, by enabling continuous monitoring of all occurrences.

On the other hand, the collection of historical data will make it possible to assess trends and evaluate the urban core, which will lead to greater efficiency in decision-making, good governance, greater cost-effectiveness/results, and to a large extent, the feedback that this valuable information provides will enable future scenarios to be projected in order to anticipate and limit the effects on the population.

Finally, the availability of historical data allows administrations to comply with legal requirements such as noise, air pollution and others. The availability of HVDs will allow municipal employees and policy makers to make decisions and formulate long-term urban public policies based on data and evidence, increasing the effectiveness of results, responsiveness and efficiency in both public service and spending by prioritising measures to be implemented.

In the use case of the Cartagena pilots, three distinct objectives are established:

UC2: URBAN SAFETY IN HISTORIC CITY WITH KEY CRITICAL INFRASTRUCTURES.

The aim is to increase the safety of the central urban area of Cartagena at different levels, mainly the safety of pedestrians from the effects of road traffic. The area is partly pedestrianised and with a large presence of tourists, which implies the need to take a series of traffic calming measures, including restrictions, to reduce the impact on residents and visitors. The evidence of vehicle volumes, pedestrian volumes, vehicle types, noise, air pollutants and climatic conditions leads to an understanding of the dynamics of urban metabolism, mobility needs and the effects of road traffic.

Only with this knowledge can effective measures be taken to address the real needs of the centre of Cartagena. The aim is to make mobility and environment related datasets more accessible and reusable, allowing more appropriate measures to be implemented by a larger number of municipal services.

Special emphasis is placed on data on traffic counts by type and pollutants that will allow the detection of potentially dangerous vehicles, as well as speeds that their study leads to increased safety for residents.

The use of traffic monitoring systems, urban dynamics such as pedestrian counts and atmospheric and climatic conditions will not only lead to increased safety but will also

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allow the formulation of long-term measures such as bicycle lanes, park-and-ride facilities, traffic calming and even access restrictions to the defined area. This will allow the detection of anomalous traffic patterns, identification of misbehaviour and anomalous environmental situations (e.g. simultaneous presence of gases and other environmental parameters).

Finally, police services, civil protection, fire brigades and other agents will have at their disposal decision support tools that allow better monitoring and planning of interventions, which they did not have before, improving their response capacity.

UC3: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

Cartagena City Council is in the process of renovating its public lighting, replacing obsolete systems with the latest LED technology. There is no denying the advantages in terms of energy efficiency, efficiency in lighting levels and the feeling of security that this brings. The use of luminaires with white light is normal as it apparently increases the feeling of security and the lighting levels of the area.

There is controversy surrounding the Cartagena and its effects so the use case focuses on the effects of installing blue LED streetlights.

These installations consume less energy as discussed, reduce maintenance costs, allow for better lighting of public spaces and adequate visibility, making urban areas safer (e.g. trip hazards, vehicle conflicts for pedestrians, etc.). But they could affect human health. The use case aims to support the identification of the characteristics of streetlights to ensure the correct safety of citizens, energy savings and health.

UC4: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEAT WAVES

Urban heat islands related to heat waves are one of the main climate risks present in Cartagena. It is known that these effects will increase over time due to the effects of Climate Change in this region.

The use case focuses on the problems posed by high temperatures generated by excessive solar radiation due to climate change and increased by urban infrastructures, lack of precipitation and atmospheric pollutants. Of particular interest are secondary pollutants such as ozone O3.

This use case is one of the most impactful for citizens as it will allow decision-makers to make decisions and prioritise actions to reduce those areas where the effects of heat are most present, to prioritise the restitution of trees in areas with the greatest influx of people, and other urban planning measures prioritised on the basis of citizen demand.

Data such as temperature and humidity, solar radiation, pedestrian traffic, vehicle traffic, atmospheric pollutants, among others, will be related. This use case not only allows the formulation of infrastructure policies, but also enables social services, Civil Protection and Local Police to prepare for episodes of extreme heat such as heat waves, which significantly increase their effects on urban centres.

3.2.2. Use case rationale: digital service, HVD and intended impact

The use case is based on the interaction of all available HVDs to develop a data-driven decision making activity. Cartagena faces this use case with information that has been collected for a long time, and with new devices that increase the available information.

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The proposed digital service is based on the need to link the data by providing evidence-based criteria to enable the Cartagena administration to make urban planning decisions and even respond appropriately to unforeseen situations that may arise.

3.2.2.1. The challenge: pre-intervention situation in pilot site

Prior to the intervention in this pilot, a limited number of environmental and temperature monitoring devices were available (four in particular). There were no weather stations to provide information and there were video cameras for traffic control, but the current number plate recognition technology that allows the development of a complete road traffic characterisation system was not available. In addition, there was only one device for pedestrian gauging and four devices for urban noise control.

In terms of digital resources, there was a data visualisation system that was only used by the Sustainable City Service for traffic and urban environment studies, but only to a limited extent.

Energy consumption and billing data is available for the public lighting control panels.

3.2.2.2. The prospected solution: digital services and HVDs

The output of the digital service for Cartagena is an interactive web platform designed to provide stakeholders with seamless access to High-Value Datasets (HVDs) through visually engaging and user-friendly dashboards. These dashboards integrate data from diverse sources such as IoT devices, Earth Observation systems, and external data repositories, presenting insights that address critical urban challenges in safety, sustainability, and climate resilience.

The service represents:

- **UC2: URBAN SAFETY IN HISTORIC CITY WITH KEY CRITICAL INFRASTRUCTURES**

It will relate traffic counts, type of vehicles, emissions associated with the status of the main air pollutants. In addition, it will be linked to pedestrian traffic counts and vehicle speed data, providing greater safety for residents and pedestrians. It is a system for linking information to increase the safety of citizens from an environmental point of view and the relationship between pedestrians and road traffic.

It is also presented as a tool for immediate response to unexpected events that may occur at any given time. An important system for municipal emergency services.

- **UC3: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT**

A service that links energy efficiency, luminaire heat hue, medical data (drug consumption), and lighting conditions related to other environmental and climatic data. A digital future urban planning solution is provided.

- **UC4: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEAT WAVES**

In this case a high value digital service is considered for urban planning, prioritisation of investments, and urgent response to one of the main climate risks in Cartagena, relating temperature and humidity with data on pedestrian, vehicle (private vehicle demand) pollutants and lighting.

In line with the objectives of BeOpen, the pilot digital service in Cartagena described above will reuse 7 HVD.

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- Table 5 – Dataset selection for Cartagena Pilot Digital Service.

# Dataset	Dataset designation
DATASET_CARTAGENA_1	Road traffic data dataset
DATASET_CARTAGENA_2	Pedestrian traffic
DATASET_CARTAGENA_3	Light indices
DATASET_CARTAGENA_4	Meteorological data and air quality
DATASET_CARTAGENA_5	Energy consumption
DATASET_CARTAGENA_6	Data on medication consumption from the Murcian Health Service
DATASET_CARTAGENA_7	Noise

3.2.2.3. The result: expected outcomes

The results achieved in the present use case is the increased use of HVDs within the Cartagena administration, and the increased number of users who employ the data as an evidence base in decision making either to address an issue or on a historical basis to formulate appropriate public policies.

UC2: URBAN SAFETY IN HISTORIC CITY WITH KEY CRITICAL INFRASTRUCTURES.

In this use case it is expected to understand the dynamics of urban traffic and its relationship with the conditions of air pollution, noise, weather data, and pedestrian flows where appropriate. With this analysis, the best traffic calming measures will be implemented, limitations to vehicle use, promotion of cycling and pedestrian mobility, and improvement of pedestrian safety. Data-driven restrictions will be developed that are truly necessary and effective.

Not only urban planners, but also the Police, Fire and Civil Protection System will benefit from improved response to incidents.

Therefore the main beneficiaries will be the citizens who will see improved air quality, better road traffic management, noise reduction, increased pedestrian safety and the use of sustainable mobility modes.

UC3: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS IMPACT ON HEALTH.

It is expected to find a balance between energy savings, safety and health of citizens by identifying the most appropriate colour temperature for public lighting that does not affect people's health.
The main beneficiaries of this digital service are urban planners who will have the most suitable typology for each case.

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Citizens will be the main beneficiaries of this use case as they will see increased safety on public roads allowing adequate visibility against risks and hazards but reducing the possible impact on health.

UC4: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEAT WAVES.

The beneficiaries in this case are, on the one hand, public employees and government officials, since the main climate risk in Cartagena will be related to situations and areas of priority action. This will enable the formulation of appropriate public policies. The social affairs and emergency services will benefit as they will have real-time information to improve their response.

Citizens are the real beneficiaries as this solution allows a significant improvement in their quality of life as it improves the response to the main climate risk in Cartagena. In particular, the development of adequate infrastructures to respond to extreme needs.

3.2.2.4. The stakeholders: engagement and inputs

The Cartagena use case involves different key stakeholders that are essential for the effective management of public policies and response to emergencies. These include:

Sustainability, Climate Change and Mobility Service: As this is the service that develops the municipality's transformative urban policies, it generally always acts in the future, anticipating the possible scenarios that Cartagena will have to face.

Urban Planning and Environmental Management Service: This is the service that regulates land use, urban planning and the development of activities in the municipality

Public Infrastructure Service: This is the service that executes physical actions and direct interventions in the form of works, services and maintenance in the city, normally linked to municipal strategies.

Municipal New Technologies Service: A municipal service that provides technological support for the deployment of platforms and the management of electronic administration.

Emergency Service: This information is required both to act in the face of an emergency and to plan for the future.

3.2.3. Baseline assessment

3.2.3.1. Rationale

The baseline assessment has been carried out by adapting it to the specific case of the Cartagena use case. It is an initial reference to evaluate the use of HVD, in reference to the use cases by the municipal services involved in its management. A baseline to subsequently evaluate the results when using the digital components. The objective of the Project is adapted to the uniqueness of Cartagena and in this way the impact of the Project is evaluated using KPIs.

The KPIs were defined based on the BeOpen metrics and the expectations present in the Project, through bilateral meetings, surveys of those interested in the Project and an analysis of the BeOpen metrics.

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■ Table 6 – Baseline assessment: data collection activities.

Activity	Description	Type of info / means of verification
Surveys	Development of surveys to collect direct input from stakeholders	Surveys (qualitative/quantitative info)
Internal analysis of BeOpen metrics	Analysis of quantitative information to help measure KPI	Quantitative information
Group meetings	Meetings with stakeholders and colleagues from the Spanish project pilots	Project logs (meetings' minutes)

•

3.2.3.2. KPI selected

In the Cartagena pilot three use case scenarios will be reproduced.

For the impact assessment tasks, Cartagena has selected a total of 21, 15 and 20 KPIs related to Use Case 2, 3 and 4, respectively, addressing the three objectives contemplated in the Cartagena pilot. They have been selected from the expanded list of KPIs proposed in Deliverable 4.1 – Validation Methodology & KPI, which aim to produce an overall impact analysis of the BeOpen project in terms of Data usage, Data availability, Data accessibility, Data quality and Stakeholder engagement.

These KPIs were defined and measured using information obtained from various data collection activities described above (e.g. project logs, surveys and BeOpen metrics). Table 7 provides a complete description of each KPI.

For each use case, the selected KPIs are shown in the following tables below.

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■ Table 7 – UC 2 – Cartagena Pilot – Key Performance Indicators.

Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_ UC2_CART _2	To what extent the availability of HVDs has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	# of HVDs made available to the public through BeOpen Framework.	BeOpen metrics Interviews	Number of HVD made available through BeOpen Framework	Number
KPI_ UC2_CART _3		% Percentage increase in the availability of high-value datasets through BeOpen Framework compared to the baseline.		Percentage increase in the availability of high-value datasets	Ratio
KPI_ UC2_CART _4	To what extent the data accessibility has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	% of HVDs accessible by the public through BeOpen Framework compared to the baseline.	BeOpen metrics	Ratio of BeOpen Datasets which will be publicly published	Ratio
KPI_ UC2_CART _5		# HVDs related to mobility and the environment are more accessible allowing the application of more appropriate measures.		# of used datasets	Number
KPI_ UC2_CART _6	How much additional data does the framework provide to stakeholders to better contribute to the implementation of more adequate measures of urban security in the historical city centre?	Ratio of data used by civil servants in their public services management processes after BeOpen compared to the baseline.	Survey / Interviews	Ratio of datasets used by civil servant	Ratio
KPI_ UC2_CART _7	Have new HVDs been made available to allow the implementation of more adequate measures of urban security in the historical city centre?	# of new HVDs made available	BeOpen metrics	# of new HVDs published	Number
KPI_ UC2_CART _8	To what extent are HVDs reusable to allow the implementation of more adequate measures of urban security in the historical city centre?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	Ratio of HVD made available	Ratio
KPI_ UC2_CART _9	To what extent has BeOpen been integrated with existing technical ecosystems to allow the implementation of more adequate measures of urban security in the historical city centre?	Degree of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site.	BeOpen metrics	Data available from the municipalities	Percentage
KPI_ UC2_CART _10	To what extent have citizens accessed the HVDs made interoperable by the BeOpen Framework used for the implementation of more adequate measures of urban security in the historical city centre?	% of citizens accessing the HVDs made interoperable by BeOpen Framework with respect to the target population in the area	External data sources / Survey	Data available from the municipalities	Number / Survey Interviews

Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_ UC2_CART _11	To what extent are citizens and critical stakeholders satisfied with the public services management processes assisted by BeOpen Framework in the implementation of more adequate measures of urban security in the historical city centre?	Degree of satisfaction of critical stakeholders in (a) participating to the public services management processes and of (b) the quality of provided services compared to current practices	Survey to citizens and critical stakeholders	Data available from the municipalities	Survey Interviews
KPI_ UC2_CART _12	How many public services have been developed over the course of the BeOpen related to more adequate measures of urban security in the historical city centre?	# of public services developed in total over the course of the BeOpen project	Project logs	Data available from the municipalities	Number
KPI_ UC2_CART _13	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and implementation of more adequate measures of urban security in historical city centres?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving / attending training, technical monitoring, communication)	External / internal data sources	# of used datasets	Number
KPI_ UC2_CART _14		HVDs fully integrated and interoperable in Pilot site before and after BeOpen.		# of published datasets	Number
KPI_ UC2_CART _15		Open data made available before and after the BeOpen		Ratio of BeOpen Datasets which will be publicly published	Ratio
KPI_ UC2_CART _16	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to allow the implementation of more adequate measures of urban security in the historical city centre?	% of Open data on total HVDs made interoperable by BeOpen Framework.	CBA	Data available from the municipalities	Percentage
KPI_ UC2_CART _17	To what extent are HVDs made interoperable by eOpen Framework used by civil servants to allow the implementation of more adequate measures of urban security in historical city centres?	# of times HVDs accessed.	BeOpen metrics / Survey / Interviews to Skateholders	# of times HVDs accessed.	Number
KPI_ UC2_CART _18		# of downloads per dataset.		# of downloads per dataset.	Number
KPI_ UC2_CART _19		Perceived necessary HVDs for each use case.		Likert scale	Number

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Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_ UC2_CART _20	To what extent can BeOpen reduce risks for crises, including natural disasters and security threats due to better plans and preparedness of the responders and citizens?	% of policymakers/ Citizens/ Stakeholders indicating usefulness of BeOpen Framework.	Survey / Interviews to policymakers / Citizens / Stakeholders	Likert scale	Percentage
KPI_ UC2_CART _21	To what extent can the BeOpen Framework be applied on a bigger scale to allow the implementation of more adequate measures of urban security in the historical city centre?	Extended data product functionality	BeOpen metrics	Ratio of BeOpen Datasets	Ratio

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■ Table 8 – UC 3 – Cartagena Pilot – Key Performance Indicators.

Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_UC3_CART_2	To what extent the data accessibility has been improved to assess the health impact of installing blue-based LED streetlights?	Time required for users to access HVDs compared to the baseline.	BeOpen metrics / Interviews	Time to access to HVD	Number
KPI_UC3_CART_3		% of HVDs accessible by the public through BeOpen Framework compared to the baseline.		# of accessible datasets	Percentage
KPI_UC3_CART_4	Have new HVDs been made available to assess the health impact of installing blue-based LED streetlight	# of new HVDs made available	BeOpen metrics	# of accessible HVDs	Number
KPI_UC3_CART_5	To what extent are HVDs reusable to assess the health impact of installing blue-based LED streetlights?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of accessible datasets	Ratio
KPI_UC3_CART_6	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to assess the health impact of installing blue-based LED streetlights?	Ratio of citizens who have accessed the HVDs made interoperable by BeOpen Framework compared to the baseline	External data sources / Survey	Ratio of citizens who have accessed the HVD available through the portal	Ratio
KPI_UC3_CART_7	Has civil servants' perceived quality of services increased to assess the health impact of installing blue-based LED streetlights?	Perceived quality of public services (Likert scale)	Survey	Likert scale	Number
KPI_UC3_CART_8	Have public authorities used the BeOpen solution in their decision-making processes to assess the health impact of installing blue-based LED streetlights?	# of times HVDs made available through BeOpen Framework consulted by public authorities	Project logs	# of used dataset	Number
KPI_UC3_CART_9	To what extent can BeOpen contribute to the reduction of operating hours and energy consumption of street lights?	30% of energy consumption is reduced.	BeOpen metrics	Data available from the municipalities	Percentage

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Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_ UC3_CART _10	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to assess the health impact of installing blue-based LED streetlights?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	CBA	Data available from the municipalities	Number
KPI_ UC3_CART _11	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to assess the health impact of installing blue-based LED streetlights?	% of Open data on total HVDs made interoperable by BeOpen Framework.	CBA	# of published open datasets	Number
KPI_ UC3_CART _12	To what extent can BeOpen increase in perceived public safety?	> 20% between beginning and end surveys.	Survey to citizens/ policymakers/ stakeholders	Likert scale	Percentage
KPI_ UC3_CART _13	To what extent can BeOpen contribute in the reduction of potential incidents.	5% reduction of incidents before and after BeOpen	BeOpen metrics / Survey to citizens	Data available from the municipalities	Percentage
KPI_ UC3_CART _14	What is the reduction of Carbon Footprint through the decrease of greenhouse gas emissions by consuming less energy due to BeOpen adoption?	Carbon footprint reduction calculation	BeOpen metrics	Data available from the municipalities	Number
KPI_ UC3_CART _15	How easy is it for policymakers to gain access to and make use of the HVDs through BeOpen Framework for policymaking to assess the health impact of installing blue-based LED streetlights?	Perceived ease of access to data	Interviews with policymakers	Likert scale	Number

- Table 9 – UC 4 – Cartagena Pilot – Key Performance Indicators.

Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_ UC4_CART _2	To what extent can BeOpen increase the geographical coverage of datasets (related to temperature and other environmental parameters, etc.)?	Increase of > 95% surface coverage.	External / internal data sources / BeOpen metrics	Measured covered by measurements	Percentage
KPI_ UC4_CART _3	To what extent the availability of HVDs have been improved to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of HVDs made available to the public through BeOpen Framework.	BeOpen metrics	# of available datasets	Number
KPI_ UC4_CART _4		% Percentage increase in the availability of high-value datasets through BeOpen Framework compared to the baseline.		# of used datasets	Percentage
KPI_ UC4_CART _5	Have new more accurate HVDs been made available, concerning the environment to support activities against climate changes?	# of new HVDs made available	BeOpen metrics	# of new datasets	Number
KPI_ UC4_CART _6	To what extent have HVDs been made discoverable through the European Data Portal to make available more accurate HVDs concerning the environment to support activities against climate changes?	Ratio of HVDs discoverable through the European Data Portal versus datasets that are not discoverable	External / internal data sources	# of published datasets	Ratio
KPI_ UC4_CART _7	To what extent are HVDs reusable to make available more accurate HVDs concerning the environment to support activities against climate changes?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of used datasets	Ratio
KPI_ UC4_CART _8	To what extent has BeOpen been integrated with existing technical ecosystems to make available more accurate HVDs concerning the environment to support activities against climate changes?	Degree of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site.	External / internal data sources	Data available from the municipalities	Percentage

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Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_ UC4_CART _9	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of citizens who have accessed the HVDs made interoperable by BeOpen Framework compared to the baseline	BeOpen metrics	# of citizens who have accessed the HVD available through the portal	Number
KPI_ UC4_CART _10		Degree of satisfaction of critical stakeholders in (a) participating to the public services management processes and of (b) the quality of provided services compared to current practices	Survey	Likert scale	Number
KPI_ UC4_CART _11	How many public services have been developed over the course of the BeOpen project to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of public services developed in total over the course of the BeOpen project	Project logs	Data available from the municipalities	Number
KPI_ UC4_CART _12	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to make available more accurate HVDs concerning the environment to support activities against climate changes?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	External / internal data sources	Data available from the municipalities	Number
KPI_ UC4_CART _13		HVDs fully integrated and interoperable in Pilot site before and after BeOpen.			
KPI_ UC4_CART _14		Open data made available before and after the BeOpen.	BeOpen metrics	# of available datasets	Number
KPI_ UC4_CART _15	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to make available more accurate HVDs concerning the environment to support activities against climate changes?	% of Open data on total HVDs made interoperable by BeOpen Framework.	CBA / BeOpen metrics	# of interoperable datasets	Number
KPI_ UC4_CART _16	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to	# of times HVDs accessed.	BeOpen metrics	# of accesses to datasets	Number

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Key Performance Indicators	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics	Key Performance Indicators
KPI_ UC4_CART _17	make available more accurate HVDs concerning the environment to support activities against climate changes?	# of downloads per dataset.		# of downloads	Number
KPI_ UC4_CART _18		Perceived necessary HVDs for each use case.	Survey / Interviews to Stakeholders	Likert scale	Number
KPI_ UC4_CART _19	To what extent can BeOpen reduce the highest temperature?	At least 2 degrees in green zones and shadow areas.	External / internal data sources	Measured temperature	Number
KPI_ UC4_CART _20	To what extent can the BeOpen Framework be applied on a bigger scale to make available more accurate HVDs concerning the environment to support activities against climate changes?	Extended data product functionality	BeOpen metrics	HVD criteria score	Number

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3.2.3.3. Other data and physical measures

In the Cartagena use case environment, those derived from satellite sources, such as Copernicus, or those manually entered statistics such as statistics from Police sources, are used.

In addition, 28 environmental sensors have currently been deployed that provide complete information of the main environmental pollutants (PM1; PM2.5; PM10; SO2, NO2, O3), 20 noise sensors, covering two urban areas of Cartagena. There is a source of data from 18 artificial vision cameras that provide a complete characterization of the vehicles, as well as their speed, which provides highly valuable information for the use case.

In a complementary way, data corresponding to 4 pedestrian gauges and 17 luxometers on the public road are made available to the Project, allowing a complete evaluation of the use case.

3.2.3.4. Stakeholder group

The stakeholders to be included in the process are:

- Table 10 – UC 2,3,4 Cartagena's stakeholders.

Organization	Type of stakeholder
Public Infrastructure Service	Direct beneficiary /user
Department of Sustainable City and European Projects	Direct beneficiary /user
Cartagena Local Police Headquarters	Direct beneficiary /user
Service of Conservation	Direct beneficiary /user
Service of Climate Change Adaptation Plan and Chair Network	Direct beneficiary /user
Civil Protection Authority of municipality of Cartagena	Direct beneficiary /user

3.2.3.5. Results of the survey

Stakeholder feedback has been provided following a general briefing on the results of the project so far by staff involved in the project, but specific calls have been necessary to obtain additional information, especially to define which datasets are intended for the responses. Extracting some statistics from the survey responses supports the following considerations (a full statistical report of all responses is available on the project cloud).

Below is the list of people selected to carry out the different surveys:

- Table 11 – UC2,3,4: Respondents to baseline survey.

RESPONDANT	ORGANIZATION	ROLE	TYPE OF STAKEHOLDER
PERSON 1_CART	Cartagena's Cityhall	Head of Control of Foreign Contractors	Beneficiary / user

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PERSON 2_CART	Cartagena's Cityhall	Head of Sustainable City and European Projects	Beneficiary / user
PERSON 3_CART	Cartagena's Cityhall	Head of the Climate Change Adaptation Plan and Chair Network	Beneficiary / user
PERSON 4_CART	Cartagena's Cityhall	Head of Environmental Planning and Activities Department	Beneficiary / user
PERSON 5_CART	Cartagena's Cityhall	Head of the New Technologies, Innovation and Computer Science Service	Beneficiary / user
PERSON 6_CART	Cartagena's Cityhall	Head of Conservation	Beneficiary / user
PERSON 7_CART	Cartagena's Cityhall	Head of Civil Protection	Beneficiary / user
PERSON 8_CART	Cartagena's Cityhall	Technical Assistant	Beneficiary / user
PERSON 9_CART	Cartagena's Cityhall	Project Engineer	Beneficiary / user
PERSON 10_CART	Cartagena's Cityhall	Project Engineer	Beneficiary / user

UC2: URBAN SAFETY IN HISTORIC CITY WITH KEY CRITICAL INFRASTRUCTURES

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations before the BeOpen project experience? In this sense, Cartagena stakeholders use more geospatial data, earth observation datasets, mobility data and meteorological datasets. In contrast, the percentage of usage in Statistics and Company Ownership is lower

According to the graph, the use of High Value Datasets (HVDs) prior to the BeOpen project experience varied by category. Geospatial, Statistics, and Mobility Data were predominantly "Extensively Used" and "Frequently Used," indicating their importance in city management. Earth Observation and Environmental Data also showed significant use, with many respondents noting "Extensively" or "Frequently Used." Meteorological and Climate Data had a mix of "Extensively Used," "Frequently Used," and "Sometimes Used." Meanwhile, Companies and Company Ownership Data showed a broader distribution, including "Extensively Used," "Frequently Used," and "Slightly Used." These results suggest that while HVDs were generally well-integrated into city operations, the extent of usage varied, highlighting the potential to enhance the consistency and effectiveness of data utilization.

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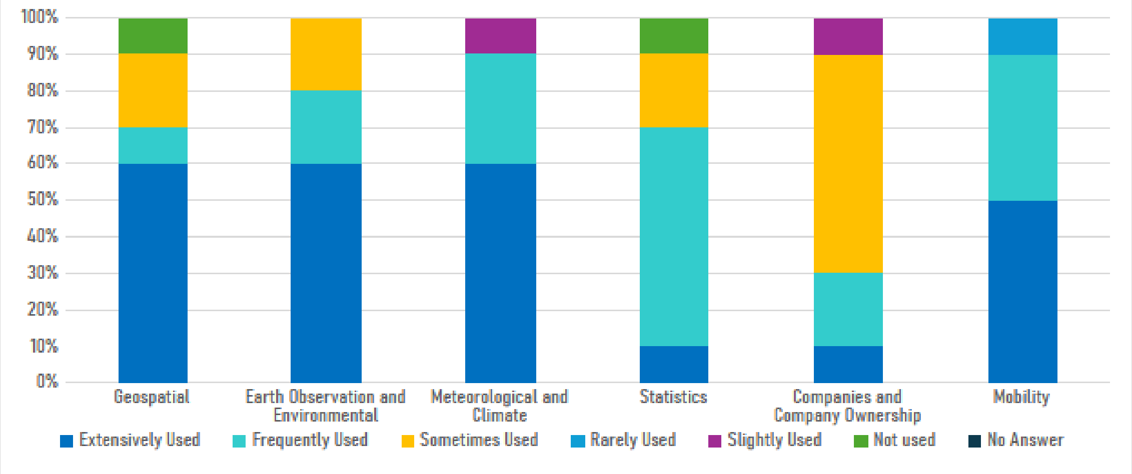
Figure 8 – UC2 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services? Regarding the critical data, the answers collected from Cartagena stakeholders present similar percentages as usage. The most critical are geospatial data, earth observation datasets, mobility data and meteorological datasets. In contrast, the Statistics and Company Ownership dataset are voted as less critical.

According to the graph, the perceived importance of High Value Datasets (HVDs) for smart city functions varies by category. Geospatial Data is widely considered "Critical" and "Very Important," with a smaller portion rating it as "Important." Earth Observation and Environmental Data is mostly viewed as "Very Important" and "Critical," with some respondents marking it as "Important." Meteorological and Climate Data and Statistics are primarily rated as "Very Important" and "Important." For Companies and Company Ownership Data, a significant portion sees it as "Somewhat Important" and "Important," while a few rate it as "Critical." Lastly, Mobility Data is considered "Critical" and "Very Important" by a large number of respondents. These findings indicate that while all HVD categories play a key role in smart city management, the degree of importance varies, suggesting a need to prioritize certain datasets to enhance service delivery and decision-making.

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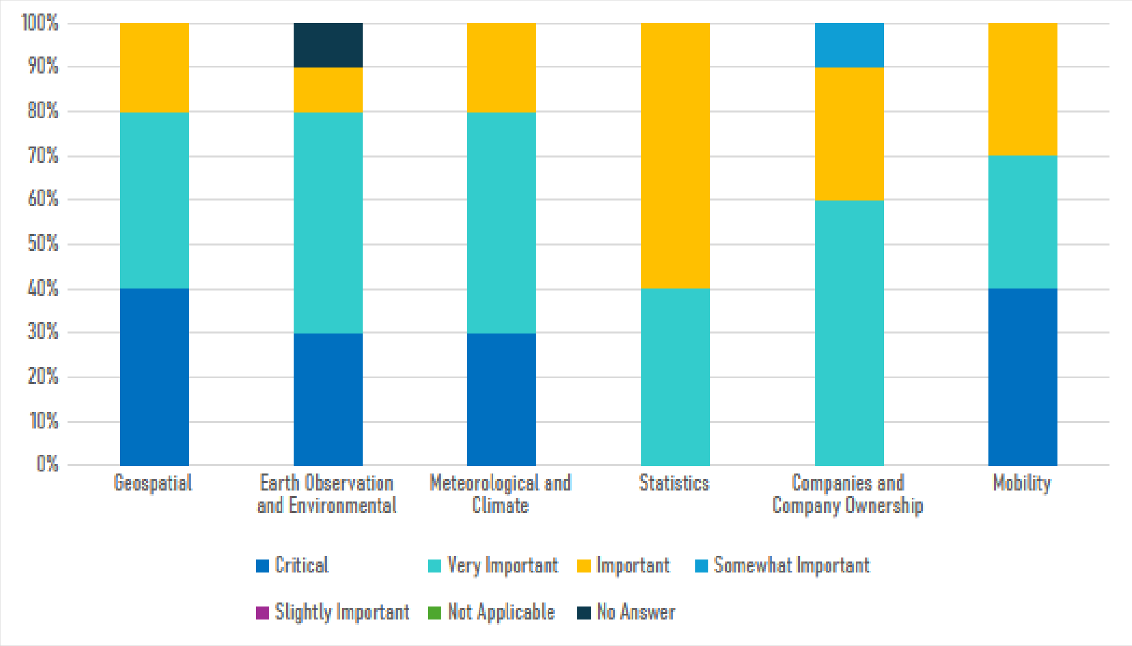
Figure 9 – UC2 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 3 (Baseline): Are currently data management solutions in place to support the management of urban safety? The 90 % of votes declared that the current data management solutions support urban safety while only the 10 % declared they are not useful

According to the graphs, 90% of respondents indicated that data management solutions are in place to support the management of urban safety, while 10% stated that no such solutions exist. Among those using these solutions, 50% rated them as "Very Effective," 40% provided "No Answer," and 10% considered them "Slightly Effective." No respondents rated the solutions as "Completely Ineffective," "Moderately Effective," or "Extremely Effective." This suggests that while data management solutions for urban safety are widely implemented, there is room to improve their perceived effectiveness and encourage more consistent feedback.

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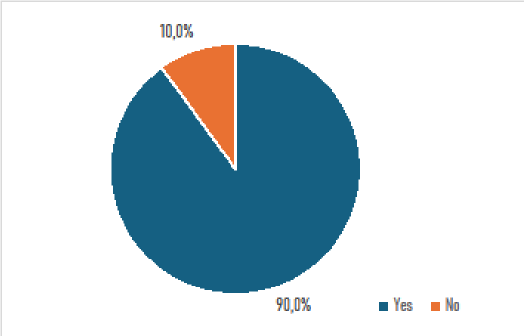
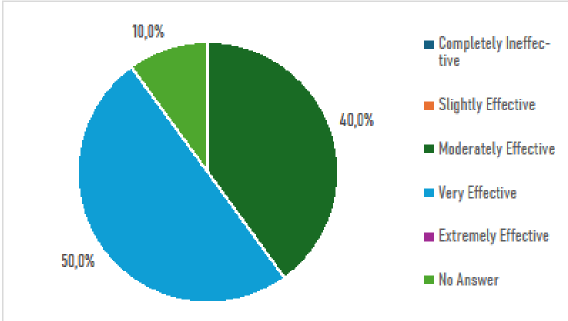
Figure 10 – UC2 – Q3 "Are currently data management solutions in place to support the management of urban safety?".





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 4: Are there HVDs in use to manage the access to city centres and to manage security and critical assets? (conditional question). The 90 % of votes declared that the HVDs manage the access to city centres and security requirements while only the 10 % declared they are not currently managed

According to the graphs, 90% of respondents indicated that High Value Datasets (HVDs) are in use to manage access to city centres and secure critical assets, while 10% stated that no such datasets are in use. Regarding their effectiveness, 40% of respondents rated these HVDs as "Moderately Effective," 30% considered them "Very Effective," and 20% rated them as "Extremely Effective." Additionally, 10% provided "No Answer." No respondents rated the datasets as "Completely Ineffective" or "Slightly Effective." This suggests that while HVDs are widely implemented and generally perceived as effective, there is still room to enhance their performance for optimal security and asset management.

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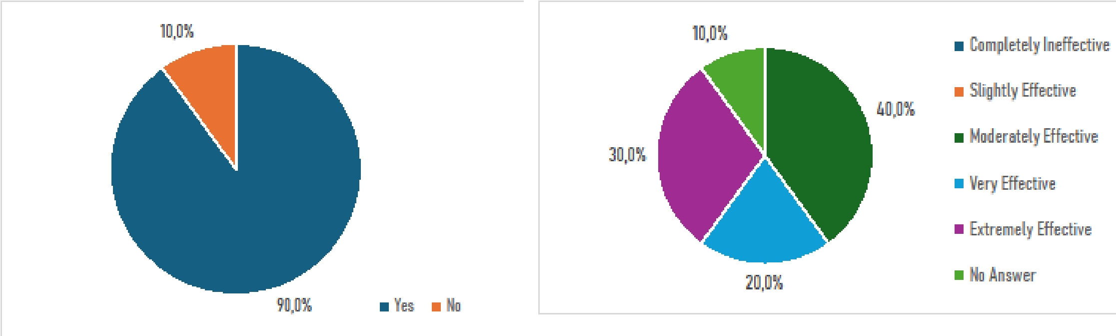
Figure 11 – UC2 – Q4 "Are there HVDs in use to manage the access to city centres and to manage security and critical assets?".



Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 5 (Baseline): How would you rate the data quality in the Cartagena use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes? The 50 % of votes said the data has a good quality and the 40 % declared a moderated quality. Last, 10 % claimed that the data has an excellent quality

According to the graph, 50% of respondents rated the data quality in the Cartagena use case before the BeOpen framework implementation as "Very Poor Quality." 40% considered it "Moderate Quality," while 10% provided "No Answer." No respondents rated the data quality as "Poor Quality," "Good Quality," or "Excellent Quality." These findings highlight significant concerns regarding data accuracy, timeliness, and suitability for decision-making processes, indicating a clear need for improvement in data quality to better support effective urban management.

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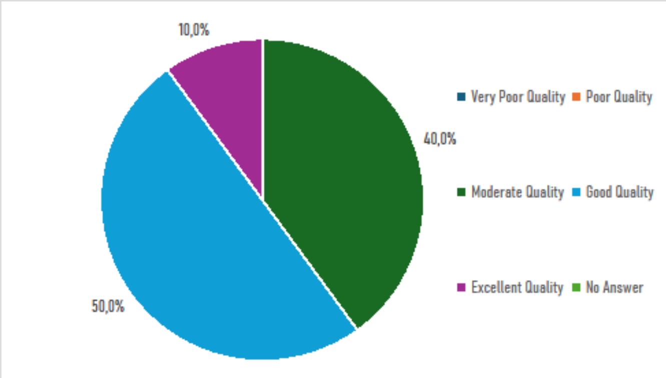
Figure 12 – UC2 – Q5 "How would you rate the data quality in the Cartagena use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?".



Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Question 6 (Baseline): How would you rate the data accessibility in the Cartagena use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes? The 50 % of users rated the data accessibility as moderate while the 20 % declared the accessibility is good and the 30 % excellent.

According to the graph, 50% of respondents provided "No Answer" regarding data accessibility in the Cartagena use case. Among the remaining responses, 20% rated data accessibility as "Very Poor Accessibility," while 30% considered it "Excellent Accessibility." There were no responses for "Poor Accessibility," "Moderate Accessibility," or "Good Accessibility." This indicates a polarized perception of data accessibility, suggesting that while some respondents found the systems highly effective, others faced significant challenges in terms of retrieval, ease of use, and technical interoperability.

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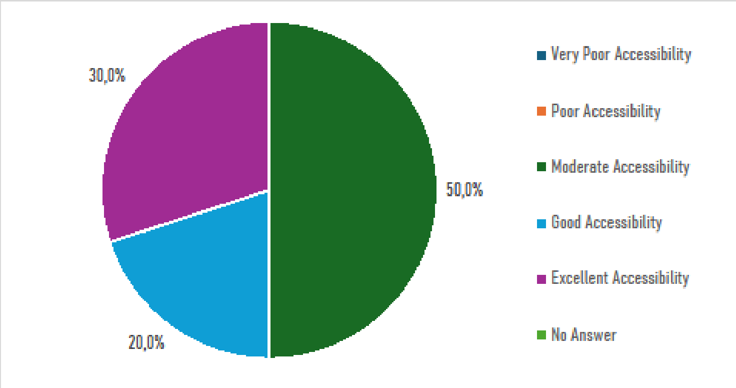
Figure 13 – UC2 – Q6 "How would you rate the data accessibility in the Cartagena use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?".



***Very Poor Accessibility** (Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
***Poor Accessibility** (Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
***Moderate Accessibility** (Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
***Good Accessibility** (Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
***Excellent Accessibility** (Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
***Very Poor Accessibility** (Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Question 7 (Baseline): How many datasets were available to support the management of access, security, safety and asset protection in city centres? Before the action, 30 % of respondents said they can access 5 datasets, 20 % to 2,3 and 4 datasets, and 10 % of voters have no access to data.

According to the graph, the number of datasets available to support the management of access, security, safety, and asset protection in city centres was distributed as follows: 20% of respondents indicated having 0 datasets, another 20% reported 2 datasets, and 20% noted 3 datasets. Additionally, 30% of respondents indicated having 5 datasets, while 10% provided No Answer. No respondents reported having 1 dataset or more than 5 datasets. This indicates a moderate level of data availability, with a need to expand data sources to better support security and asset protection management.

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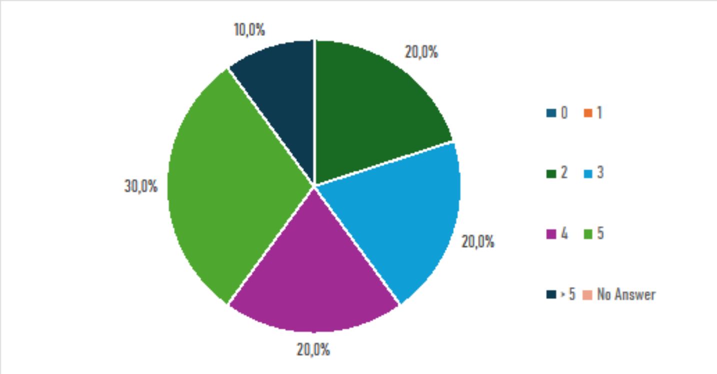
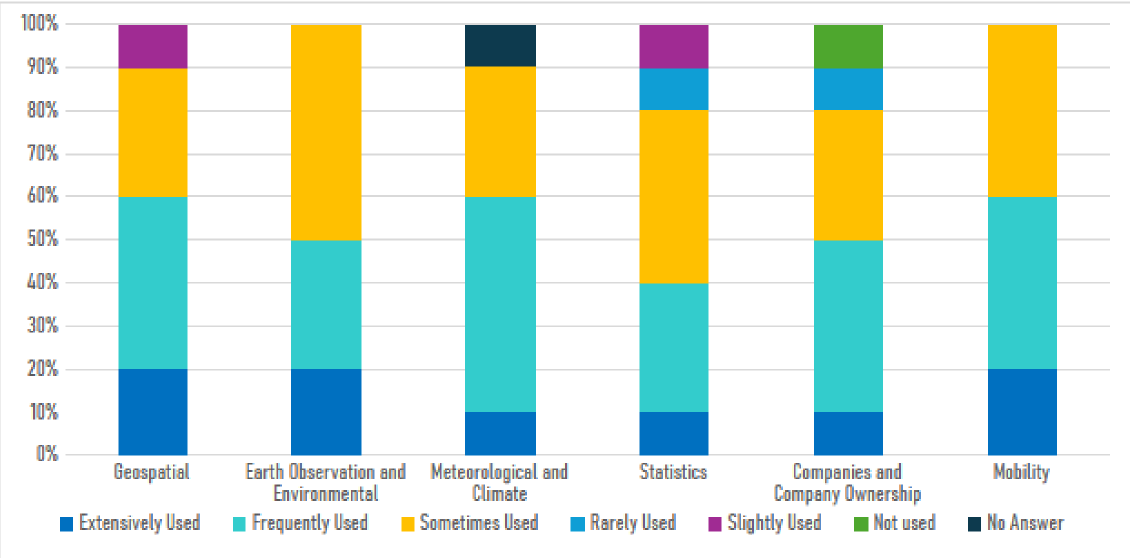
Figure 14 – UC2 – Q7 "How many datasets were available to support the management of access, security, safety and asset protection in city centres?".



UC3: SUSTAINABLE INTRODUCTION OF LED LIGHTNING AND ITS IMPACT ON HEALTH

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?

Figure 15 – UC3 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?".



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves*

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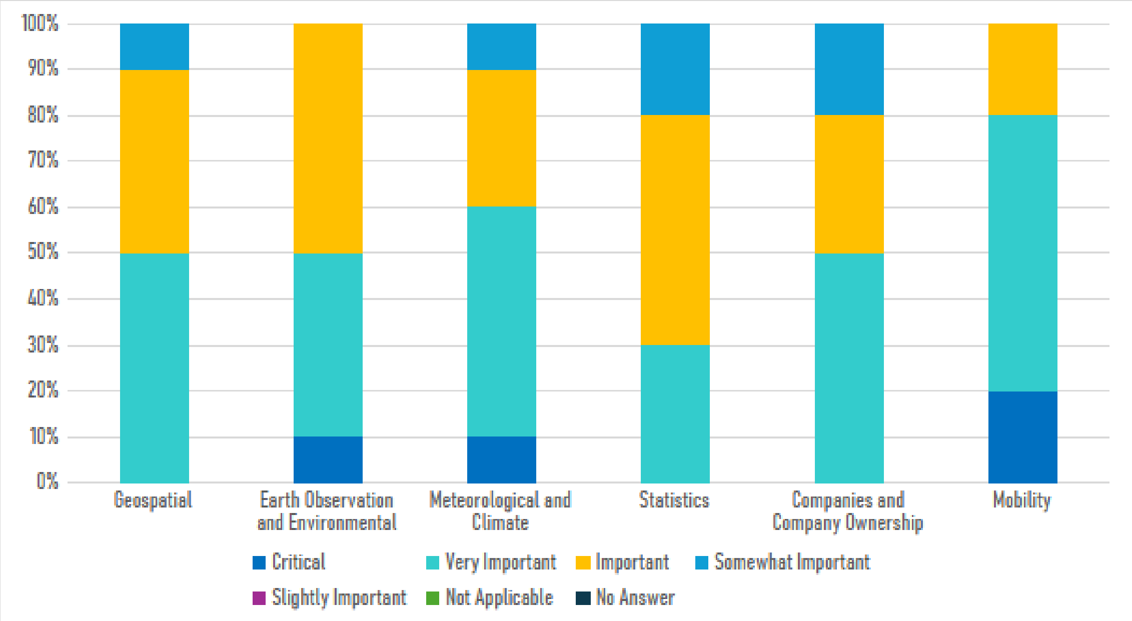
weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

Figure 16 – UC3 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 3 (Baseline): Are currently data management solutions in place to monitor the use of LED lighting in the City of Cartagena and its impacts on energy efficiency, public safety and security and on the health of citizens?

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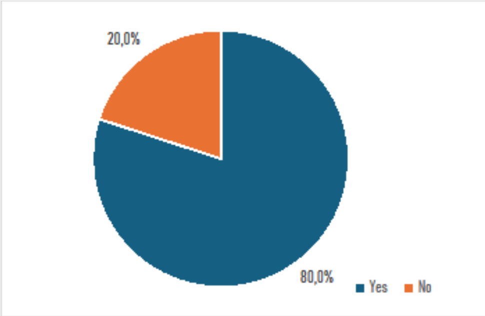
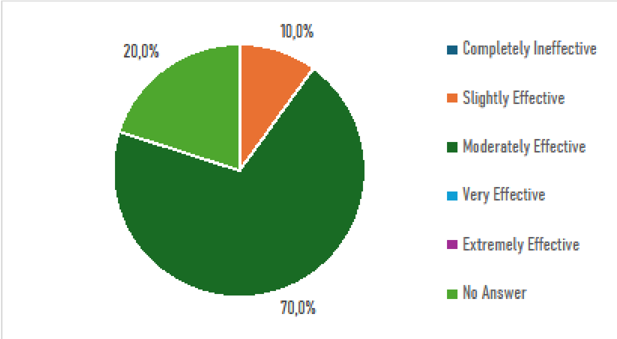
Figure 17 – UC3 – Q3 "Are currently data management solutions in place to monitor the use of LED lighting in the City of Cartagena and its impacts on energy efficiency, public safety and security and on the health of citizens?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 4 (Baseline): Are there HVDs in use to monitor the use of LED lighting in the City of Cartagena and its impacts on energy efficiency, public safety and security and on the health of citizens? (conditional question)

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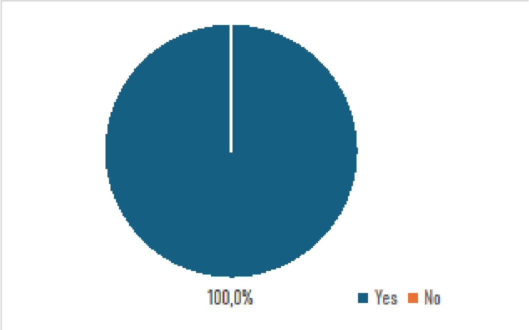
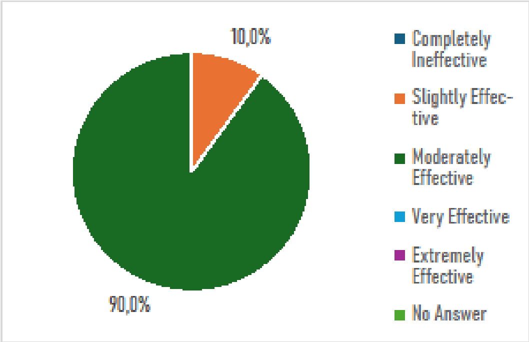
Figure 18 – UC3 – Q4 "Are there HVDs in use to monitor the use of LED lighting in the City of Cartagena and its impacts on energy efficiency, public safety and security and on the health of citizens?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 5 (Baseline): How would you rate the data quality in the Cartagena use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

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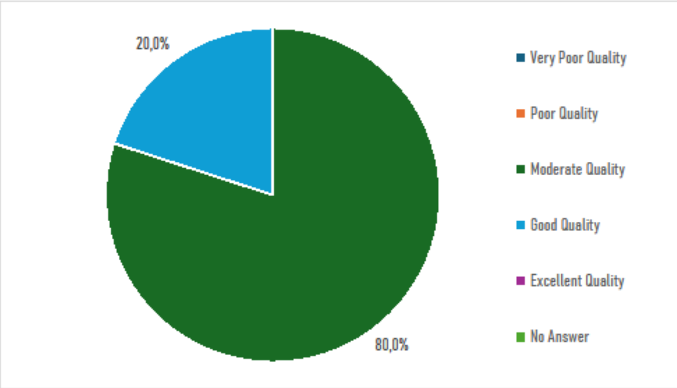
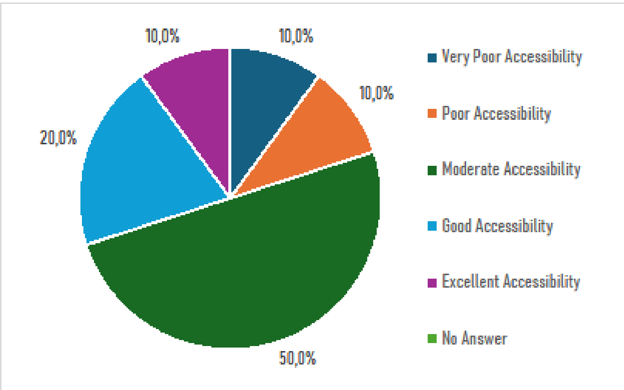
Figure 19 – UC3 – Q5 "How would you rate the data quality in the Cartagena use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"



Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Question 6 (Baseline): How would you rate the data accessibility in the Cartagena use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

Figure 20 – UC3 – Q6 "How would you rate the data accessibility in the Cartagena use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?".



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*

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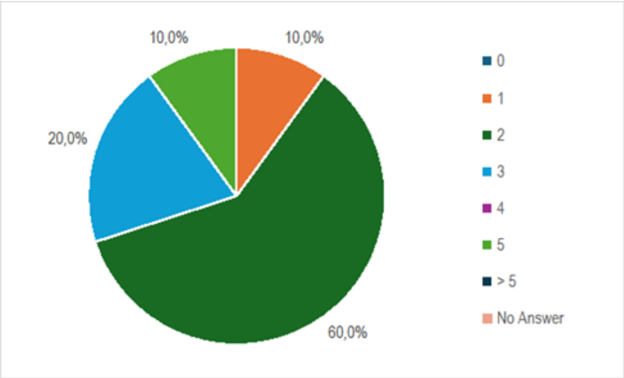
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Question 7 (Baseline): How many datasets were available to support the monitoring of the use of LED lighting in the City of Cartagena and its impacts on energy efficiency, public safety and security and on the health of citizens?

Figure 21 – UC3 – Q7 "How many datasets were available to support the monitoring of the use of LED lighting in the City of Cartagena and its impacts on energy efficiency, public safety and security and on the health of citizens?"



UC4: CLIMATE CHANGE MITIGATION ACTIONS. URBAN HEAT ISLANDS AND HEAT WAVES.

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?

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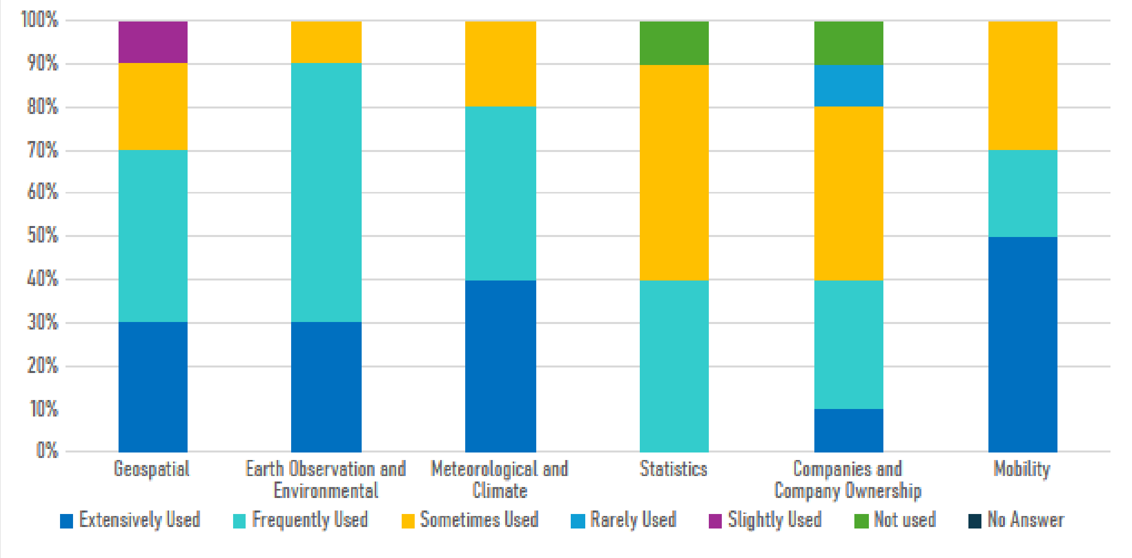
Figure 22 – UC4 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

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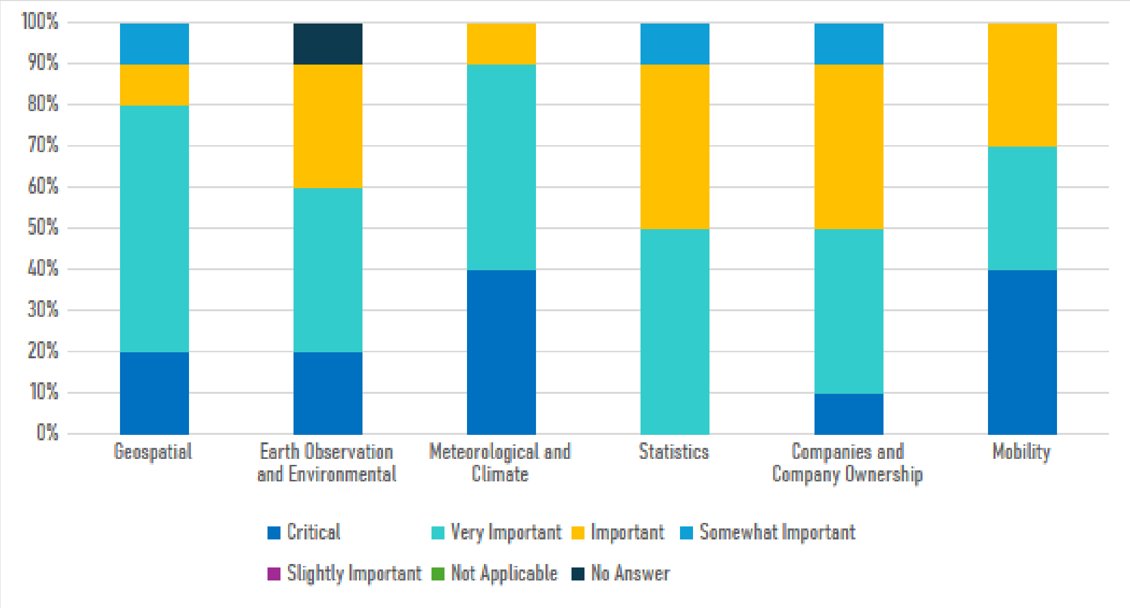
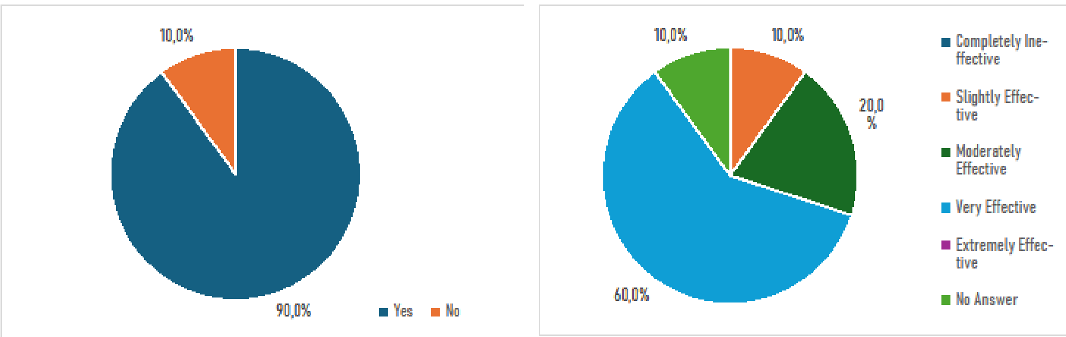
Figure 23 – UC4 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 3 (Baseline): Are currently digital services in place to monitor urban heat and climate issues in the city of Cartagena, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

Figure 24 – UC4 – Q3 "Are current digital services in place to monitor urban heat and climate issues in the city of Cartagena, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?"



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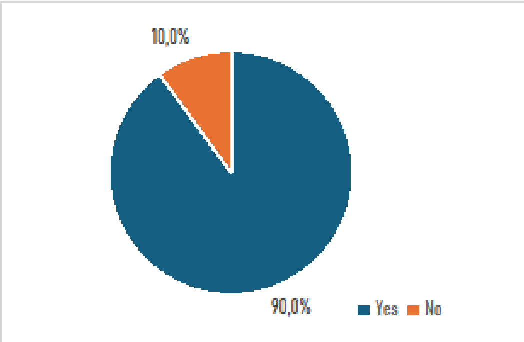
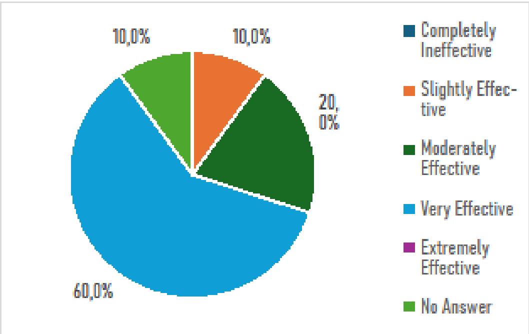
Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 4 (Baseline): Are there HVDs in use to monitor urban heat and climate issues in the city of Cartagena, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

Figure 25 – UC4 – Q4 "Are there HVDs in use to monitor urban heat and climate issues in the city of Cartagena, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

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***Moderately Effective** (Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Very Effective** (Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
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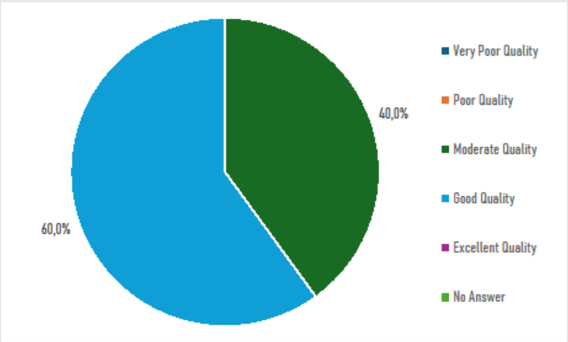
Question 5 (Baseline): How would you rate the data quality in the Cartagena use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

Figure 26 – UC4 – Q5 "How would you rate the data quality in the Cartagena use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"



***Very Poor Quality** (Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
***Poor Quality** (Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
***Moderate Quality** (Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
***Good Quality** (Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
***Excellent Quality** (Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Question 6 (Baseline): How would you rate the data accessibility in the Cartagena use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

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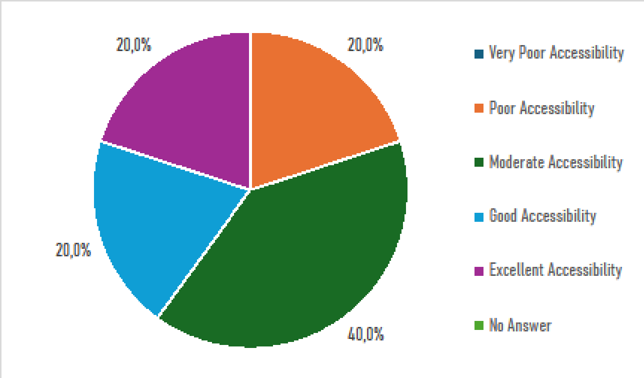
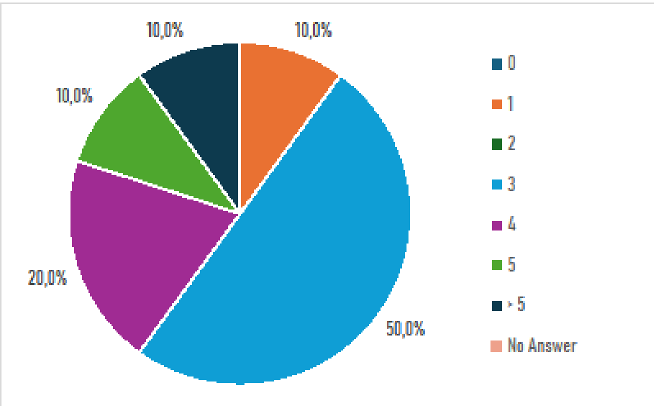
Figure 27 – UC4 – Q6 "How would you rate the data accessibility in the Cartagena use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Question 7 (Baseline): Prior to the BeOpen implementation, how many datasets were available to monitor urban heat and climate issues in the city of Cartagena, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

Figure 28 – UC4 – Q7 "Prior to the BeOpen implementation, how many datasets were available to monitor urban heat and climate issues in the city of Cartagena, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?"



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3.2.4. Synthesis

Survey results for UC2: Urban Safety in Historic City with Key Critical Infrastructures

If we focus on the analysis of the results of the surveys conducted prior to the implementation of the BeOpen project, we realize that, in general, the HVD are very useful, in many cases greater than 60-70%, and of great importance, greater than 80%. The solutions, HVD in use, quality and accessibility of data, baseline prior to the BeOpen project do not show excessive effectiveness, around 50%, and there is no agreement about the number of data available.

Survey results for UC3: Sustainable Introduction of LED Lighting and Impact on Health

If we focus on the analysis of the results of the surveys carried out prior to the implementation of the BeOpen project, we realise that, in general, the HVD are of some use, in many cases higher than 50-60%, and of importance higher than 80%.
The solutions, HVD in use, quality and accessibility of the data, baseline prior to the BeOpen project do not show excessive effectiveness, around 50%, although there is a certain agreement in the number of available data.

Survey results for UC4: Climate Change Mitigation Actions. Urban Heat Islands and Heat Waves

If we focus on the analysis of the results of the surveys carried out prior to the implementation of the BeOpen project, we realize that, in general, HVD are quite widely used and important, in many cases over 60%.

The solutions, HVD in use, quality and accessibility of data, baseline prior to the BeOpen project show a relative effectiveness, around 50%, and very different results in the number of data available.

In summary, a complex use case is presented due to its broad spectrum in order to achieve three specific objectives, complementary to each other, such as Urban Security in a Historic City with Key Critical Infrastructures; Sustainable Introduction of LED Lighting and its Impact on Health; Climate Change Mitigation Actions: Urban Heat Islands and Waves. Availability of HVD and digital services that transform the way of decision-making and development of urban policies. A defined use case accompanied by a list of indicators (KPI) designed to achieve a true evaluation of the impact of the Project in the municipality of Cartagena. The use case is presented as a true tool to create an impact in the territory.

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3.3. Molina de Segura

3.3.1. Overview of use case

In the Molina de Segura pilot, three complementary actions are described which reflect the reality of the urban nucleus. With the use case proposed in the BeOpen Project, the municipality of Molina aims to enable and improve urban management focused on the management of both traffic safety and atmospheric pollution, heat islands and the introduction of LED technologies in public lighting with its possible impact on health. For this reason, different public services have been involved in the proposed use case.

USE CASE 5: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

The city centre covers major surfaces of the metropolitan area and hosts critical infrastructure and important political and cultural establishments.

The city centre is subject to traffic limitations, with several impacts on the residents and visitors. To properly manage traffic limitations and improve the urban security of city centres it is essential to fully understand the traffic flows and their impacts on urban security of City centres.

The aim of these use cases is to make more accessible and reusable mobility and environment related datasets, allowing the implementation of more adequate measures of urban security for critical infrastructures available in City centres.

The ultimate result of this use case is to provide to the municipality all the data and tools needed to manage traffic limitations in the best way possible and to create a Low Emission Zone (LEZ) for the city centre, improving people's life quality.

USE CASE 6: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

The installation of LED lighting presents significant advantages from technology, efficiency, effectiveness and management. LED lighting in cities consumes less energy, reduces maintenance costs, delivers more correct lighting in public spaces, and improves visibility, with major impacts on safety and quality of living.

This use case aims to assess the effects of installing blue-based LED streetlights and as concerns human health: it is possible that mental and physical illnesses are triggered, impacting on the circadian rhythm, melatonin secretion, alertness, and sleep regulation and have harmful effects on eye health. Due to the incapability to access historical health statistics the correlation of LED lighting with impacts on health will be conducted through surveys to the corresponding citizens.

The expected result of this use case is to collect all the necessary inputs to introduce LED lighting in an optimal way, where the brightness and colour are set to minimize the impact on health of the affected people and the energy consumption.

USE CASE 7: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

BeOpen has received funding from European Union's Horizon Europe Research and Innovation programme under the Grant Agreement No 101100807

This use case aims to mitigate the causes of climate change, according to the objectives of the 2030 climate and energy framework, including EU-wide targets and policy objectives for 2021-2030.

The use case focuses on problems raised by high temperatures generated by excessive solar radiation due to climate change and augmented by urban infrastructures (e.g.: reflective properties of the ground, paved and dark surfaces of roads, lack of vegetation, the excessive waste of heat exhausted from mechanical air conditioning), lack of rainfall and air pollutants.

This use case will promote the quality and amount of data collected concerning climate change and will allow local governments to plan and execute data-based actions to mitigate this phenomenon.

3.3.2. Use case rationale: digital service, HVD and intended impact

The use case is designed as a replica of the original implementation of Cartagena, focusing on the interaction of all available High-Value Datasets (HVDs) to enable data-driven decision-making processes. In Torre Pacheco, the initiative leverages both historical data and new devices that enhance the breadth and accuracy of the collected information.

The proposed digital service addresses the need to integrate and link this data, providing evidence-based criteria that support the Molina de Segura administration in making informed urban planning decisions. Additionally, the service enables the municipality to respond effectively to unforeseen challenges or emerging situations, ensuring a more resilient and adaptable urban management approach.

3.3.2.1. The challenge: pre-intervention situation in pilot site

USE CASE 5: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

The city centre has mobility, pollution and safety problems due to high traffic. The challenge is to limit traffic in the historic city centre. The needs:

- More accessible and reusable mobility and environment related datasets, allowing the implementation of more adequate measures.
- Analysis of traffic mobility for the definition of the baseline situation.
- Detection of anomalous traffic patterns. Identification of typology of vehicles that could raise safety and security issues.
- Identification of misbehaviours and anomalous environmental situations (e.g. simultaneous presence of gasses, and other environmental parameters).

Before implementing the BeOpen project framework, digital services and pilot tests, it was essential to thoroughly assess the situation at the pilot site. Understanding the pre-intervention context is essential to tailor digital services to the needs of stakeholders and to assess the expected impact of the BeOpen project.

To achieve this, the most appropriate stakeholders, HVDs, KPIs, as well as the most effective digital services have been identified.

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USE CASE 6: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

Improvement of the lighting in streets is needed but cost-effective solutions (less energy consumption, reduction of maintenance costs) may have an impact on different mental and physical illnesses. To meet these challenges, we need:

- Analyse effects of installing blue based LED streetlights.
- Support the identification of the characteristics of streetlights (LEDs) to ensure proper security of citizens, energy-saving and health.

Before implementing the BeOpen project framework, digital services and pilot tests, it was essential to thoroughly assess the situation at the pilot site. Understanding the pre-intervention context is essential to tailor digital services to the needs of stakeholders and to assess the expected impact of the BeOpen project.

To achieve this, the most appropriate stakeholders, HVDs, KPIs, as well as the most effective digital services have been identified.

USE CASE 7: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

There is a problem of high temperatures in urban areas, caused by climate change and urban infrastructure. This problem can negatively impact the environment and population's well-being: Heat-related illness, reduced air quality, negative impact on biodiversity, etc. To meet these challenges, we need:

- Increase data quality
- Reduction of highest temperature of at least 2 degrees in green zones and shadow areas.
- Increase of geographical coverage of datasets

Preparation, planning and response mechanisms are essential to minimize the impacts of such events on the population and infrastructure.

Before implementing the BeOpen project framework, digital services and pilot tests, it was essential to thoroughly assess the situation at the pilot site. Understanding the pre-intervention context is essential to tailor digital services to the needs of stakeholders and to assess the expected impact of the BeOpen project.

To achieve this, the most appropriate stakeholders, HVDs, KPIs, as well as the most effective digital services have been identified.

3.3.2.2. The prospected solutions: digital services and HVDs

To address the challenges identified in the 3 use cases, the pilot project focuses on the development of a digital service: Data Visualisation Platform.

The main function of this digital service is to provide collected data to the stakeholders (public administration, private companies and citizens). The idea is to construct a unique platform with several dashboards where real time data is published. Stakeholders can view and download updated data concerning different interesting topics such as air quality, heatmaps, luminosity, noise levels and crowd monitoring. With this, local authorities can improve their management of the city with improved data-based decisions. In addition, by publishing all the data, we allow emerging researchers and institutions to elaborate further studies regarding the topics treated in each use case.

These are the HVDs and its categories used in the 3 use cases of the Molina de Segura pilot:

- Table 12 – Dataset selection for Molina Pilot Digital Service.

# Dataset	Dataset designation
DATASET_MOLINA_1	Road traffic data dataset
DATASET_MOLINA_2	Pedestrian traffic
DATASET_MOLINA_3	Light indices
DATASET_MOLINA_4	Meteorological data and air quality
DATASET_MOLINA_5	Energy consumption
DATASET_MOLINA_6	Data on medication consumption from the Murcian Health Service
DATASET_MOLINA_7	Noise

In line with BeOpen's objectives, the digital service described will reuse the following HVDs in each use case:

USE CASE 5: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

The datasets related to this use case are:

- Air quality (Dataset including gas levels and PM among others)
- Noise levels (Noise levels of different points of the city)
- Crowd monitoring (People count in different places of the city)
- Traffic data (Traffic information including number of vehicles and pollution features)

USE CASE 6: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

The datasets related to this use case are:

- Satellite Data (Luminosity maps)
- Luminosity Data (Manually collected)
- Energy Consumption (Street lightning energy consumption)

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USE CASE 7: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

The datasets related to this use case are:

- Environmental Data (Humidity and temperature levels)
- Air Quality (Dataset including gas levels and PM among others)

3.3.2.3. The results: expected outcomes

The results achieved in this use case include the increased utilization of High-Value Datasets (HVDs) within the Molina administration. Additionally, there is a notable growth in the number of users relying on this data as an evidence base for decision-making processes—whether to address specific issues or analyze historical trends to formulate effective and well-informed public policies.

USE CASE 5: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

- Solve the traffic limitations, with various impacts on residents and visitors. To properly manage traffic limitations, it is essential to have a thorough knowledge of traffic and its repercussions.
- Make datasets related to mobility and the environment more accessible and reusable, allowing the application of more appropriate measures.
- Introduce a data exchange format and methodology, while adding information from other sources to develop applications, learn from other experiences. Improve platforms in general.
- Introduce the pilots into the city council's FIREWARE platform, so that the results of these analyses are available for use by all municipal employees.
- Increase data quality using the IEEE P2510 protocol for environmental datasets (e.g. related to gases). Data contextualization and fusion/merge by using NGSI-LD to link environmental datasets (e.g. related to sounds and noise) and mobility related datasets.

USE CASE 6: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

- Increase in perceived public safety (through survey): >20% between beginning and end surveys.
- Reduction of health issues related to LED lighting (60%; supported by regional health services statistics).
- Reduction of operating hours and energy consumption of street lights (30% of energy consumption reduced by reducing bright levels, and operational hours).

USE CASE 7: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

- Increase data quality through correlation of datasets concerning LST from satellites and datasets coming from environmental networks ($R2 > 0,9$).
- Reduction of highest temperature of at least 2 degrees in green zones and shadow areas.
- Increase of geographical coverage of datasets (related to temperature and other environmental parameters, etc.) concerning the city area,

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thanks to the fusion of datasets coming from satellite and environmental stations (> 95% surface).

3.3.2.4. The stakeholders: engagement and inputs

The Molina use case involves different key stakeholders that are essential for the effective management of public policies and response to emergencies.

USE CASE 5: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

- Public administration: solutions to analyse traffic and environment to better understand how the former impacts the latter.
- Police, civil protection, fire brigades and other actors: decision support tools for better monitoring and planning of interventions.

USE CASE 6: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

The project achieves a balance between the benefits of LED lighting and preservation of public health, which helps **public administration** and **law enforcement** in decision-making and intervention planning.

Other relevant stakeholders of these three use cases are:

- Public health organizations, and health care professionals.
- Citizens and local communities.
- Local businesses.

USE CASE 7: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

Public administrations which are interested in decision-making and intervention planning for climate changes risk reduction.
Environmental and Health Agencies: which are interested in better understanding the health impacts of heat and contribute to the development of policies and guidelines for mitigating heat-related risks.
Public Health Organizations: which are interested in monitoring the health effects of heatwaves and provide guidance for safeguarding public health during extreme heat events.
Emergency Services: Police, fire departments, and emergency medical services are vital for responding to emergencies during heatwaves and providing support to vulnerable populations.
Community Organizations and citizens: They can provide input, raise awareness, and engage in activities to support heat mitigation and response efforts.
Local Businesses. They are interested in having better mitigation plans to support their activities.

3.3.3. Baseline assessment

3.3.3.1. Rationale

The baseline evaluation is the reference point for understanding the previous state of the pilot project, the needs of the stakeholders and their expectations. It establishes a basis from which the project objectives can be adapted to the real challenges of management

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and decision-making in the city of Molina de Segura, progress can be measured, and our key success indicators (KPIs) can be determined.

The data collection, description and documentation activities are summarized in the following table.

■ Table 13 – Baseline assessment: Data collection activities.

Activity	Description	Data collection documentation
Surveys	Development of surveys to collect direct input from stakeholders	Surveys results (Excel)
Internal analysis of BeOpen metrics	Analysis of quantitative information to help measure KPI	Quantitative info (Excel)
Group meetings	Meetings with stakeholders and colleagues from the Spanish project pilots	Project log

3.3.3.2. KPI selected

For the impact assessment task, Molina de Segura selected different KPIs for Use Cases 5, 6, and 7 from the expanded list of KPIs proposed in Deliverable 4.1 – KPI Validation Methodology, which aim to produce an overall impact analysis of the BeOpen project in terms of data usage, data availability, data accessibility, data quality, and stakeholder engagement.

These KPIs were constructed and measured using information obtained from various data collection activities described above (e.g., project logs, surveys, and BeOpen metrics). Table XX provides a complete description of each KPI, including source (e.g., survey, project logs, BeOpen metrics), metrics, metric units (e.g., Likert scale, number, percentage), measurement phase (baseline and/or impact assessment), and final measurement.

USE CASE 5: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

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USE CASE 5: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

■ Figure 14 – UC 5 – Molina Pilot - Key Performance Indicators.

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_MOL_1	To what extent the availability of HVDs has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	# of HVDs made available to the public through BeOpen Framework	BeOpen metrics	Number of HVD made available through BeOpen Framework	Number
KPI_MOL_2	To what extent the availability of HVDs has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	% Percentage increase in the availability of datasets through BeOpen Framework compared to the baseline.	BeOpen metrics	Ratio of BeOpen Datasets which will be available	Ratio
KPI_MOL_3	To what extent the data accessibility has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	% of HVDs accessible by the public through BeOpen Framework compared to the baseline.	BeOpen metrics	Ratio of BeOpen Datasets which will be publicly published	Ratio
KPI_MOL_4	To what extent the data accessibility has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	# of HVDs related to mobility and the environment are more accessible allowing the application of more appropriate measures.	BeOpen metrics	# of used datasets	Number
KPI_MOL_5	How much additional data does the framework provide to stakeholders to better contribute to the implementation of more adequate measures of urban security in the historical city centre?	Ratio of data used by civil servants in their public services management processes after BeOpen compared to the baseline.	BeOpen metrics	Ratio of datasets used by civil servants	Ratio
KPI_MOL_6	To what extent are HVDs reusable to allow the implementation of more adequate measures of urban security in the historical city centre?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of used datasets	Ratio
KPI_MOL_7	To what extent has BeOpen been integrated with existing technical ecosystems to allow the implementation of more adequate measures of urban security in the historical city centre?	Ratio of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site.	BeOpen metrics	Data available from the municipalities	Ratio
KPI_MOL_8	In what concerns the HVD criteria, how has the quality been improved in terms of score?	HVD criteria score	BeOpen metrics	HVD criteria score	Number
KPI_MOL_9	To what extent have citizens accessed the HVDs made interoperable by the BeOpen Framework used for the implementation of more adequate measures of urban security in the historical city centre?	# of citizens accessing the HVDs made interoperable by BeOpen Framework	BeOpen metrics	# of citizens who have accessed the HVD available through the portal	Number
KPI_MOL_10	To what extent are citizens and critical stakeholders satisfied with the public services management processes assisted by BeOpen Framework in the implementation of more adequate measures of urban security in the historical city centre?	Degree of satisfaction of critical stakeholders in (a) participating to the public services management processes and of (b) the quality of provided services compared to current practices	Survey to critical stakeholders	Data available from the municipalities	Survey / Interviews

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# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_MOL_11	How many public services have been developed over the course of the BeOpen related to more adequate measures of urban security in the historical city centre?	# of public services developed in total over the course of the BeOpen project	Project logs	Data available from the municipalities	Number
KPI_MOL_12	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and implementation of more adequate measures of urban security in historical city centre?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	External/internal data sources	Data available from the municipalities	Number
KPI_MOL_13	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and implementation of more adequate measures of urban security in historical city centre?	HVDs fully integrated and interoperable in Pilot site before and after BeOpen	BeOpen metrics	# of used datasets	Number
KPI_MOL_14	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and implementation of more adequate measures of urban security in historical city centre?	Open data made available before and after the BeOpen.	BeOpen metrics	# of published datasets	Number
KPI_MOL_15	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to allow the implementation of more adequate measures of urban security in the historical city centre?	% of Open data on total HVDs made interoperable by BeOpen Framework.	BeOpen metrics	Ratio of BeOpen Datasets which will be publicly published	Ratio
KPI_MOL_16	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to allow the implementation of more adequate measures of urban security in the historical city centre?	# of times HVDs accessed.	BeOpen metrics	# of times HVDs accessed.	Number
KPI_MOL_17	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to allow the implementation of more adequate measures of urban security in the historical city centre?	# of downloads per dataset.	BeOpen metrics	# of downloads per dataset.	Number
KPI_MOL_18	To what extent can BeOpen reduce risks for crises, including natural disasters and security threats due to better plans and preparedness of the responders and citizens?	% of Stakeholders indicating usefulness of BeOpen Framework.	Survey/Interviews to Stakeholders	Data available from the municipalities	Ratio

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USE CASE 6: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

■ Table 15 – UC 6 – Molina Pilot - Key Performance Indicators.

# KPI	Evaluation question?	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_MOL_1	To what extent the availability of HVDs has been improved to assess the health impact of installing blue-based LED streetlights?	# of HVDs made available to the public through BeOpen Framework	BeOpen metrics	# of used datasets	Number
KPI_MOL_2	To what extent the data accessibility has been improved to assess the health impact of installing blue-based LED streetlights?	Time required for users to access HVDs compared to the baseline.	BeOpen metrics	Time to access a HVD	Number
KPI_MOL_3	To what extent the data accessibility has been improved to assess the health impact of installing blue-based LED streetlights?	% of HVDs accessible by the public through BeOpen Framework compared to the baseline.	BeOpen metrics Interviews	# of accessible datasets	Percentage
KPI_MOL_4	To what extent are HVDs reusable to assess the health impact of installing blue-based LED streetlights?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of used datasets	Ratio
KPI_MOL_5	In what concerns the HVD criteria, how has the quality been improved in terms of score?	HVD criteria score	BeOpen metrics	HVD criteria score	Number
KPI_MOL_6	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to assess the health impact of installing blue-based LED streetlights?	Ratio of citizens who have accessed the HVDs made interoperable by BeOpen Framework compared to the baseline	BeOpen metrics	Ratio of citizens who have accessed the HVD available through the portal	Ratio
KPI_MOL_7	Has civil servants' perceived quality of services increased to assess the health impact of installing blue-based LED streetlights?	Perceived quality of public services (Likert scale)	Survey	Likert scale	Number
KPI_MOL_8	Have public authorities used the BeOpen solution in their decision-making processes to assess the health impact of installing blue-based LED streetlights?	# of times HVDs made available through BeOpen Framework have been consulted by public authorities	BeOpen metrics	# of used datasets	Number
KPI_MOL_9	To what extent can BeOpen contribute to the reduction of operating hours and energy consumption of street lights?	30% of energy consumption is reduced.	External/internal data sources	Data available from the municipalities	Percentage
KPI_MOL_10	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to assess the health impact of installing blue-based LED streetlights?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	CBA	Data available from the municipalities	Number

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# KPI	Evaluation question?	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_MOL_11	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to assess the health impact of installing blue-based LED streetlights?	% of Open data on total HVDs made interoperable by BeOpen Framework.	BeOpen metrics	# of published open datasets	Ratio
KPI_MOL_12	To what extent can BeOpen increase in perceived public safety?	>20% perceived public safety between beginning and end surveys.	Survey to citizens/ policymakers/ stakeholders	Likert scale	Percentage
KPI_MOL_13	To what extent can BeOpen contribute in the reduction of potential incidents.	5% reduction of incidents before and after BeOpen	External/internal data sources	Data available from the municipalities	Percentage
KPI_MOL_14	What is the reduction of Carbon Footprint through the decrease of greenhouse gas emissions by consuming less energy due to BeOpen adoption?	Carbon footprint reduction calculation	External/internal data sources	Data available from the municipalities	Number
KPI_MOL_15	How easy is it for policymakers to gain access to and make use of the HVDs through BeOpen Framework for policymaking to assess the health impact of installing blue-based LED streetlights?	Perceived ease of access to data	Surveys	Likert scale	Number

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USE CASE 7: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

■ Table 16 – UC 7 - Molina Pilot – Key Performance Indicators.

# KPI	Evaluation question?	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_MOL_1	To what extent can BeOpen increase the data quality through correlation of datasets concerning LST from satellites and datasets coming from environmental networks?	Correlation coefficient R2 > 0,9 between satellite and local data.	External/internal data sources	Correlation coefficient	Ratio
KPI_MOL_2	To what extent can BeOpen increase the geographical coverage of datasets (related to temperature and other environmental parameters, etc.?	Increase of > 95% surface coverage.	External/internal data sources	Measured covered by measurements	Percentage
KPI_MOL_3	To what extent the availability of HVDs have been improved to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of HVDs made available to the public through BeOpen Framework	BeOpen metrics	# of available datasets	Number
KPI_MOL_4	To what extent the availability of HVDs have been improved to make available more accurate HVDs concerning the environment to support activities against climate changes?	% Percentage increase in the availability of high-value datasets through BeOpen Framework compared to the baseline	BeOpen metrics	# of used datasets	Percentage
KPI_MOL_5	Have new more accurate HVDs been made available, concerning the environment to support activities against climate changes?	# of new HVDs made available	BeOpen metrics	# of new datasets	Number
KPI_MOL_6	To what extent have HVDs been made discoverable through the European Data Portal to make available more accurate HVDs concerning the environment to support activities against climate changes?	Ratio of HVDs discoverable through the European Data Portal versus datasets that are not discoverable	External/internal data sources	# of published datasets	Ratio
KPI_MOL_7	To what extent are HVDs reusable to make available more accurate HVDs concerning the environment to support activities against climate changes?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of used datasets	Ratio
KPI_MOL_8	To what extent has BeOpen been integrated with existing technical ecosystems to make available more accurate HVDs concerning the environment to support activities against climate changes?	Degree of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site	External/internal data sources	Data available from the municipalities	Percentage
KPI_MOL_9	In what concerns the HVD criteria, how has the quality been improved in terms of score?	HVD criteria score	BeOpen metrics	HVD criteria score	Number
KPI_MOL_10	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of citizens who have accessed the HVDs made interoperable by BeOpen Framework	BeOpen metrics	# of citizens who have accessed the HVD available through the portal	Number
KPI_MOL_11	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to make available	Degree of satisfaction of critical stakeholders in (a) participating to the public services	Survey	Likert scale	Number

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# KPI	Evaluation question?	KPI Indicator	SOURCE	METRICS	METRIC UNIT
	more accurate HVDs concerning the environment to support activities against climate changes?	management processes and of (b) the quality of provided services compared to current practices			
KPI_MOL_12	How many public services have been developed over the course of the BeOpen project to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of public services developed in total over the course of the BeOpen project	Project logs	Data available from the municipalities	Number
KPI_MOL_13	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to make available more accurate HVDs concerning the environment to support activities against climate changes?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	External/internal data sources	Data available from the municipalities	Number
KPI_MOL_14	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to make available more accurate HVDs concerning the environment to support activities against climate changes?	HVDs fully integrated and interoperable in Pilot site before and after BeOpen	External/internal data sources	Data available from the municipalities	Number
KPI_MOL_15	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to make available more accurate HVDs concerning the environment to support activities against climate changes?	Open data made available before and after the BeOpen.	BeOpen metrics	# of available datasets	Number
KPI_MOL_16	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to make available more accurate HVDs concerning the environment to support activities against climate changes?	% of Open data on total HVDs made interoperable by BeOpen Framework.	BeOpen metrics	# of interoperable datasets	Number
KPI_MOL_17	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of times HVDs accessed.	BeOpen metrics	# of accesses to datasets	Number
KPI_MOL_18	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of downloads per dataset.	BeOpen metrics	# of downloads	Number
KPI_MOL_19	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to make available more accurate HVDs concerning the environment to support activities against climate changes?	Perceived necessary HVDs for each use case.	Survey/Interviews to Stakeholders	Likert scale	Number
KPI_MOL_20	To what extent can BeOpen reduce the highest temperature?	Reduction of at least 2 degrees in green zones and shadow areas.	External/internal data sources	Measured temperature	Number

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3.3.3.3. Other data and physical measures

Other data have been obtained through Survey to critical stakeholders, project logs, external/internal data sources or Survey to citizens/ policymakers/ stakeholders.

3.3.3.4. Stakeholder group

In Molina de Segura we have selected a group of stakeholders who are mainly part of our public administration, who have experience and knowledge in project management and decision-making in matters of security, environment, industry, ICT, etc.

Their participation is important to gather information on the problems faced by the municipality and to achieve the expected results with the use cases.

Our public administration is the main beneficiary since with the results it will have access to solutions to better understand the impact of traffic on security and the environment or public lighting on health and safety. It will also see the benefits of cost efficiency and energy consumption. The different municipal services will have decision-making support tools for better monitoring and planning of interventions.

Other beneficiaries will be citizens, who will improve their quality of life.

- Table 17 – UC 5,6,7 Molina's stakeholders.

Organization	Type of stakeholder
Lighting technical department	Direct beneficiary /user
Department of environment	Direct beneficiary /user
e-administration department	Direct beneficiary /user
European projects department	Direct beneficiary /user
Urban planning department	Direct beneficiary /user
IT department	Direct beneficiary /user
Municipal services company	Direct beneficiary /user
Local police	Direct beneficiary /user
Department of Transparency	Direct beneficiary /user
Department of Citizen Participation	Direct beneficiary /user

3.3.3.5. Results of the survey

The survey aimed to establish baseline metrics regarding the use and impact of High-Value Datasets (HVDs) in the context of smart city management within the 3 Molina de Segura use cases. The survey responses, completed by several stakeholders, provide critical insights into the initial conditions prior to the implementation of the BeOpen framework.

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All three baseline surveys, corresponding for each of the use cases, were sent to the same 10 stakeholders selected, as the Molina de Segura pilot is defined in a way that the same stakeholders will be beneficiary/users of the digital services provided.

The participation of a civil protection technician and an employee of the Molina hospital had initially been planned, but the dates of the surveys prevented their participation in the baseline survey.

- Table 18 – UC5,6,7 Respondents to baseline survey.

RESPONDANT	ORGANIZATION	ROLE	TYPE OF STAKEHOLDER
PERSON_MOLINA_1	Molina Town Hall (Lighting technical department)	Engineer (Lighting technical manager)	Beneficiary / user
PERSON_MOLINA_2	Molina Town Hall (Department of environment)	Chemical (Technical manager of the air quality network)	Beneficiary / user
PERSON_MOLINA_3	e-administration department	Head of service of the electronic administration department	Beneficiary / user
PERSON_MOLINA_4	Molina Town Hall (European projects department)	Head of service of the European projects department	Beneficiary / user
PERSON_MOLINA_5	Molina Town Hall (Urban planning department)	Architect technical manager of the municipal GIS	Beneficiary / user
PERSON_MOLINA_6	Molina Town Hall (IT department)	Head of IT Department	Beneficiary / user
PERSON_MOLINA_7	Municipal services company	Telecommunications Engineer (Sercomosa)	Beneficiary / user
PERSON_MOLINA_8	Local police	Local Police Chief	Beneficiary / user
PERSON_MOLINA_9	Molina Town Hall (Department of Transparency)	Computer Applications Technician (Open Data)	Beneficiary / user
PERSON_MOLINA_10	Molina Town Hall (Department of Citizen Participation)	Citizen Participation Animator	Beneficiary / user

•

Stakeholder feedback has been provided following a general briefing on the results of the project so far by staff involved in the project, but specific calls have been necessary to obtain additional information, especially to define which datasets are intended for the responses. Extracting some statistics from the survey responses supports the following considerations.

USE CASE 5: URBAN SAFETY IN HISTORIC CITY WITH KEY CRITICAL INFRASTRUCTURES

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?

Regarding the usage of data across different thematic categories, the majority of stakeholders indicated Geospatial Data and Statistics as the most frequently or extensively used. Geospatial data is highly valued for its critical role in supporting decision-making processes, particularly when combined with datasets like spatial boundaries or geographic overlays. Similarly, Statistics emerges as a key resource for analysis, with a significant proportion of respondents indicating frequent usage.

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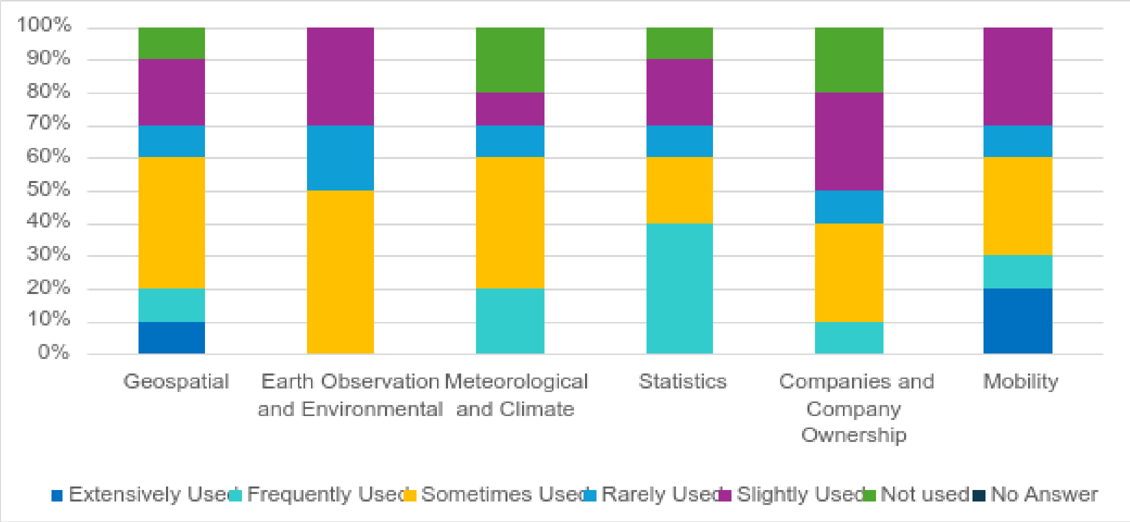
On the other hand, Earth Observation, Meteorological and Climate, and Mobility data show a more balanced distribution across usage levels. While some respondents highlight their importance in specific contexts, such as environmental monitoring or transportation planning, a notable percentage report only slight or occasional usage.

Finally, data on Companies and Company Ownership appears less prominently used, with a relatively higher percentage of respondents indicating minimal or no usage. This reflects its secondary role compared to other thematic categories, which are often more operational and context-dependent.

Figure 29 – UC5 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

Regarding the perceived importance of different thematic data categories, the majority of respondents identified Geospatial, Earth Observation and Environmental, and Meteorological and Climate data as critical or very important. Geospatial data, in particular, stands out as the most critical, reflecting its foundational role in spatial planning and decision-making processes.

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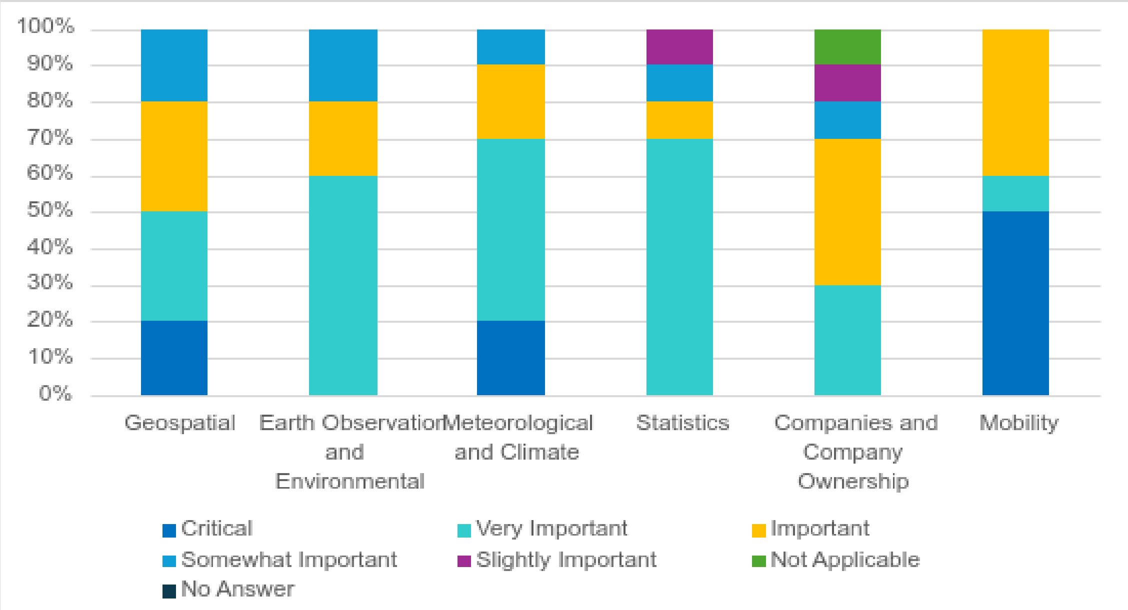
Meteorological and climate data were also deemed essential, especially for applications like weather forecasting and environmental monitoring. Similarly, Earth Observation and Environmental data hold significant importance, emphasizing their role in sustainability and ecosystem management.

In contrast, Statistics and Companies and Company Ownership data are perceived as somewhat less critical. While acknowledged as important or very important by some respondents, they appear to play a more supportive role compared to other categories. Mobility data, though relevant, also demonstrates a more varied distribution of importance, with some respondents considering it slightly important or not applicable in certain contexts.

Figure 30 – UC5 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 3 (Baseline): Are currently data management solutions in place to support the management of urban safety?

Based on the graphs, 80% of respondents indicated that data management solutions are currently in place to support urban safety management. Of those, 50% consider these solutions "Moderately Effective," 30% view them as "Very Effective," and 20% rate them

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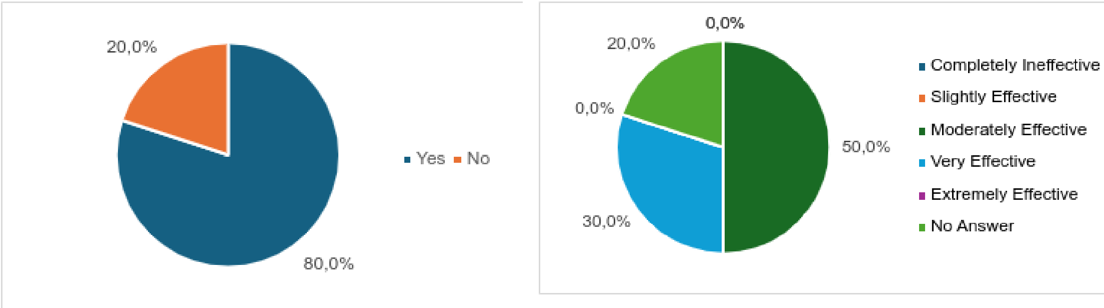
as "Slightly Effective." No respondents described them as "Completely Ineffective" or "Extremely Effective." This suggests that while these solutions are widely implemented, there is room to enhance their overall effectiveness.

Figure 31 – UC5 – Q3 "Are currently data management solutions in place to support the management of urban safety?"



Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 4 (Baseline): Are there HVDs in use to manage the access to city centres and to manage security and critical assets? (conditional question)

According to the graphs, 70% of respondents indicated that HVDs are in use to manage access to city centers and protect critical assets, while 30% do not use them. Among those who implement these solutions, 40% consider them "Moderately Effective," 30% rate them as "Very Effective," 10% view them as "Slightly Effective," and another 10% find them "Extremely Effective." No respondents described them as "Completely Ineffective," and 10% provided no answer. This suggests that while HVDs are widely implemented and generally perceived as effective, there is still room to improve their performance and maximize their impact on urban security and asset protection.

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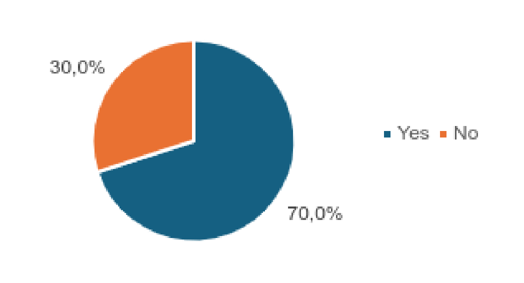
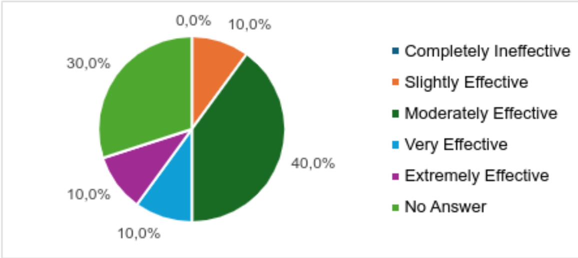
■

Figure 32 – UC5 – Q4 "Are there HVDs in use to manage the access to city centres and to manage security and critical assets?"





***Completely Ineffective** (No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Slightly Effective** (Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Moderately Effective** (Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Very Effective** (Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Extremely Effective** (Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 5 (Baseline): How would you rate the data quality in the Molina de Segura use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

According to the graph, 60% of respondents rated the data quality in the Molina de Segura use case before the BeOpen framework implementation as "Moderate Quality." Meanwhile, 30% assessed it as "Very Poor Quality," and 10% classified it as "Poor Quality." There were no ratings of "Good Quality" or "Excellent Quality," and no respondents selected "No Answer." This indicates that the data quality was generally seen as lacking in accuracy, timeliness, and relevance, highlighting a clear need for improvement to better support decision-making processes.

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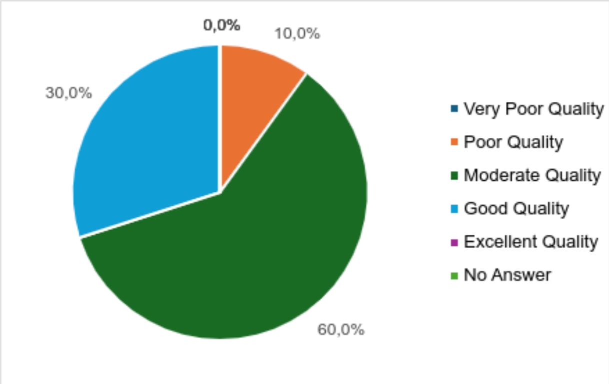
Figure 33 – UC5 – Q5 "How would you rate the data quality in the Molina de Segura use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"

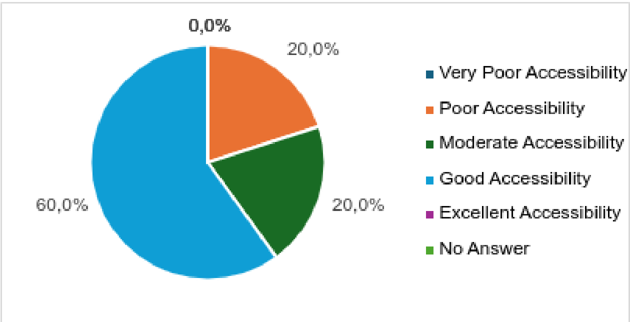


Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Question 6 (Baseline): How would you rate the data accessibility in the Molina de Segura use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

According to the graph, 60% of respondents rated the data accessibility in the Molina de Segura use case as "Very Poor Accessibility." Meanwhile, 20% classified it as "Poor Accessibility," and another 20% assessed it as "Moderate Accessibility." There were no ratings of "Good Accessibility" or "Excellent Accessibility," and no respondents selected "No Answer." This indicates significant challenges in data retrieval, ease of use, and technical interoperability, underscoring the need for improvements to facilitate more effective decision-making processes.

Figure 34 – UC5 – Q6 "How would you rate the data accessibility in the Molina de Segura use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



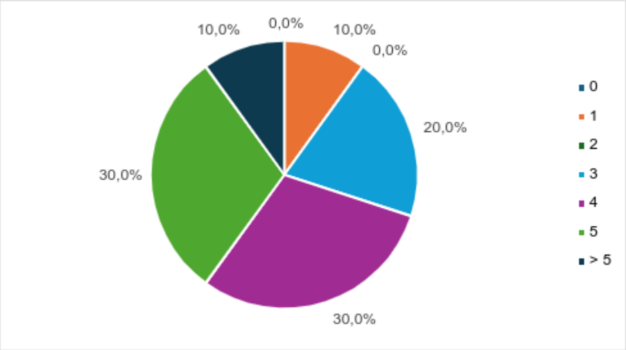
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

__Poor Accessibility__ (Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)
__Moderate Accessibility__ (Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)
__Good Accessibility__ (Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)
__Excellent Accessibility__ (Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)
__Very Poor Accessibility__ (Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)

Question 7 (Baseline): How many datasets were available to support the management of access, security, safety and asset protection in city centres?

According to the graph, 30% of respondents indicated that 4 datasets were available to support the management of access, security, safety, and asset protection in city centers. Another 30% reported having 5 datasets available. 20% noted 3 datasets, while 10% mentioned only 1 dataset. Additionally, 10% indicated having more than 5 datasets. No respondents reported having 0 datasets or 2 datasets available. This suggests a moderate level of data availability, with most respondents relying on a limited number of datasets, highlighting the potential need to expand data sources to enhance security and asset protection management.

Figure 35 – UC5 – Q7 "How many datasets were available to support the management of access, security, safety and asset protection in city centres?"



CONCLUSIONS:
• Regarding to what extent are the categories of HVD used, only 20% responded that they use them frequently or extensively, however 53.33% responded that they consider them very important or critical.
• 8 out of 10 responded yes to the question: Are there currently data management solutions…?, of which only 37.5% considered them: Very effective (significant impact on area monitoring, safety and security, . ..)
• 7 out of 10 responded yes to the question Are high-value datasets (HVD) used to manage access to urban centres…?, of which only 28.57% considered it very or extremely effective.
• Regarding the quality of the data before the implementation of the BeOpen framework, only 30% responded with good or excellent quality.
• Regarding the accessibility of the data, 60% responded with good or excellent accessibility.

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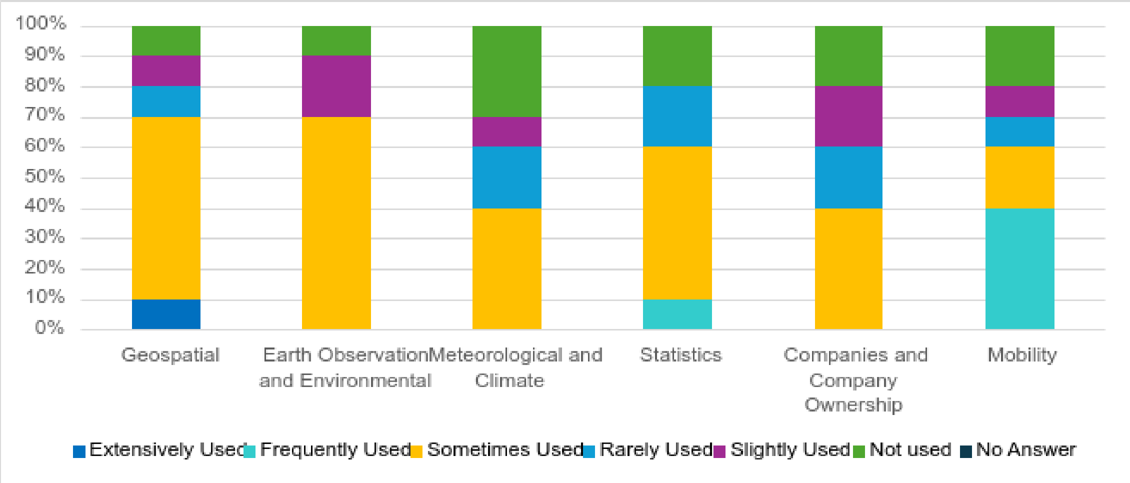
• The question “How many datasets were available?” has very varied answers, with 80% falling between values 3 and 5.

UC6: SUSTAINABLE INTRODUCTION OF LED LIGHTNING AND ITS IMPACT ON HEALTH

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?

According to the graph, the use of High Value Datasets (HVDs) in city management before the BeOpen project varied by category. Geospatial and Earth Observation and Environmental data were predominantly used "Sometimes" by around 70% of respondents, with limited extensive use. Meteorological and Climate data showed moderate use, often rated as "Sometimes" or "Rarely." In contrast, Statistics and Mobility data had higher utilization, with approximately 40% using them "Frequently." For Companies and Company Ownership data, 40% reported "Frequent" use, though some reported limited or no use. These patterns highlight an opportunity to enhance the consistency and depth of dataset usage to improve urban management and decision-making processes.

Figure 36 – UC6 – Q1 “To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?”



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

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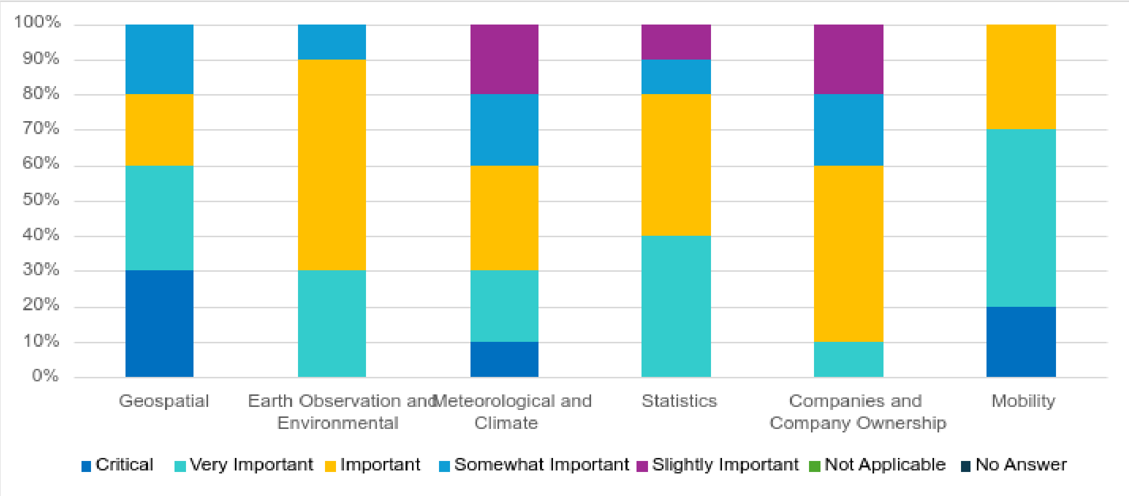
Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

According to the graph, the perceived importance of High Value Datasets (HVDs) for smart city functions varies by category. Geospatial data is largely rated as "Very Important" or "Critical" by most respondents. Earth Observation and Environmental data is also considered essential, with the majority rating it as "Very Important" and a smaller segment marking it as "Critical." Meteorological and Climate data shows a similar trend, with a large portion identifying it as "Very Important" and some as "Critical" or "Somewhat Important." Statistics data is seen as "Very Important" and "Critical" by a substantial number, though some respondents rated it as "Slightly Important." Companies and Company Ownership data is divided, with many considering it "Very Important" or "Somewhat Important," while a segment sees it as "Slightly Important." Finally, Mobility data stands out, with a majority rating it as "Important" or "Very Important," and some respondents considering it "Critical." These insights emphasize the varying degrees of importance across dataset categories, highlighting the need to prioritize their integration for effective smart city management and services.

Figure 37 – UC6 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 3 (Baseline): Are currently data management solutions in place to monitor the use of LED lighting in the City of Molina de Segura and its impacts on energy efficiency, public safety and security and on the health of citizens?

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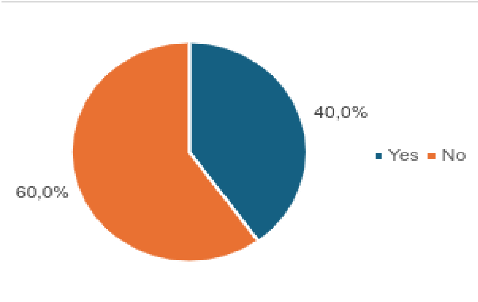
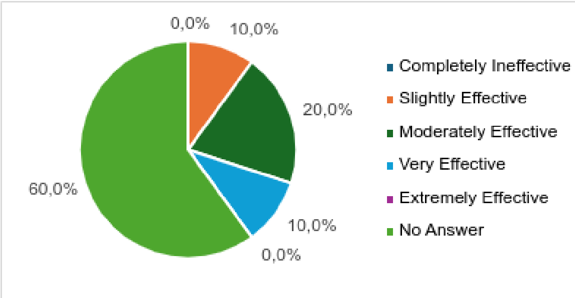
According to the graphs, 40% of respondents indicated that data management solutions are in place to monitor the use of LED lighting in the City of Molina de Segura, while 60% stated that no such solutions exist. Among those who have these solutions, 60% consider them "Very Effective," 20% rate them as "Moderately Effective," 10% find them "Slightly Effective," and another 10% deem them "Completely Ineffective." No respondents rated them as "Extremely Effective" or provided "No Answer." This suggests that while some monitoring solutions are in place, there is significant room for expansion and improvement to enhance their impact on energy efficiency, public safety, and citizen health.

Figure 38 – UC6 – Q3 "Are currently data management solutions in place to monitor the use of LED lighting in the City of Molina de Segura and its impacts on energy efficiency, public safety and security and on the health of citizens?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 4 (Baseline): Are there HVDs in use to monitor the use of LED lighting in the City of Molina de Segura and its impacts on energy efficiency, public safety and security and on the health of citizens? (conditional question)

According to the graphs, 50% of respondents indicated that HVDs (High Value Datasets) are in use to monitor the use of LED lighting in the City of Molina de Segura, while the

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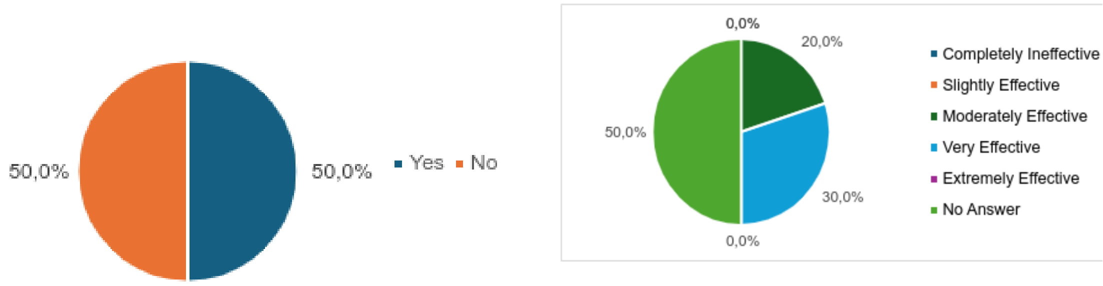
other 50% stated that they are not. Regarding their effectiveness, 50% of respondents provided "No Answer." Of the remaining responses, 30% rated the HVDs as "Moderately Effective" and 20% considered them "Slightly Effective." There were no ratings for "Completely Ineffective," "Very Effective," or "Extremely Effective." This indicates a balanced deployment of HVDs, with room for improving their effectiveness in monitoring LED lighting's impact on energy efficiency, public safety, and citizen health.

Figure 39 – UC6 – Q4 "Are there HVDs in use to monitor the use of LED lighting in the City of Molina de Segura and its impacts on energy efficiency, public safety and security and on the health of citizens?"



Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 5 (Baseline): How would you rate the data quality in the Molina de Segura use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

According to the graph, 30% of respondents rated the data quality in the Molina de Segura use case before the BeOpen framework implementation as "Very Poor Quality," while 20% rated it as "Moderate Quality." The majority, 50%, provided "No Answer." There were no responses indicating "Poor Quality," "Good Quality," or "Excellent

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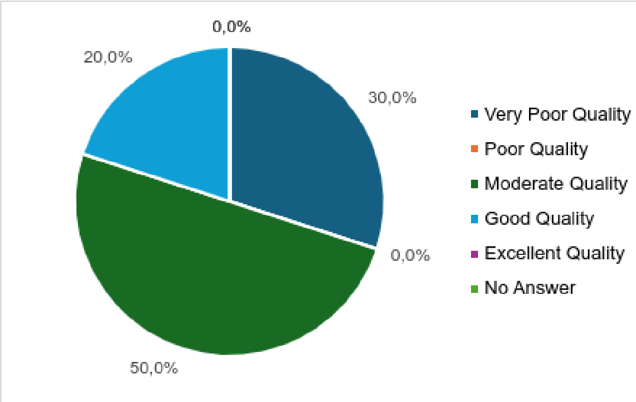
Quality." This suggests that data quality was perceived as inadequate in terms of accuracy, timeliness, and appropriateness, with significant gaps in its ability to support effective decision-making processes.

Figure 40 – UC6 – Q5 "How would you rate the data quality in the Molina de Segura use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"



Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Question 6 (Baseline): How would you rate the data accessibility in the Molina de Segura use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

According to the graph, 30% of respondents rated the data accessibility in the Molina de Segura use case as "Very Poor Accessibility," while 20% rated it as "Poor Accessibility." 40% of respondents indicated "Moderate Accessibility," and 10% provided "No Answer." There were no responses for "Good Accessibility" or "Excellent Accessibility." This suggests that data accessibility faced significant challenges related to retrieval, ease of use, and system compatibility, highlighting the need for improvements to support more effective decision-making processes.

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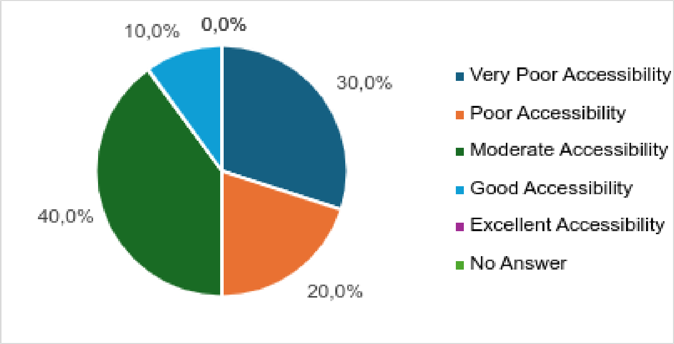
Figure 41 – UC6 – Q6 "How would you rate the data accessibility in the Molina de Segura use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"

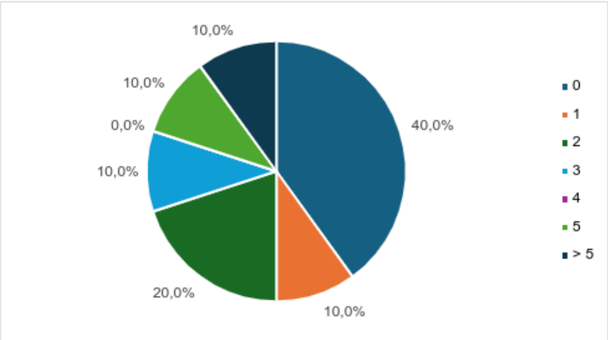


Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Question 7 (Baseline): How many datasets were available to support the monitoring of the use of LED lighting in the City of Molina de Segura and its impacts on energy efficiency, public safety and security and on the health of citizens?

According to the graph, 40% of respondents indicated that there were 0 datasets available to support the monitoring of LED lighting in the City of Cartagena. Additionally, 10% reported having 1 dataset, another 10% indicated 2 datasets, and 10% noted 3 datasets. 20% reported 4 datasets available, while 10% indicated having more than 5 datasets. No respondents reported having exactly 5 datasets. This highlights a significant gap in data availability, suggesting the need to enhance data collection and monitoring efforts to effectively support energy efficiency, public safety, and citizen health.

Figure 42 – UC6 – Q7 "How many datasets were available to support the monitoring of the use of LED lighting in the City of Cartagena and its impacts on energy efficiency, public safety and security and on the health of citizens?"



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CONCLUSIONS:

• To what extent are the following categories of HVD used… only 10.00% answered that they use them frequently or extensively and 40.00% answered that they consider them very important or critical.
• 4 out of 10 answered yes to the question Are there currently data management solutions to monitor the use of LED lighting…?, of which 2 (50.00%) considered them moderately effective and 1 very effective.
• 5 out of 10 answered yes to the question Are there LED lighting monitoring devices…?, of which 3 (60.00%) considered them very or extremely effective.
• Regarding the quality of the data before the implementation of the BeOpen framework, only 20% answered good or excellent quality.
• Regarding the accessibility of the data, 10% answered good or excellent accessibility.
• The question: How many datasets were available…? It has very varied responses, with 20% falling between values 3 and 5.

UC7: CLIMATE CHANGE MITIGATION ACTIONS. URBAN HEAT ISLANDS AND HEAT WAVES.

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?

According to the graph, the usage of High Value Datasets (HVDs) in city management before the BeOpen project experience varied across categories. For Geospatial Data, a significant portion reported using it "Sometimes" or "Rarely," with some respondents indicating it was "Not Used." Earth Observation and Environmental Data saw a mix of "Sometimes Used" and "Rarely Used," with a small portion stating "Extensively Used." Meteorological and Climate Data showed moderate use, primarily categorized as "Sometimes Used" and "Rarely Used." Statistics Data had a broader range, including "Frequently Used" and "Sometimes Used," but also some instances of "Rarely Used." For Companies and Company Ownership Data, many reported "Sometimes Used" and "Slightly Used," with a few indicating no usage. Finally, Mobility Data was mostly rated as "Sometimes Used" and "Rarely Used." This distribution underscores the inconsistent application of these datasets and the opportunity to improve their integration to enhance smart city operations.

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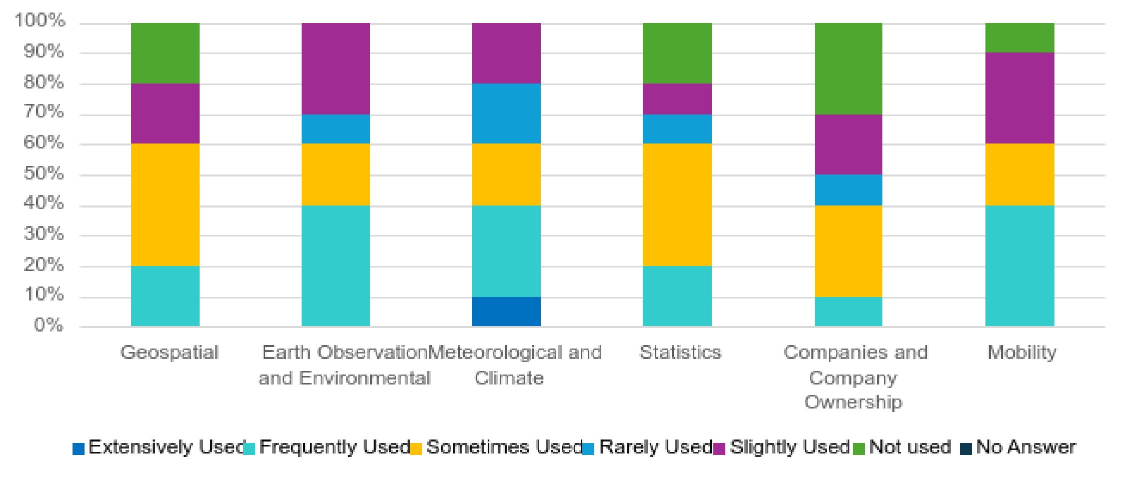
Figure 43 – UC7 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?"



***Note: Geospatial Data:** Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. **Earth Observation and Environmental Data**: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; **Meteorological and Climate Data:** Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; **Statistics:** Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. **Companies and Company Ownership Data:** Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. **Mobility Data**: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

Based on the graph, the perceived importance of High Value Datasets (HVDs) for managing smart city functions and delivering smart services varies by category. Geospatial Data is mostly seen as "Very Important" and "Critical," with a smaller percentage rating it as "Important." Earth Observation and Environmental Data is primarily rated as "Very Important" and "Critical." Meteorological and Climate Data shows a mix, with many respondents considering it "Somewhat Important" or "Critical." Statistics Data has a varied response, with categories spread across "Somewhat Important," "Important," and "Slightly Important." For Companies and Company Ownership Data, opinions are split between "Slightly Important" and "Somewhat Important," with a few seeing it as "Very Important." Finally, Mobility Data is largely viewed as "Somewhat Important," with a notable portion considering it "Critical." This variation underscores the need to prioritize specific datasets to effectively support different aspects of smart city operations.

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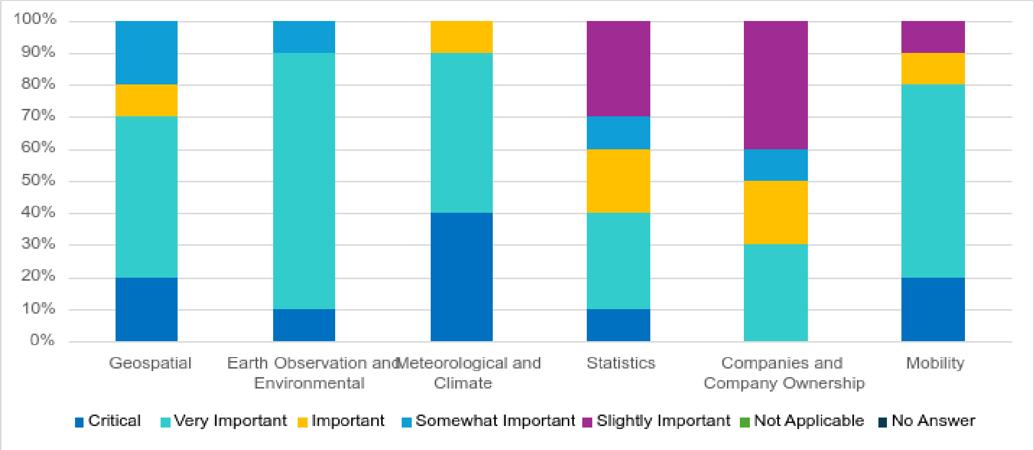
Figure 44 – UC7 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Question 3 (Baseline): Are currently digital services in place to monitor urban heat and climate issues in the city of Molina de Segura, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

According to the graphs, 70% of respondents indicated that digital services are in place to monitor urban heat and climate issues in the city of Molina de Segura, while 30% stated that such services are not in place. Regarding the effectiveness of these services, 40% rated them as "Moderately Effective," 20% considered them "Slightly Effective," and 10% described them as "Extremely Effective." Meanwhile, 30% provided "No Answer." No respondents rated the services as "Completely Ineffective" or "Very Effective." These findings suggest that while digital services exist to address urban heat and climate issues, there is still room to improve their overall effectiveness in supporting mitigation, adaptation, and citizen health initiatives.

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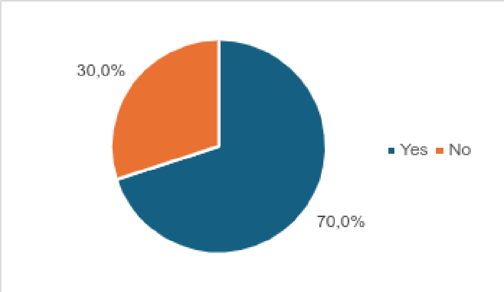
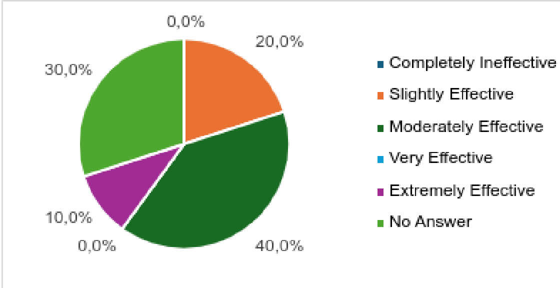
Figure 45 – UC7 – Q3 "Are current digital services in place to monitor urban heat and climate issues in the city of Molina de Segura, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 4 (Baseline): Are there HVDs in use to monitor urban heat and climate issues in the city of Molina de Segura, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

According to the graphs, 70% of respondents indicated that HVDs (High Value Datasets) are in use to monitor urban heat and climate issues in the city of Molina de Segura, while 30% stated that they are not. Regarding the effectiveness of these HVDs, 30% of respondents rated them as "Slightly Effective," another 30% considered them "Moderately Effective," and 10% rated them as "Extremely Effective." Additionally, 30% provided "No Answer." No respondents rated these datasets as "Completely Ineffective" or "Very Effective." These results highlight the need for improving the effectiveness of these datasets to better support climate mitigation, adaptation, and public health initiatives.

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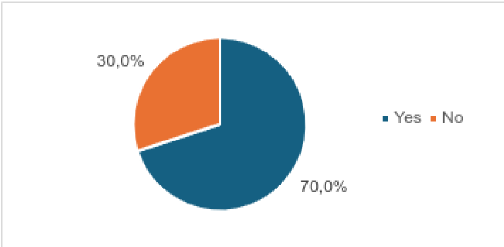
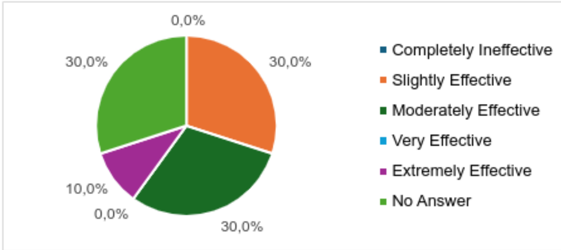
Figure 46 – UC7 – Q4 "Are there HVDs in use to monitor urban heat and climate issues in the city of Molina de Segura, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Question 5 (Baseline): How would you rate the data quality in the Molina de Segura use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

According to the graph, 30% of respondents rated the data quality in the Molina de Segura use case before the BeOpen framework implementation as "Very Poor Quality." 10% rated it as "Poor Quality," while the majority, 60%, provided "No Answer." There were no ratings for "Moderate Quality," "Good Quality," or "Excellent Quality." This indicates significant concerns about data quality, specifically regarding accuracy, timeliness, and appropriateness, with a substantial portion of respondents not providing feedback. This highlights the need for considerable improvements in data quality to better support decision-making processes.

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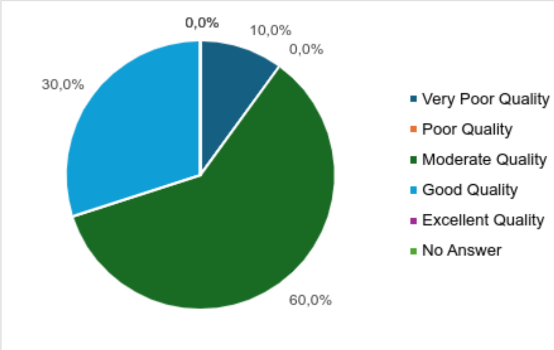
Figure 47 – UC7 – Q5 "How would you rate the data quality in the Molina de Segura use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"

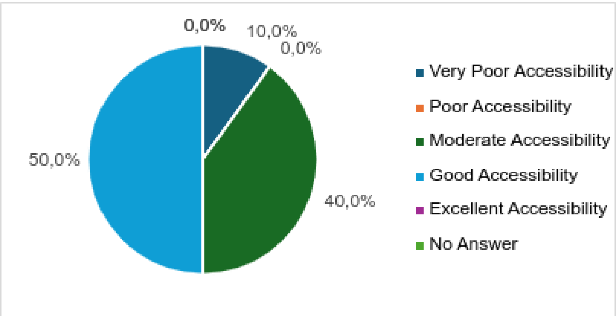


Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Question 6 (Baseline): How would you rate the data accessibility in the Molina de Segura use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

According to the graph, 50% of respondents rated the data accessibility in the Molina de Segura use case as "Very Poor Accessibility." Additionally, 10% rated it as "Poor Accessibility," while 40% provided "No Answer." There were no responses indicating "Moderate Accessibility," "Good Accessibility," or "Excellent Accessibility." These results highlight significant challenges with data accessibility, particularly regarding ease of retrieval, technical interoperability, and compatibility with existing systems, indicating the need for substantial improvements to support effective decision-making processes.

Figure 48 – UC7 – Q6 "How would you rate the data accessibility in the Molina de Segura use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*

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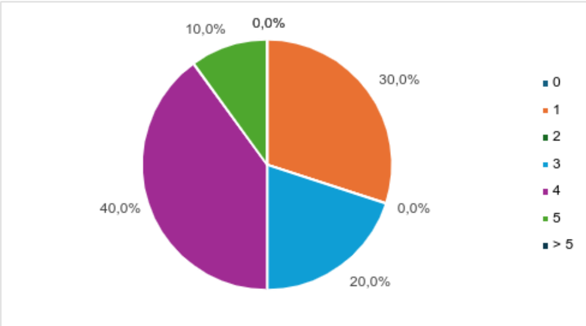
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Question 7 (Baseline): Prior to the BeOpen implementation, how many datasets were available to monitor urban heat and climate issues in the city of Molina de Segura, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

According to the graph, 30% of respondents indicated that there was 1 dataset available to monitor urban heat and climate issues in the city of Cartagena prior to the BeOpen implementation. Additionally, 20% reported having 2 datasets, while 40% noted 4 datasets. 10% indicated having more than 5 datasets, and no respondents reported having 0 datasets, 3 datasets, or exactly 5 datasets. This distribution highlights a moderate availability of datasets, indicating a need for expanding data sources to enhance the monitoring and evaluation of mitigation and adaptation strategies for safety, security, and citizen health.

Figure 49 – UC7 – Q7 "Prior to the BeOpen implementation, how many datasets were available to monitor urban heat and climate issues in the city of Cartagena, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?"



CONCLUSIONS:
• To what extent are the following categories of HVD used… only 28.33% responded that they use them frequently or extensively, however 66.67% responded that they consider them very important or critical.
• 7 out of 10 responded yes to the question Are there currently digital services to monitor urban heat and climate problems…?, of which 4 (57.14%) considered them moderately effective, 0 very effective and 1 extremely effective.
• 7 out of 10 responded yes to the question Are there HVD in use to monitor urban heat and climate problems…?, of which only 1 (14.29%) considered them very or extremely effective.
• Regarding the quality of the data before the implementation of the BeOpen framework, only 30% responded with good or excellent quality.
• Regarding the accessibility of the data, 50% responded with good or excellent accessibility.

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• The question: How many datasets were available…? It has very varied responses, with 70% falling between values 3 and 5.

3.3.4. Synthesis

The evaluation carried out on the 3 use cases being developed in Molina de Segura shows a difference in terms of the implementation of the **UC5**: Urban security in historical city centre with key critical infrastructure and **UC7**: Climate change mitigation actions: Urban Heat Islands and Heatwaves, which are more developed, with respect to the **UC6**: Sustainable introduction of LED lighting and its health impact use case, which is less known and used in the organisation.

The use of the different datasets (HVD) is generally very low, however they are considered very important or critical by the stakeholders for the effective management of the city and the provision of smart services.

The distribution of the answers suggests different levels of knowledge among the respondents regarding the datasets they use, with the worst value being that which refers to companies and data owned by companies.

Regarding the quality and accessibility of the datasets, the rating is very low, so there is potential for improvement in these aspects.

The previous situation also highlighted the limitations of communication, making it necessary to improve the transparency and knowledge of the stakeholders about the available datasets, hoping that they will become very relevant once they know the digital services and the work developed in the BeOpen project.

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3.4. Torre Pacheco

3.4.1. Overview of use case

In the Torre Pacheco pilot, three complementary actions are described which reflect the reality of the urban nucleus. With the use case proposed in the BeOpen Project, the municipality of Torre Pacheco aims to enable and improve urban management focused on the management of both traffic safety and atmospheric pollution, heat islands and the introduction of LED technologies in public lighting with its possible impact on health. For this reason, different public services have been involved in the proposed use case.

UC 8: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

City centers are subject to traffic limitations, with several impacts on the residents and visitors. To properly manage traffic limitations, it is essential to fully understand the traffic and its impacts. The aim of the use case is to make more accessible and reusable mobility and environment related datasets, allowing the implementation of more adequate measures. All areas are subject to traffic restrictions and control over environmental impacts. The Open Framework is expected to increase the availability and usability of Open Data provided by the public sector that will address the challenges of mobility, urban safety, and environment in various regions of the EU.

The ultimate result of this use case is to provide to the municipality all the data and tools needed to manage traffic limitations in the best way possible and to create a Low Emission Zone (LEZ) for the city center, improving people’s life quality.

UC 9: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

The installation of LED lighting presents significant advantages from technology, efficiency, effectiveness and management. LED lighting in cities consumes less energy, reduces maintenance costs, delivers more correct lighting in public spaces, and improves visibility, with major impacts on safety and quality of living. This use case aims to assess the effects of installing blue-based LED streetlights and in particular as concerns human health: it is possible that mental and physical illnesses are triggered, impacting on the circadian rhythm, melatonin secretion, alertness, and sleep regulation and have harmful effects on eye health. Due to the incapability to access historical health statistics the correlation of LED lighting with impacts on health will be conducted through surveys to the corresponding citizens.

The expected result of this use case is to collect all the necessary inputs to introduce LED lighting in an optimal way, where the brightness and colour are set to minimize the impact on health of the affected people and the energy consumption.

UC 10: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

This use case aims to mitigate the causes of climate change, according to the objectives of the 2030 climate and energy framework, including EU-wide targets and policy objectives for 2021-2030. The use case focuses on problems raised by high

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temperatures generated by excessive solar radiation due to climate change and augmented by urban infrastructures (e.g.: reflective properties of the ground, paved and dark surfaces of roads, lack of vegetation, the excessive waste of heat exhausted from mechanical air conditioning), lack of rainfall and air pollutants.

This use case will promote the quality and amount of data collected concerning climate change and will allow local governments to plan and execute data-based actions to mitigate this phenomenon.

3.4.2. Use case rationale: digital service, HVD and intended impact

The use case is designed as a replica of the original implementation of Cartagena, focusing on the interaction of all available High-Value Datasets (HVDs) to enable data-driven decision-making processes. In Torre Pacheco, the initiative leverages both historical data and new devices that enhance the breadth and accuracy of the collected information.

The proposed digital service addresses the need to integrate and link this data, providing evidence-based criteria that support the Torre Pacheco administration in making informed urban planning decisions. Additionally, the service enables the municipality to respond effectively to unforeseen challenges or emerging situations, ensuring a more resilient and adaptable urban management approach.

3.4.2.1. The challenge: pre-intervention situation in pilot site

Each use case has its own rationale as we have specified on the overview. Here we show the actions implemented in each use case in Torre Pacheco Pilot:

UC 8: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

The urban security use case in Torre Pacheco will be based on the structure and digital services platform which hosts 10 sensors for monitoring environmental parameters and 10 sensors for monitoring occupancy and people flow. This use case has been enhanced with the installation of 2 traffic cameras and its software which enables the collection of datasets on the number of vehicles, traffic-related emissions, and the management of security-related alerts.

The digital platforms and sensor network installed will allow the Torre Pacheco City Council to analyse the impact and scope of the implementation of the Sustainable Urban Mobility Plan, as well as the measures executed in public spaces. These tools, based on open datasets, will provide a more comprehensive view of territorial planning and security, along with quantitative conclusions and an assessment of the cost-to-impact ratio of the measures implemented in public areas.

This approach enables the quantitative and qualitative evaluation of decisions and actions taken in public spaces, examining their relationship with urban security and the environment.

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UC 9: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

From Torre Pacheco City Council, various public lighting audits have been conducted over time, reflecting data on both luminosity and energy consumption. As a case study, the San Antonio neighborhood has been chosen, providing data on public lighting consumption over several years—both before the replacement of luminaires and after the introduction of LED luminaires. The Torre Pacheco City Council has adopted the standard protocol of replacing luminaires with 2700K LED lights.

Additionally, by using surveys that will be conducted during the piloting phase, data will be cross-referenced with groups highly sensitive to sleep disturbances and the potential effects of blue light on citizens' health. This approach aims to facilitate decision-making that takes into account the needs of the most sensitive or vulnerable groups.

The objective of this use case is to establish conclusions that enable urban design to be informed by open datasets, considering their relationship with health, energy consumption, and safety.

UC 10: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

The urban safety use case of Torre Pacheco will be based on the structure and digital services platform, which hosts 10 environmental parameter sensors and 10 sensors for monitoring occupancy and pedestrian flow. The digital platform and the installed sensor network will enable the Torre Pacheco City Council to analyze the impact, conditions, and parameters affecting heat islands, as well as provide territorial analysis to support decision-making, material selection, and the creation of spaces designed to reduce temperatures and mitigate heat islands.

Additionally, an environmental monitoring station, measuring parameters such as temperature and humidity, has been incorporated into a rehabilitated green zone. The goal is to establish conclusions that will guide urban planning, including the selection of materials that promote soil permeability and the strategic placement of green areas and shaded spaces, thereby effectively combating heat islands and heat waves.

3.4.2.2. The prospected solutions: digital services and HVDs

To address the challenges identified in the 3 use cases, the pilot project focuses on the development of a digital service: Data Visualisation Platform.

The main function of this digital service is to provide collected data to the stakeholders (public administration, private companies and citizens). The idea is to construct a unique platform with several dashboards where real time data is published. Stakeholders can view and download updated data concerning different interesting topics such as air quality, heatmaps, luminosity, noise levels and crowd monitoring. With this, local authorities can improve their management of the city with improved data-based decisions. In addition, by publishing all the data, we allow emerging researchers and institutions to elaborate further studies regarding the topics treated in each use case.

These are the HVDs and its categories used in the 3 use cases of Torre Pacheco pilot:

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■ Table 19 – Dataset selection for Torre Pacheco Digital Service.

# Dataset	Dataset designation
DATASET_TPACHECO_1	Road traffic data dataset
DATASET_TPACHECO_2	Pedestrian traffic
DATASET_TPACHECO_3	Light indices
DATASET_TPACHECO_4	Meteorological data and air quality
DATASET_TPACHECO_5	Energy consumption
DATASET_TPACHECO_6	Data on medication consumption from the Murcian Health Service
DATASET_TPACHECO_7	Noise

•

In line with BeOpen's objectives, the digital service described will reuse the following HVDs in each use case:

UC 8: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

Traffic Datasets (Vehicle counting, metadata from plates, ...)
Crowd Datasets (People counting, ...)
Environmental Data.
Air Quality Data (gases, PM10, humidity, etc.)

UC 9: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

City luminosity Data
Energy Consumption Data Sets
Satellite data (luminosity)

UC 10: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

Environmental Data (Humidity and temperature levels)
Air Quality Data (Gas levels and PM among others)
Satellite Data (Geospatial heat maps from Copernicus)

3.4.2.3. The results: expected outcomes

Before implementing the BeOpen project framework, digital services and pilot tests, it was essential to thoroughly assess the situation at the pilot site. Understanding the pre-intervention context is essential to tailor digital services to the needs of stakeholders and to assess the expected impact of the BeOpen project.

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To achieve this, the most appropriate stakeholders, HVDs, KPIs, as well as the most effective digital services have been identified.

UC 8: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

- To obtain sufficient data in quantity and quality so that the city is safer. Analyse the scope of the measures implemented as well as their functionality.
- To enhance the management of traffic limitations to improve urban security in these critical historical areas.
- To understand traffic dynamics and its impact on urban security.
- The implementation of decision support tools.
- More effective monitoring and planning of interventions, ultimately improving safety and mobility in these urban centers

UC 9: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

- To support the identification of the energy efficiency and safety trade-off concerning streetlights.
- To contextualize the incidence of blue LED-based street lights on the processes of circadian regulation.
- To support the evaluation of using different colors of light in public outdoor spaces and for identifying the more convenient.
- To identify the proper temperature and color of public lightning, especially at night, to allow appropriate visibility reducing risk and hazards.
- To integrate cost-benefit approaches to optimize lighting efficiency and effectiveness minimizing health impacts.

UC 10: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

- Main objective: To reduce the effects of high temperatures generated by excessive solar radiation due to climate change and urban infrastructures.
- Identification of prevention and mitigation actions of issues caused by excessive temperatures (droughts, floods, heat islands, tropical nights, ...)

3.4.3. Baseline assessment

3.4.3.1. Rationale

The baseline assessment acts as a reference point for understanding the prior-intervention status for Torre Pacheco Pilot, the stakeholders' needs, and their expectations. It sets a foundation from which we can adapt the project objectives to the real challenges in Torre Pacheco city management and decision-making, specifically, the baseline assessment will help us measure progress and determine our success indicators (KPI).

The data collection, description and documentation activities are summarized in the following table.

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■ Table 20 – Baseline assessment: data collection activities.

Activity	Description	Data collection documentation
Surveys	Development of surveys to collect direct input from stakeholders	Surveys results (Excel)
Internal analysis of BeOpen metrics	Analysis of quantitative information to help measure KPI	Quantitative info (Excel)
Group meetings	Meetings with stakeholders and colleagues from the Spanish project pilots	Project log

UC 8: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

From the municipality of Torre Pacheco, in the case of urban security, the municipality has an installation of 10 environmental parameter sensors, 10 people counting sensors, and a network of surveillance cameras that only record images and do not provide datasets. that cannot be analyzed in the management of urban security or in municipal planning. Furthermore, the Torre Pacheco city council lacks professional services for the interpretation of these datasets, and stakeholders also do not have this information available in city planning or decision making. To complement this use case, two traffic cameras have been installed with license plate reading and a specific digital platform for managing the datasets generated by these cameras.

UC 9: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

As basic information, the municipality of Torre Pacheco has several energy audits of public lighting throughout the municipality, from which maps of luminosity and the chosen study area have been obtained. The Torre Pacheco City Council and its urban planning department carry out public lighting changes taking into account the optimal relationship between energy consumption-health-safety. There is no data available that would allow appropriate decision-making for each area or neighborhood, taking into account their circumstances. To achieve this, the aim of this use case is to identify the most vulnerable areas and be able to make decisions taking into account the impact on health, in addition to energy savings and safety.

UC 10: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

In the case of use of the Heat Islands, the municipality has an installation of 10 environmental parameter sensors with temperature and humidity measurement and 10 people counting sensors. The data provided by these sensors is not analyzed or interpreted by professionals and is not used in urban planning or in municipal decision-making by stakeholders. This use case aims to have a vision of how materials, design and waterproofed areas (asphalt and concrete) affect temperatures and the increase in heat islands.

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3.4.3.2. KPI selected

For the impact assessment task, Torre Pacheco municipality selected different KPIs for Use Cases 8, 9, and 10 from the expanded list of KPIs proposed in Deliverable 4.1 – KPI Validation Methodology, which aim to produce an overall impact analysis of the BeOpen project in terms of data usage, data availability, data accessibility, data quality, and stakeholder engagement.

These KPIs were constructed and measured using information obtained from various data collection activities described above (e.g., project logs, surveys, and BeOpen metrics). The following tables provide a complete description of each KPI, including source (e.g., survey, project logs, BeOpen metrics), metrics, metric units (e.g., Likert scale, number, percentage), measurement phase (baseline and/or impact assessment), and final measurement.

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USE CASE 8: URBAN SECURITY IN HISTORICAL CITY CENTRE WITH KEY CRITICAL INFRASTRUCTURE

■ Table 21 – UC8 – Torre Pacheco Pilot – Key Performance Indicators.

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_ TPACH _1	To what extent the availability of HVDs has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	# of HVDs made available to the public through BeOpen Framework	BeOpen metrics	Number of HVD made available through BeOpen Framework	Number
KPI_ TPACH _10	To what extent are citizens and critical stakeholders satisfied with the public services management processes assisted by the BeOpen Framework in the implementation of more adequate measures of urban security in the historical city centre?	Degree of satisfaction of critical stakeholders in (a) participating to the public services management processes and of (b) the quality of provided services compared to current practices	Survey to critical stakeholders	Data available from the municipalities	Survey / Interviews
KPI_ TPACH _11	How many public services have been developed over the course of the BeOpen related to more adequate measures of urban security in the historical city centre?	# of public services developed in total over the course of the BeOpen project	Project logs	Data available from the municipalities	Number
KPI_ TPACH _12	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and implementation of more adequate measures of urban security in historical city centres?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	External/internal data sources	Data available from the municipalities	Number
KPI_ TPACH _13	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and implementation of more adequate measures of urban security in historical city centres?	HVDs fully integrated and interoperable in Pilot site before and after BeOpen	BeOpen metrics	# of used datasets	Number
KPI_ TPACH _14	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and implementation of more adequate measures of urban security in historical city centres?	Open data made available before and after the BeOpen.	BeOpen metrics	# of published datasets	Number
KPI_ TPACH _15	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to allow the implementation of more adequate measures of urban security in the historical city centre?	% of Open data on total HVDs made interoperable by BeOpen Framework.	BeOpen metrics	Ratio of BeOpen Datasets which will be publicly published	Ratio
KPI_ TPACH _16	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to allow the implementation of more adequate measures of urban security in the historical city centre?	# of times HVDs accessed.	BeOpen metrics	# of times HVDs accessed.	Number
KPI_ TPACH _17	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to allow the	# of downloads per dataset.	BeOpen metrics	# of downloads per dataset.	Number

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# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS	METRIC UNIT
	implementation of more adequate measures of urban security in the historical city centre?				
KPI_ TPACH _18	To what extent can BeOpen reduce risks for crises, including natural disasters and security threats due to better plans and preparedness of the responders and citizens?	% of Stakeholders indicating usefulness of BeOpen Framework.	Survey/Interviews to Stakeholders	Data available from the municipalities	Ratio
KPI_ TPACH _2	To what extent the availability of HVDs has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	% Percentage increase in the availability of datasets through BeOpen Framework compared to the baseline.	BeOpen metrics	Ratio of BeOpen Datasets which will be available	Ratio
KPI_ TPACH _3	To what extent the data accessibility has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	% of HVDs accessible by the public through BeOpen Framework compared to the baseline.	BeOpen metrics	Ratio of BeOpen Datasets which will be publicly published	Ratio
KPI_ TPACH _4	To what extent the data accessibility has been improved to allow the implementation of more adequate measures of urban security in the historical city centre?	# HVDs related to mobility and the environment are more accessible allowing the application of more appropriate measures.	BeOpen metrics	# of used datasets	Number
KPI_ TPACH _5	How much additional data does the framework provide to stakeholders to better contribute to the implementation of more adequate measures of urban security in the historical city centre?	Ratio of data used by civil servants in their public services management processes after BeOpen compared to the baseline.	BeOpen metrics	Ratio of datasets used by civil servants	Ratio
KPI_ TPACH _6	To what extent are HVDs reusable to allow the implementation of more adequate measures of urban security in the historical city centre?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of used datasets	Ratio
KPI_ TPACH _7	To what extent has BeOpen been integrated with existing technical ecosystems to allow the implementation of more adequate measures of urban security in the historical city centre?	Ratio of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site.	BeOpen metrics	Data available from the municipalities	Ratio
KPI_ TPACH _8	In what concerns the HVD criteria, how has the quality been improved in terms of score?	HVD criteria score	BeOpen metrics	HVD criteria score	Number
KPI_TPACH_9	To what extent have citizens accessed the HVDs made interoperable by the BeOpen Framework used for the implementation of more adequate measures of urban security in the historical city centre?	# of citizens accessing the HVDs made interoperable by BeOpen Framework	BeOpen metrics	# of citizens who have accessed the HVD available through the portal	Number

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USE CASE 9: SUSTAINABLE INTRODUCTION OF LED LIGHTING AND ITS HEALTH IMPACT

■ Table 22 – UC9 – Torre Pacheco Pilot – Key Performance Indicators.

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_ TPACH _1	To what extent the availability of HVDs has been improved to assess the health impact of installing blue-based LED streetlights?	# of HVDs made available to the public through BeOpen Framework	BeOpen metrics	# of used datasets	Number
KPI_ TPACH _10	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to assess the health impact of installing blue-based LED streetlights?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	CBA	Data available from the municipalities	Number
KPI_ TPACH _11	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to assess the health impact of installing blue-based LED streetlights?	% of Open data on total HVDs made interoperable by BeOpen Framework.	BeOpen metrics	# of published open datasets	Ratio
KPI_ TPACH _12	To what extent can BeOpen increase in perceived public safety?	>20% perceived public safety between beginning and end surveys.	Survey to citizens/ policymakers/ stakeholders	Likert scale	Percentage
KPI_ TPACH_13	To what extent can BeOpen contribute in the reduction of potential incidents.	5% reduction of incidents before and after BeOpen	External/internal data sources	Data available from the municipalities	Percentage
KPI_ TPACH_14	What is the reduction of Carbon Footprint through the decrease of greenhouse gas emissions by consuming less energy due to BeOpen adoption?	Carbon footprint reduction calculation	External/internal data sources	Data available from the municipalities	Number
KPI_ TPACH_15	How easy is it for policymakers to gain access to and make use of the HVDs through BeOpen Framework for policymaking to assess the health impact of installing blue-based LED streetlights?	Perceived ease of access to data	Surveys	Likert scale	Number
KPI_ TPACH_2	To what extent the data accessibility has been improved to assess the health impact of installing blue-based LED streetlights?	Time required for users to access HVDs compared to the baseline.	BeOpen metrics	Time to access a HVD	Number
KPI_ TPACH_3	To what extent the data accessibility has been improved to assess the health impact of installing blue-based LED streetlights?	% of HVDs accessible by the public through BeOpen Framework compared to the baseline.	BeOpen metrics Interviews	# of accessible datasets	Percentage
KPI_ TPACH_4	To what extent are HVDs reusable to assess the health impact of installing blue-based LED streetlights?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of used datasets	Ratio
KPI_ TPACH_5	In what concerns the HVD criteria, how has the quality been improved in terms of score?	HVD criteria score	BeOpen metrics	HVD criteria score	Number

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KPI_ TPACH_6	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to assess the health impact of installing blue-based LED streetlights?	Ratio of citizens who have accessed the HVDs made interoperable by BeOpen Framework compared to the baseline	BeOpen metrics	Ratio of citizens who have accessed the HVD available through the portal	Ratio
KPI_ TPACH_7	Has civil servants' perceived quality of services increased to assess the health impact of installing blue-based LED streetlights?	Perceived quality of public services (Likert scale)	Survey	Likert scale	Number
KPI_ TPACH_8	Have public authorities used the BeOpen solution in their decision-making processes to assess the health impact of installing blue-based LED streetlights?	# of times HVDs made available through BeOpen Framework have been consulted by public authorities	BeOpen metrics	# of used datasets	Number
KPI_ TPACH_9	To what extent can BeOpen contribute to the reduction of operating hours and energy consumption of street lights?	30% of energy consumption is reduced.	External/internal data sources	Data available from the municipalities	Percentage

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USE CASE 10: CLIMATE CHANGE MITIGATION ACTIONS: URBAN HEAT ISLANDS AND HEATWAVES

■ Table 23 – UC10 – Torre Pacheco Pilot – Key Performance Indicators.

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_TPACH_1	To what extent can BeOpen increase the data quality through correlation of datasets concerning LST from satellites and datasets coming from environmental network?	Correlation coefficient R2 > 0,9 between satellite and local data.	External/internal data sources	Correlation coefficient	Ratio
KPI_ TPACH_10	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of citizens who have accessed the HVDs made interoperable by BeOpen Framework	BeOpen metrics	# of citizens who have accessed the HVD available through the portal	Number
KPI_ TPACH_11	To what extent have citizens accessed the HVDs made interoperable by BeOpen Framework to make available more accurate HVDs concerning the environment to support activities against climate changes?	Degree of satisfaction of critical stakeholders in (a) participating to the public services management processes and of (b) the quality of provided services compared to current practices	Survey	Likert scale	Number
KPI_ TPACH_12	How many public services have been developed over the course of the BeOpen project to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of public services developed in total over the course of the BeOpen project	Project logs	Data available from the municipalities	Number
KPI_ TPACH_13	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to make available more accurate HVDs concerning the environment to support activities against climate changes?	Total investment in person days to implement the BeOpen Framework in the use case (such as giving/attending training, technical monitoring, communication)	External/internal data sources	Data available from the municipalities	Number
KPI_ TPACH_14	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to make available more accurate HVDs concerning the environment to support activities against climate changes?	HVDs fully integrated and interoperable in Pilot site before and after BeOpen	External/internal data sources	Data available from the municipalities	Number
KPI_ TPACH_15	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes to make available more accurate HVDs concerning the environment to support activities against climate changes?	Open data made available before and after the BeOpen.	BeOpen metrics	# of available datasets	Number
KPI_ TPACH_16	To what extent are HVDs made interoperable through BeOpen Framework open and to whom to make available more accurate HVDs concerning the environment to support activities against climate changes?	% of Open data on total HVDs made interoperable by BeOpen Framework.	BeOpen metrics	# of interoperable datasets	Number

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS	METRIC UNIT
KPI_ TPACH_17	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of times HVDs accessed.	BeOpen metrics	# of accesses to datasets	Number
KPI_ TPACH_18	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of downloads per dataset.	BeOpen metrics	# of downloads	Number
KPI_ TPACH_19	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to make available more accurate HVDs concerning the environment to support activities against climate changes?	Perceived necessary HVDs for each use case.	Survey/Interviews to Stakeholders	Likert scale	Number
KPI_ TPACH_2	To what extent can BeOpen increase the geographical coverage of datasets (related to temperature and other environmental parameters, etc.?	Increase of > 95% surface coverage.	External/internal data sources	Measured covered by measurements	Percentage
KPI_ TPACH_20	To what extent can BeOpen reduce the highest temperature?	Reduction of at least 2 degrees in green zones and shadow areas.	External/internal data sources	Measured temperature	Number
KPI_ TPACH_3	To what extent the availability of HVDs have been improved to make available more accurate HVDs concerning the environment to support activities against climate changes?	# of HVDs made available to the public through BeOpen Framework	BeOpen metrics	# of available datasets	Number
KPI_ TPACH_4	To what extent the availability of HVDs have been improved to make available more accurate HVDs concerning the environment to support activities against climate changes?	% Percentage increase in the availability of high-value datasets through BeOpen Framework compared to the baseline	BeOpen metrics	# of used datasets	Percentage
KPI_ TPACH_5	Have new more accurate HVDs been made available, concerning the environment to support activities against climate changes?	# of new HVDs made available	BeOpen metrics	# of new datasets	Number
KPI_ TPACH_6	To what extent have HVDs been made discoverable through the European Data Portal to make available more accurate HVDs concerning the environment to support activities against climate changes?	Ratio of HVDs discoverable through the European Data Portal versus datasets that are not discoverable	External/internal data sources	# of published datasets	Ratio
KPI_ TPACH_7	To what extent are HVDs reusable to make available more accurate HVDs concerning the environment to support activities against climate changes?	Ratio of HVDs that are reusable compared to the baseline	BeOpen metrics	# of used datasets	Ratio
KPI_ TPACH_8	To what extent has BeOpen been integrated with existing technical ecosystems to make available more accurate HVDs concerning the environment to support activities against climate changes?	Degree of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site	External/internal data sources	Data available from the municipalities	Percentage
KPI_ TPACH_9	In what concerns the HVD criteria, how has the quality been improved in terms of score?	HVD criteria score	BeOpen metrics	HVD criteria score	Number

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3.4.3.3. Other data and physical measures

Other data have been obtained through Survey to critical stakeholders, project logs, external/internal data sources or Survey to citizens/ policymakers/ stakeholders.

3.4.3.4. Stakeholder group

For Torre Pacheco pilots we have selected a group of stakeholders that are part of our public administration mainly. These technicians have been chosen for their expertise and knowledge on matters of public security, management and decision making.

Their engagement is crucial to gather input on the problems facing the municipality, and also to achieve the results expected with the pilots.

Our public administration is the main beneficiary as with the results we will have access to solutions to better understand the impact of traffic on the environment or public lighting on health and safety. The public administration will see the benefits of cost efficiency and energy consumption. Different municipal services will have decision-making support tools to better monitor and plan interventions. Other beneficiaries would be the citizens, who may see an improvement in their quality of life.

Torre Pacheco has also selected three main external contributors that have important information about the city management.

■ Table 24 – UC 8,9,10 Torre Pacheco's stakeholders.

Organization	Type of stakeholder
Lighting technical department	Direct beneficiary /user
Department of environment	Direct beneficiary /user
e-administration department	Direct beneficiary /user
European projects department	Direct beneficiary /user
Urban planning department	Direct beneficiary /user
IT department	Direct beneficiary /user
Municipal services department	Direct beneficiary /user
Local police	Direct beneficiary /user
Civil defense	Direct beneficiary /user
Department of Citizen Participation	Direct beneficiary /user

3.4.3.5. Results of the survey

The survey aimed to establish baseline metrics regarding the use and impact of High-Value Datasets (HVDs) in the context of smart city management within the Torre Pacheco pilot use cases. The survey responses, completed by several stakeholders,

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provide critical insights into the initial conditions prior to the implementation of the BeOpen framework.

All three baseline surveys, corresponding for each of the use cases, were sent to the same 10 stakeholders selected, as the Torre Pacheco pilot is defined in a way that the same stakeholders will be beneficiary/users of the digital services provided. However, the results of the surveys show that some stakeholders didn't manage to complete the three surveys. And one of the stakeholders was not able to collaborate in the time and place provided. All confirmed that the language and technicity of the questions were difficult to understand.

■ Table 25 – UC8,9,10 Respondents to baseline survey.

RESPONDANT	ORGANIZATION	ROLE	TYPE OF STAKEHOLDER
PERSON_TPACHECO_1	Torre Pacheco Municipality	Municipal IT Head Technician	Beneficiary / user
PERSON_TPACHECO_2	Torre Pacheco Municipality	Municipal urban planning technician	Beneficiary / user
PERSON_TPACHECO_3	Torre Pacheco Municipality	Municipal Lighting and Electricity technician	Beneficiary / user
PERSON_TPACHECO_4	Torre Pacheco Municipality	Municipal risk prevention technician	Beneficiary / user
PERSON_TPACHECO_5	Torre Pacheco Municipality	Civil Protection Department	Beneficiary / user
PERSON_TPACHECO_6	Torre Pacheco Municipality	Municipal Pubic road technician	Beneficiary / user
PERSON_TPACHECO_7	Torre Pacheco Municipality	Police Department	Beneficiary / user
PERSON_TPACHECO_8	Public Water Management	External consultant	User
PERSON_TPACHECO_9	Mobility and Sustainable Urban Planning	External consultant	User
PERSON_TPACHECO_10	Project Managing Technical Assistant	External consultant	User

UC8: URBAN SAFETY IN HISTORIC CITY WITH KEY CRITICAL INFRASTRUCTURES

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?

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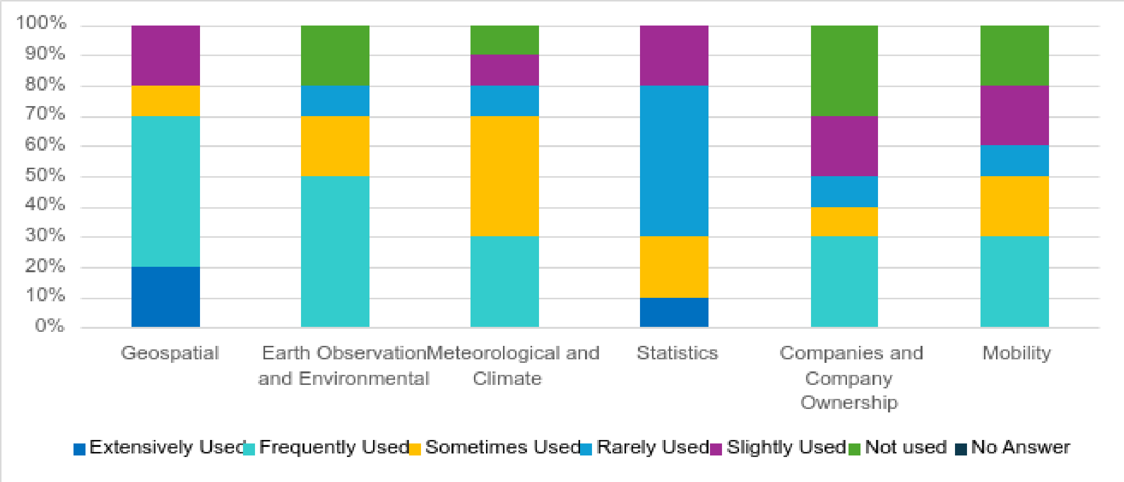
Figure 50 – UC8 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?"



***Note: Geospatial Data:** Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. **Earth Observation and Environmental Data**: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; **Meteorological and Climate Data:** Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; **Statistics:** Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. **Companies and Company Ownership Data:** Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. **Mobility Data**: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

The most frequently used HVD categories are geospatial, earth observation and environmental, standing out with 70%, mainly due to the implementation of the use of these HVDs by urban planning services. For the rest of the stakeholders, the use of HVD is neither as well known nor is it implemented in daily use.

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

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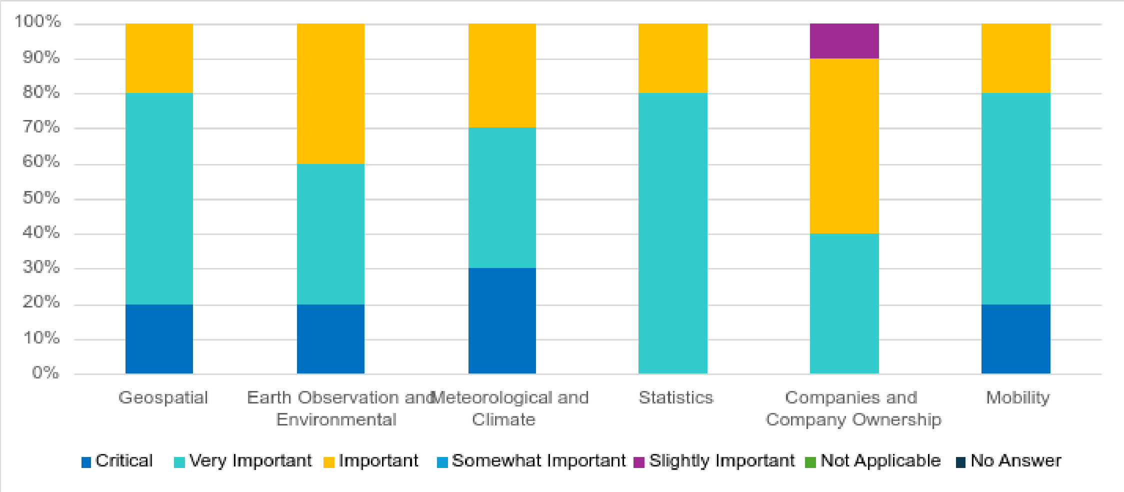
Figure 51 – UC8 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"

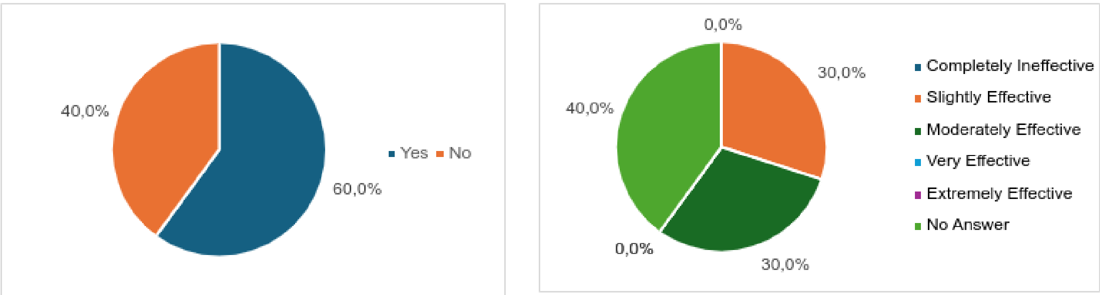


***Note: Geospatial Data:** Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. **Earth Observation and Environmental Data**: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; **Meteorological and Climate Data:** Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; **Statistics:** Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. **Companies and Company Ownership Data:** Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. **Mobility Data**: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

The use of geospatial data, earth observation, statistics and mobility data stands out, services that by their very definition have already integrated the use of public open data platforms for their operation and decision-making.

Question 3 (Baseline): Are currently data management solutions in place to support the management of urban safety?

Figure 53 – UC8 – Q3 "Are currently data management solutions in place to support the management of urban safety? – If yes, the solution currently in use is:"



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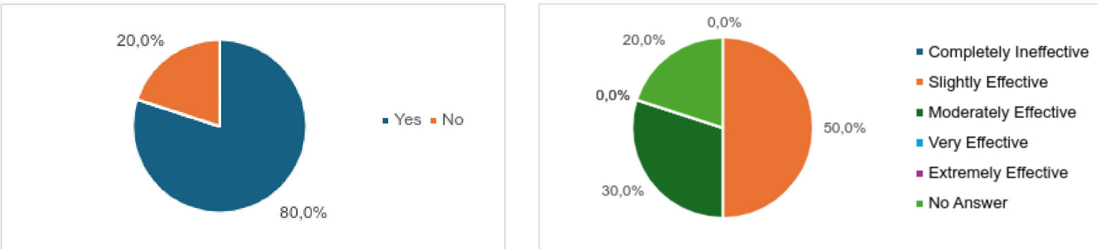
__Completely Ineffective__ (No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)
__Slightly Effective__ (Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)
__Moderately Effective__ (Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)
__Very Effective__ (Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)
__Extremely Effective__ (Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)

56% of respondents reported using a data management solution for monitoring the use of LED lightning.

Of the solutions in place, the majority of the respondents didn't answer the effectiveness. 22% considered it slightly effective and 33% moderately effective. This suggests that existing systems provide some benefit, but there is room for improvement, particularly in prediction accuracy, coordination, and resource allocation.

Question 4 (Baseline): Are there HVDs in use to manage the access to city centres and to manage security and critical assets? (conditional question)

Figure 54 – UC8 – Q4 "Are there HVDs in use to manage the access to city centres and to manage security and critical assets?"



__Completely Ineffective__ (No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)

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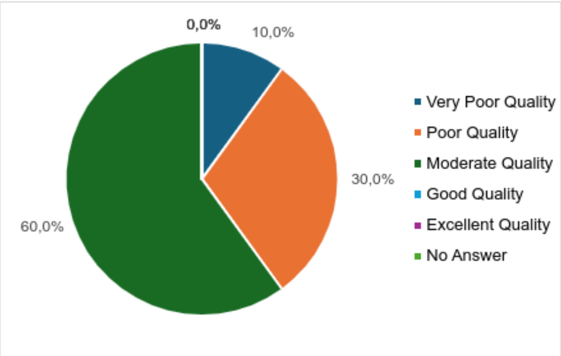
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

80% of respondents confirmed that high-value datasets (HVDs) are already used to support the management, decision-making, and mitigation efforts related to city center security in Torre Pacheco. From this, 50% perceive it as slightly effective and 30% as moderate effective.

Question 5 (Baseline): How would you rate the data quality in the Torre Pacheco use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

Figure 55 – UC8 – Q5 "How would you rate the data quality in the Torre Pacheco use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"



Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

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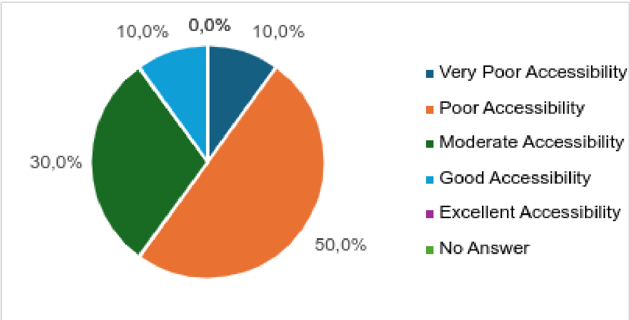
30% of the respondents rated data quality as poor, 60% as moderate and 10% as very poor. The relatively low-quality rating (with half of respondents indicating poor quality) suggests issues with the accuracy, timeliness, and curation of data before the BeOpen framework was implemented.

Question 6 (Baseline): How would you rate the data accessibility in the Torre Pacheco use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

Figure 56 – UC8 – Q6 "How would you rate the data accessibility in the Torre Pacheco use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Also, 30% of respondents indicated that data is moderately accessible, and 50% as poorly accessible, meaning data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges and only 10% rated this parameter as good.

Question 7 (Baseline): How many datasets were available to support the management of access, security, safety and asset protection in city centres?

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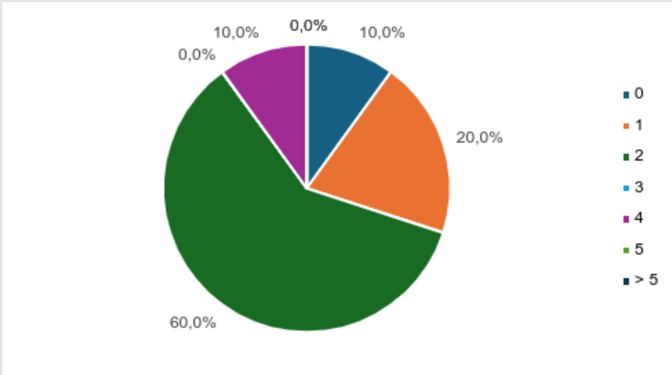
Figure 57 – UC8 – Q7 "How many datasets were available to support the management of access, security, safety and asset protection in city centres?"

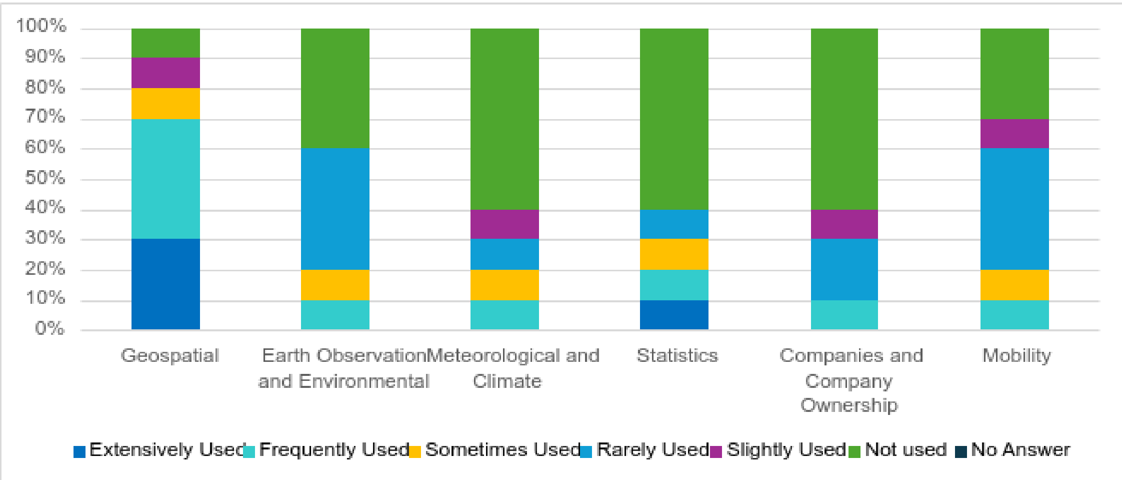


Regarding data available before the BeOpen framework implementation, 60% of respondents had 2 datasets, 20% had 1 dataset, and 10% had 4 datasets. The divergence of responses suggests that data is available and used by certain stakeholders, but access and knowledge of such datasets are unevenly distributed. This confirms communication among stakeholders has room for improvement.

USE CASE 9: SUSTAINABLE INTRODUCTION OF LED LIGHTNING AND ITS IMPACT ON HEALTH

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?

Figure 58 – UC9 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?"

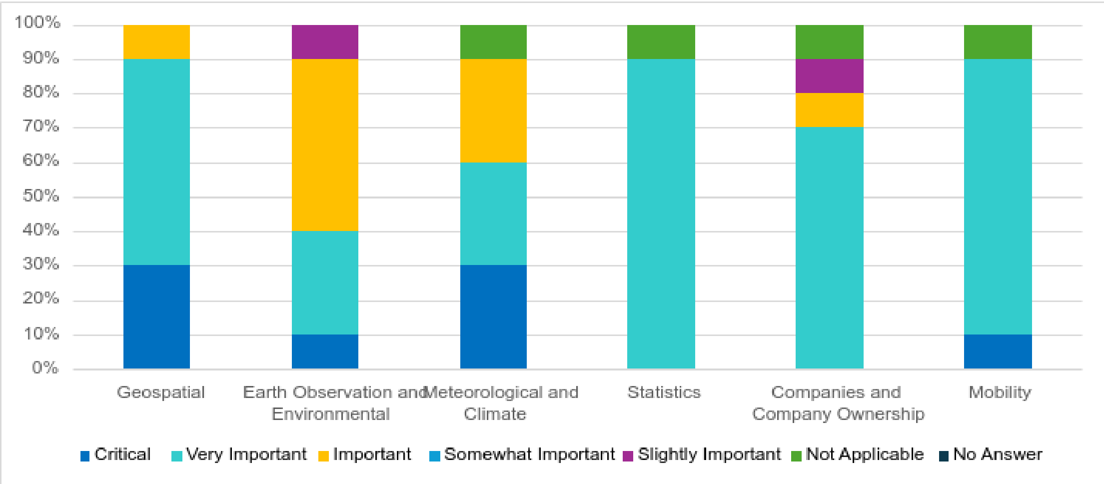


Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves* *weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

In this use case, it becomes apparent that the use of HVD is under-implemented. The use of geospatial data was one of the highest percentages, with 30% frequently used and extensively used. In the rest of the areas, it stands out for being very little used or being unknown, both its scope and its applications.

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

Figure 59 – UC9 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

The use of HVD in statistics and mobility stands out above all categories, obtaining 85.714% in statistics and 71.429% in mobility, considering the use of HVD very important and critical.

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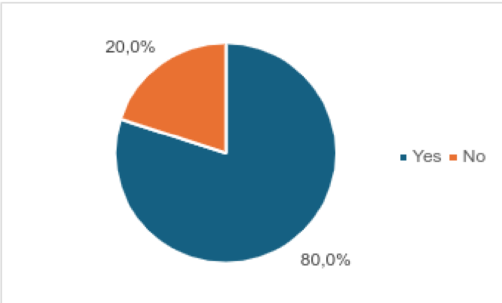
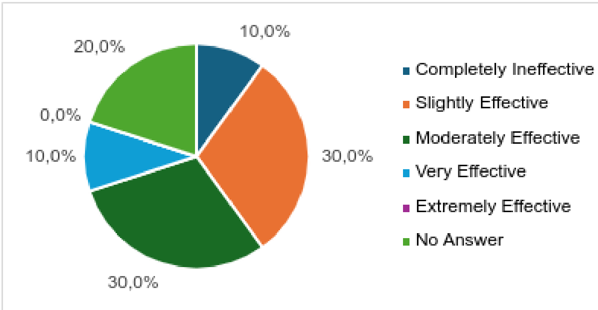
Question 3 (Baseline): Are currently data management solutions in place to monitor the use of LED lighting in the City of Torre Pacheco and its impacts on energy efficiency, public safety and security and on the health of citizens?

Figure 60 – UC9 – Q3 "Are currently data management solutions in place to monitor the use of LED lighting in the City of Torre Pacheco and its impacts on energy efficiency, public safety and security and on the health of citizens? If yes, the solution currently in use is:"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

80% of respondents reported using a data management solution for monitoring the use of LED lightning. Of the solutions in place, the majority were considered slightly effective (30%) or moderately effective (30%). Only 10% indicated it as very effective and another 10% as completely ineffective. This suggests that existing systems provide some benefit, but there is room for improvement, particularly in prediction accuracy, coordination, and resource allocation.

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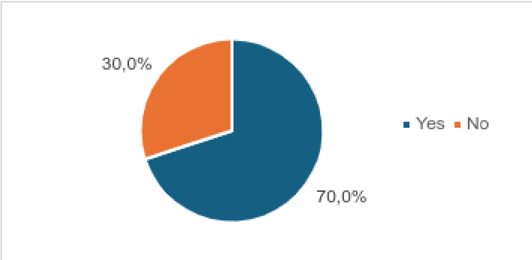
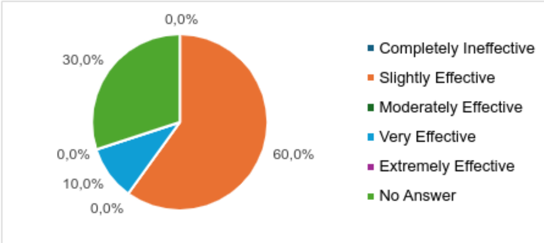
Question 4 (Baseline): Are there HVDs in use to monitor the use of LED lighting in the City of Terro Pacheco and its impacts on energy efficiency, public safety and security and on the health of citizens? (conditional question)

Figure 61 – UC9 – Q4 "Are there HVDs in use to monitor the use of LED lighting in the City of Torre Pacheco and its impacts on energy efficiency, public safety and security and on the health of citizens?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

70% of respondents confirmed that high-value datasets (HVDs) are already used to support the management, decision-making, and mitigation efforts. Nevertheless, perceptions related 60% to the effectiveness of HVD usage to monitoring LED installation is slightly effective.

Question 5 (Baseline): How would you rate the data quality in the Torre Pacheco use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

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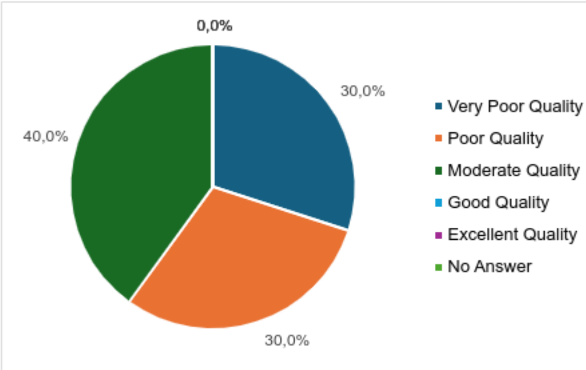
Figure 62 – UC9 – Q5 "How would you rate the data quality in the Torre Pacheco use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"

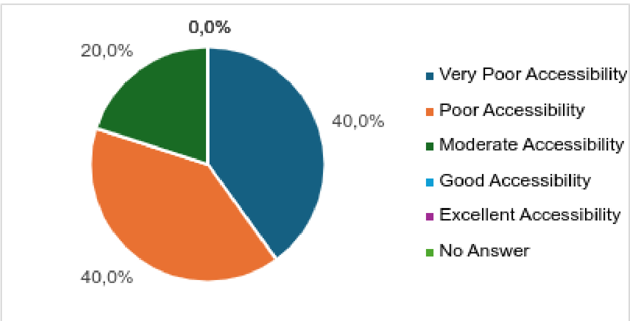


Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

30% of the respondents rated data quality as poor, 40% as moderate and 30% as very poor. The relatively low-quality rating (with half of respondents indicating poor quality) suggests issues with the accuracy, timeliness, and curation of data before the BeOpen framework was implemented.

Question 6 (Baseline): How would you rate the data accessibility in the Torre Pacheco use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

Figure 63 – UC9 – Q6 "How would you rate the data accessibility in the Torre Pacheco use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



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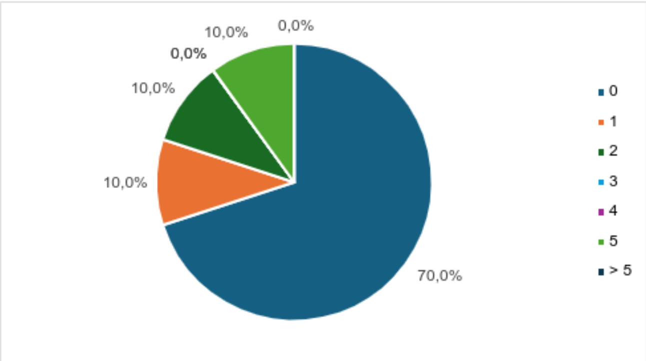
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

43% of respondents indicated that data is poorly accessible, meaning data is somewhat accessible, but may require some effort, and 43% indicated that data is very poorly accessible.

Question 7 (Baseline): How many datasets were available to support the monitoring of the use of LED lighting in the City of Torre Pacheco and its impacts on energy efficiency, public safety and security and on the health of citizens?

Figure 64 – UC9 – Q7 "How many datasets were available to support the monitoring of the use of LED lighting in the City of Torre Pacheco and its impacts on energy efficiency, public safety and security and on the health of citizens?"



70% of respondents indicated that data was not available, 10% indicated only 1 dataset was available, as in the case of 2 datasets. Only 10% reported to have access to 5 datasets.

UC10: CLIMATE CHANGE MITIGATION ACTIONS. URBAN HEAT ISLANDS AND HEATWAVES

Question 1 (Baseline): To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?

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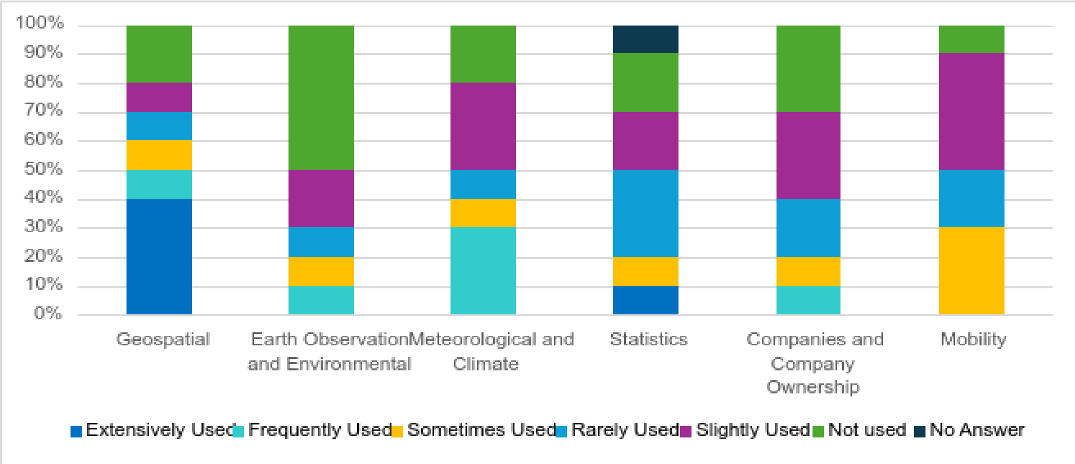
Figure 65 – UC10 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations previous to the BeOpen project experience?"



***Note: Geospatial Data:** Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. **Earth Observation and Environmental Data**: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; **Meteorological and Climate Data:** Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; **Statistics:** Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. **Companies and Company Ownership Data:** Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. **Mobility Data**: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Following the variety of answers regarding the use of data prior to the Be Open project for monitoring urban heat and climate issues in the city of Torre Pacheco, it is important to note that more effort is needed to make more extensive use of HVD after the Be Open framework.

Question 2 (Baseline): How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?

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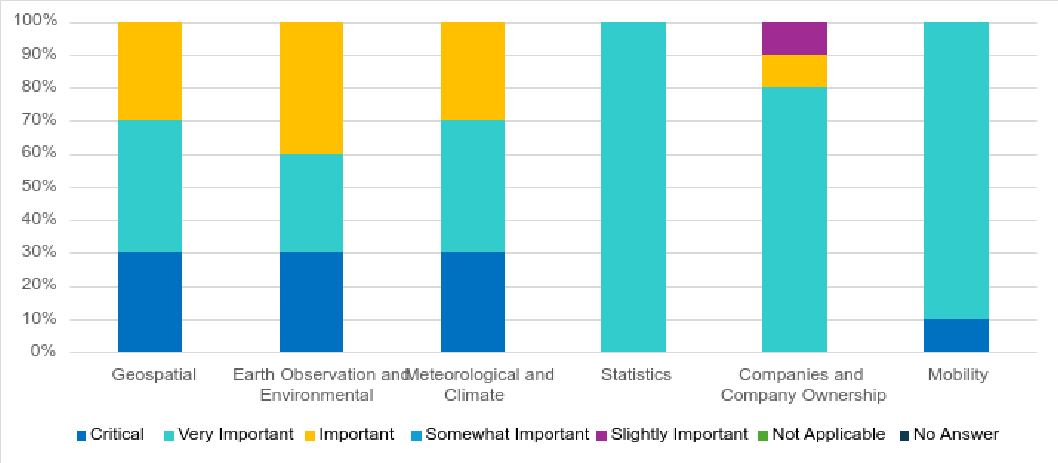
Figure 66 – UC10 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Regarding the perception of criticality of HVD for smart managing a city, most of the respondents indicated Geospatial Data, Earth Observation and Environmental Data, Meteorological and Climate and Mobility as critical or very important thematic to be considered. 100% of respondents indicated that statistics are **very important** for smart city management. 85% indicated that mobility is very important.

Question 3 (Baseline): Are currently digital services in place to monitor urban heat and climate issues in the city of Torre Pacheco, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

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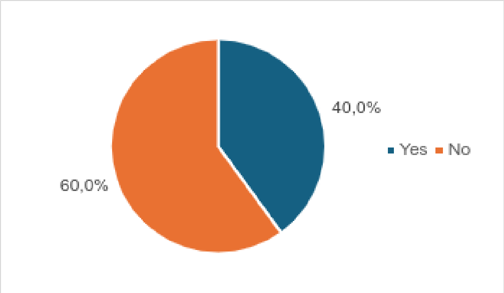
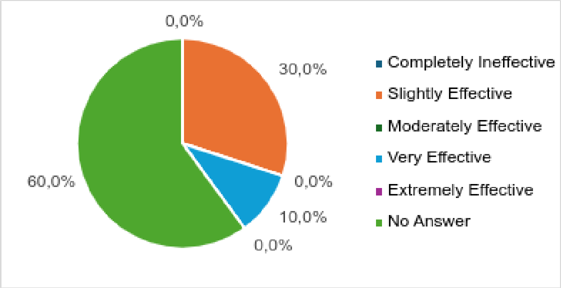
Figure 67 – UC10 – Q3 "Are current digital services in place to monitor urban heat and climate issues in the city of Torre Pacheco, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens? If yes, the solution currently in use is:





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Only 40% of respondents reported using a data management solution for monitoring urban heat and climate issues. This means less than half of the respondents know about and use the solution in place, perceiving it as slightly effective 10% and very effective 10%. This suggests that existing systems provide little benefit, or that only some respondents may use it effectively. There is room for improvement, particularly in making the digital services improved by the BE Open framework available to the stakeholders for monitoring urban heat and climate issues.

Question 4 (Baseline): Are there HVDs in use to monitor urban heat and climate issues in the city of Torre Pacheco, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

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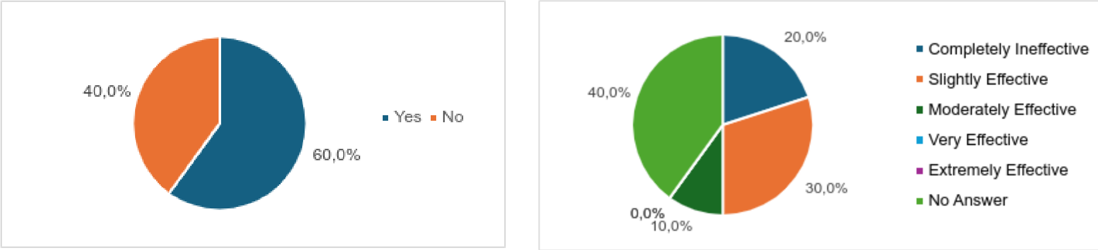
Figure 58 – UC10 – Q4 "Are there HVDs in use to monitor urban heat and climate issues in the city of Torre Pacheco, to evaluate mitigation and adaptation options and to prioritize the relevant lines of action for safety and security and on the health of citizens?"



Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Here, 60% of respondents confirmed that high-value datasets (HVDs) are already used to support the management, decision-making, and mitigation efforts related to monitoring urban heat and climate issues in the city of Torre Pacheco. Within these responses, only 20% rate the effectiveness of HVD usage as moderate, while the rest perceive it as ineffective or slightly effective. This indicates that there is room for improvement in the effectiveness of the HVD used, and on the knowledge and usage of the HVD.

As a reminder prior to BeOpen, Torre Pacheco has a moderate number of datasets available for monitoring urban heat and climate issues, mainly from the sensors previously installed.

Question 5 (Baseline): How would you rate the data quality in the Torre Pacheco use case before the BeOpen framework implementation, considering aspects such as

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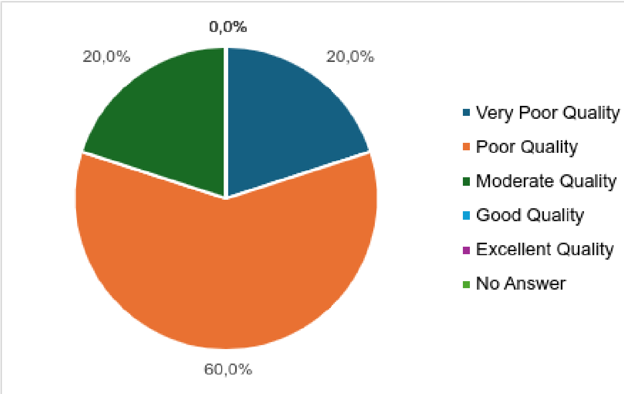
accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?

Figure 69 – UC10 – Q5 "How would you rate the data quality in the Torre Pacheco use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"

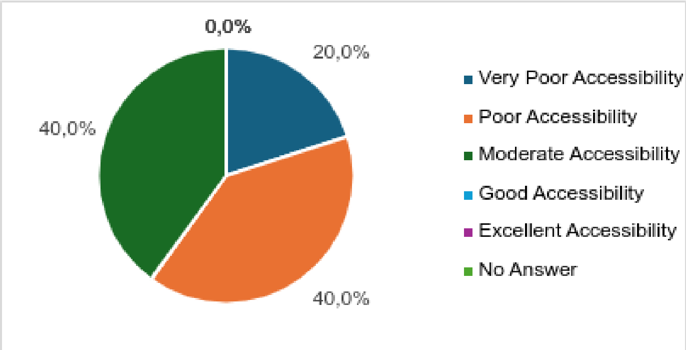


Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

60% of the respondents rated data quality as poor, 20% as very poor, and only 20% indicated it as moderate. The important low-quality rating (with the majority of respondents indicating poor quality) suggests important issues with the accuracy, timeliness, and curation of data before the BeOpen framework was implemented.

Question 6 (Baseline): How would you rate the data accessibility in the Torre Pacheco use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?

Figure 70 – UC10 – Q6 "How would you rate the data accessibility in the Torre Pacheco use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

40% of respondents indicated that data is poorly accessible, and 20% as very poor, this is something to work on as it presents important technical and interoperable challenges to work on. At the same time, another 40% of the respondents indicated that data is moderately accessible, meaning data is somewhat accessible, but may require some effort.

Question 7 (Baseline): Prior to the BeOpen implementation, how many datasets were available to monitor urban heat and climate issues in the city of Torre Pacheco, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?

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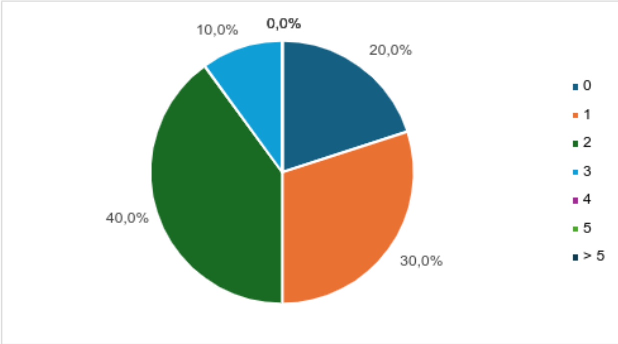
Figure 71 – UC10 – Q7 "Prior to the BeOpen implementation, how many datasets were available to monitor urban heat and climate issues in the city of Torre Pacheco, to evaluate mitigation and adaptation options and to prioritise the relevant lines of action for safety and security and on the health of citizens?"



Regarding data available before the BeOpen framework implementation, 40% of respondents had 2 datasets, 30% had 1 dataset, 10% had 3 datasets, and another 20% had none. The divergence of responses suggests that data is available and used by certain stakeholders, but access and knowledge of such datasets are unevenly distributed. This confirms communication among stakeholders has room for improvement.

CONCLUSIONS

From the conclusions of the results obtained in the surveys in the different use cases of the Pilot of the municipality of Torre Pacheco we can say that there are specific services such as urban planning, urban security and statistics that regularly use datasets in the development of tasks and projects, using the High Value Datasets (HVDs) for very limited aspects. Even so, the lack of specific training and professionals specialized in the interpretation of results stands out. Ignorance means that the great potential that can be obtained for the improvement of decision-making, the transformation of the territory and the health of citizens is undervalued.

There is also a large percentage of responses that indicate a great lack of knowledge both in the field of High Value Datasets (HVDs) and in the management, application of them and how this area can be integrated into their different services as well as in their planning and the improvement of decision-making.

In the case of the use of Urban Security, it is the case where the use of datasets by stakeholders is most integrated, for certain tasks and services. Its use is quite frequent, it is integrated at a high level, but with very limited scope.

We found that the use case of LED lights and their impact on health is the case in which High Value Datasets (HVDs) are least frequently used for planning and decision-making. It also highlights the wide lack of knowledge both in its use and in its potential.

Heat Islands is a use case that presents a problem that is currently being evidenced, and that High Value Datasets (HVDs) have not yet begun to be used as a tool to support decision-making and the realization of projects to combat heat islands.

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3.4.4. Synthesis

As a synthesis of the BeOpen project in the Municipality of Torre Pacheco, it is necessary to highlight the turning point in the decision-making methodology based on High Value Datasets (HVDs), so that the municipality can evolve in its different departments, make a much more optimized management and with an optimal cost-benefit ratio based on high-value datasets. BeOpen provides a holistic vision in the different pilots developed, highlights the importance of integrating datasets in municipal management and decision-making, obtaining real-time monitoring of the evolution of the territory and municipal management, which allows at the same time to offer real transparency to the citizen, based on solid information.

Torre Pacheco's digital strategy is at a basic level of maturity, although it highlights that it has a very solid base infrastructure, which allows it to grow, evolve and integrate digital management and data-based decision-making in the different services and stakeholders, thus evolving the Smart Cities platform and integrating it as part of the different services.

The lack of knowledge, the lack of professionals and the lack of specific training in the management, interpretation and use of open datasets is one of the main gaps that the municipality encounters. At the same time, BeOpen offers great potential for the development and enhancement of the project, as well as its infinite and future applications for better management of the territory and municipal resources.

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3.5. Herne

3.5.1. Overview of use case

The city of Herne is a very densely populated city in Germany. It is in the central Ruhr area, a metropolitan region with around 5 million inhabitants.

Two use cases are being implemented in Herne. Use Case 11 deals with the digital, automated recording of road damage, Use Case 12 deals with crowd management at major events.

USE CASE 11 - AI-TOOLS FOR STREET MANAGEMENT INVESTMENTS

The road network in the city of Herne covers several hundred kilometers and is usually the largest asset of a municipality. At the same time, the expansion and repair of the road network costs enormous sums. The aim of reducing these costs and making maintenance and repair more sustainable is hampered by the following problems:

1) Poor information on road conditions
2) Incompatibility of datasets
3) Missing interfaces between systems involved

In this use case, the recording of road damages is automated and standardized so that this data can be transferred to the existing urban special applications for analysis and processing via newly created interfaces along with other important data. The aim is to make road management significantly more effective and sustainable.

USE CASE 12 - MANAGEMENT OF LARGE-SCALE EVENTS AND CIVIL PROTECTION

The so called “Cranger Kirmes” is a large fair that takes place every year in August. It attracts around 4 million visitors in 10 days.

The fair takes place in the middle of the city on public streets and squares. This means that the paths and areas on the fairgrounds are very narrow and there are no designated entrances and exits through which the flow of visitors can be controlled.

Particularly dangerous situations are large traffic jams through the city, right up to the highway and mass panic on the fairground due to overcrowding.

The aim of the use case is to identify these situations more quickly than before and to initiate appropriate countermeasures. In the best case, these situations can even be identified before they arise and thus avoided completely.

3.5.2. Use case rationale: Digital service, HVD and intended impact

USE CASE 11 - AI-TOOLS FOR STREET MANAGEMENT INVESTMENTS

As part of a development partnership with an external technology company, edge devices were developed that are attached to the city's garbage trucks to continuously detect road damage using AI. This means that information on the condition of the roads is available in a comprehensive, continuous, uniform and objectively evaluated manner.

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A new databroker transfers this data to the cities data platform and performs a model mapping in order to ensure interoperability with other datasets that are available in the data platform and which can influence the development of road conditions. In order to further increase data quality, availability and interoperability, the datasets are further processed using the BeOpen framework and then passed on to the city's special applications as high-value datasets using the data broker.

In these applications, the data can be merged and analyzed to better understand relationships, implement construction projects more sustainably, or better plan budgets for future investments.

USE CASE 12 - MANAGEMENT OF LARGE-SCALE EVENTS AND CIVIL PROTECTION

In order to be able to properly assess the situation at the fair, important factors must be recorded in real time and effectively visualized. For this purpose, Sensrik was installed, which records the following parameters and transfers them to the city's data platform:

1) Parking space occupancy
2) Road traffic on the main access road
3) People density at hotspots on the fairground

These datasets are visualized in dashboards. In order to increase reaction times and identify dangerous situations even more quickly, the dashboard is supplemented with a forecast.

For forecasting, an ML model must be trained with suitable historical data. This data must be of particularly high quality. For this purpose, the data from previous events and other datasets that have an impact on the number of visitors are transferred to the BeOpen framework. After processing in the BeOpen framework, the datasets are used as high-value datasets with guaranteed quality, interoperability and availability as training data for an ML model.

After training, the forecast is continuously recalculated based on the current situation and integrated into the dashboard. This makes it possible to estimate how long it will take until limit values are reached.

3.5.3. Baseline assessment

3.5.3.1. Rationale

The baseline assessment acts as a starting point to understand the Herne pilots' previous intervention status as well as the needs and expectations of stakeholders. It forms the basis on which the project goals can be adapted to the real challenges in city administration and decision-making in Herne. This particularly affects the Herner Fair and the recording of road conditions. It also enables us to measure progress and determine our success indicators (KPI).

An overview of data collection activities can be found in the following table.

▪ Table 26 – Baseline assessment: data collection activities description.

Activity	Description	Type of info / means of verification
Surveys	Development of surveys	Surveys (qualitative/quantitative info)
Internal analysis of BeOpen metrics	Analysis of quantitative information to help measure KPI	Quantitative information

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Meetings with the Stakeholders	Meetings with users and technical partners	Project steps

3.5.3.2. KPI selected

An overview of the selected KPIs can be found in the table below.

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Table 27 – UC11 – Herne Pilot – Key Performance Indicators.

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
KPI_HERN11_1	To what extent the quality of data has been improved to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Degree of data accuracy, completeness, and reliability improvements in integrating road infrastructure and related HVDs for better maintenance and investment planning	BeOpen metrics Interviews	Degree of data accuracy and reliability achieved with BeOpen Framework with respect to the current solution in place.
KPI_HERN11_2	To what extent the HVDs are better integrated and accessible to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Extent of HVD integration and accessibility improvements for supporting visual monitoring and cross-departmental data access	Survey/Interviews	Perceived state of public services affected by HVDs before and after the adoption of BeOpen Framework
KPI_HERN11_3	Have new HVDs been made available to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	# of new HVDs introduced and utilized for road infrastructure visual monitoring and planning purposes	BeOpen metrics	# of new HVDs made available
KPI_HERN11_4	To what extent are HVDs reusable to integrate the visual of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Ratio of HVDs that are reusable across different municipal applications compared to baseline usability	BeOpen metrics	Ratio of HVDs that are reusable compared to the baseline
KPI_HERN11_5	Is there the potential for additional services being developed beyond the end of the BeOpen project to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Perceived likelihood of new services development after the project	The consortium's exploitation report	Perceived likelihood of further services being developed.
KPI_HERN11_6 KPI_HERN11_7	Was BeOpen worth the invested time and effort designing, developing, and implementing solutions to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities	Perceived balance of costs versus benefits for implementing new solutions through BeOpen	CBA Survey/Interviews	Perceived costs and benefits of use case

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# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
	providers to optimize maintenance and investments?			
KPI_HERN11_8 KPI_HERN11_9	Will BeOpen Framework use improvement of investment costs?	Reduction in investment costs achieved through the BeOpen Framework for road infrastructure and related planning	CBA Interviews	e.g.: saving public money by setting the best time for reconstruction – reducing investment costs up to 30% and at the end saving resources
KPI_HERN11_10 KPI_HERN11_11	To what extent can BeOpen contribute in improving traffic management by sharing traffic information and construction sites status?	Potential impact of shared traffic and construction data in improving traffic flow, based on stakeholders assessments and initial feedback	BeOpen metrics Interviews	reducing traffic up to 10% - reducing traffic pollution up to 10%
KPI_HERN11_12	To what extent is the granularity of BeOpen data sufficient for public services management processes to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Level of granularity in the improved data meeting the requirements for public services management.	BeOpen metrics	Observed level of data granularity for selected public services management processes
KPI_HERN11_13	To what extent can the BeOpen Framework be applied on a bigger scale to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Scalability of the BeOpen Framework to cover larger areas and more datasets	BeOpen metrics	Extended data product functionality
KPI_HERN11_14	Which are the current and planned HVDs that will be made available for public services management processes that use the AI-driven approach to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	# of HVDs planned or already made available for public services after the use of BeOpen Framework	BeOpen metrics	# of HVDs integrated by BeOpen Framework that use AI.
KPI_HERN11_15	To what extent is the existing technological infrastructure adequate for the development, deployment and maintenance of AI-based services to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities	Degree of adequacy of technological infrastructure for AI-based services.	Interviews	Degree of adequacy of existing technological infrastructure for AI-applications management processes.

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# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
	providers to optimize maintenance and investments?			
KPI_HERN11_16	Which is the degree of implementation of an AI-driven approach for the public services management processes to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Ratio of implementation and operationalization of AI-driven approaches in public service management	Interviews	Degree of development of the AI-driven approach for city security and mobility services.
KPI_HERN11_17 KPI_HERN11_18 KPI_HERN11_19	To what extent is the chosen AI-driven approach scalable and flexible to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Level of scalability and adaptability of the AI-driven approach to changing conditions and needs	Interviews	Degree of scalability (Likert scale) to cover larger areas of the pilot location. Degree of flexibility (Likert scale) to cover larger areas of the pilot location. be adaptable to changing urban conditions and needs of the use case
KPI_HERN11_20	To what extent is the AI-driven approach is cost effective to integrate the visual monitoring of Herne's Road infrastructure and the other HVDs on climate, material and planning of utilities providers to optimize maintenance and investments?	Ratio of cost savings achieved compared to traditional approaches	CBA	Degree of cost-effectiveness of AI-driven approach in the use case with respect to the current practices.

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CITY OF HERNE USE CASE 12

Table 28 – UC12 – Herne Pilot – Key Performance Indicators.

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
KPI_HERN12_1	To what extent the quality of data has been improved to track real-time data about the crowd participating in main city events to improve security in mobility?	Degree of improvement in data accuracy, timeliness, and reliability for real-time crowd monitoring	BeOpen metrics Interviews	Degree of data accuracy achieved with BeOpen Framework adoption with respect to the current solution in place.
KPI_HERN12_2	To what extent the quality of data has been improved to track real-time data about the crowd participating in main city events to improve security in mobility?	Degree of improvement in data accuracy, timeliness, and reliability for real-time crowd monitoring	BeOpen metrics Interviews	Degree of data reliability achieved with BeOpen Framework with respect to the current solution in place.
KPI_HERN12_3	To what extent the availability of HVDs has been improved to track real-time data about the crowd participating in main city events to improve security in mobility?	# of HVDs made available to enhance real-time crowd monitoring and mobility management	BeOpen metrics/Interview	# of HVDs made available to the public through BeOpen Framework.
KPI_HERN12_4	To what extent the availability of HVDs has been improved to track real-time data about the crowd participating in main city events to improve security in mobility?	# of HVDs made available to enhance real-time crowd monitoring and mobility management		% Percentage increase in the availability of high-value datasets through BeOpen Framework compared to the baseline.
KPI_HERN12_5	Have new HVDs been made available to track real-time data about the crowd participating in main city events to improve security in mobility?	# of newly introduced HVDs for crowd and event monitoring	BeOpen metrics	# of new HVDs made available
KPI_HERN12_6	To what extent have HVDs been made discoverable through European Union member states' open data portals to track real-time data about the crowd participating in main city events to improve security in mobility?	% of HVDs reused in different event monitoring or public service processes	External/internal data sources	Ratio of HVDs discoverable through European Union member states' open data portals versus datasets that are not discoverable

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# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
KPI_HERN12_7	To what extent have HVDs been made discoverable through the European Data Portal to track real-time data about the crowd participating in main city events to improve security in mobility?	% of HVDs reused in different event monitoring or public service processes	External/internal data sources	Ratio of HVDs discoverable through the European Data Portal versus datasets that are not discoverable
KPI_HERN12_8	To what extent are HVDs reusable to track real-time data about the crowd participating in main city events to improve security in mobility?	Ratio of HVDs reused across multiple processes for real-time crowd monitoring	BeOpen metrics	Ratio of HVDs that are reusable compared to the baseline
KPI_HERN12_9	To what extent has the BeOpen Framework increased the use of HVDs to track real-time data about the crowd participating in main city events to improve security in mobility?	Increase in the active use of HVDs for crowd and event monitoring	BeOpen metrics	Ratio of HVDs that are used by civil servants in their public services management activities after BeOpen compared to the current practices.
KPI_HERN12_10	To what extent has the BeOpen Framework increased the use of HVDs to track real-time data about the crowd participating in main city events to improve security in mobility?	Increase in the active use of HVDs for crowd and event monitoring		Ratio of HVDs that are used by policymakers in their policy decision-making processes after BeOpen compared to the current practices.
KPI_HERN12_11	To what extent has BeOpen been integrated with existing technical ecosystems to track real-time data about the crowd participating in main city events to improve security in mobility?	Degree of technical interoperability between BeOpen and existing systems	BeOpen metrics	Degree of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site.
KPI_HERN12_12	Is there the potential for additional services being developed beyond the end of the BeOpen project to track real-time data about the crowd participating in main city events to improve security in mobility?	Likelihood of new services being developed based on BeOpen contributions after the project	The consortium's exploitation report	Perceived likelihood of further services being developed.
KPI_HERN12_13	Is there the potential for additional services being developed beyond the end of the BeOpen project to track real-time data about the crowd participating in main city events to improve security in mobility?	Likelihood of new services being developed based on BeOpen contributions after the project		Assessment by the Advisory Board
KPI_HERN12_14	Was BeOpen worth the invested time and effort designing, developing, and implementing solutions to track real-time data about the crowd participating in main city events to improve security in mobility?	Perceived cost-effectiveness and benefits of BeOpen in improving event safety and mobility	CBA	Perceived costs and benefits of use case

# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
KPI_HERN12_15	Was BeOpen worth the invested time and effort designing, developing, and implementing solutions to track real-time data about the crowd participating in main city events to improve security in mobility?	Perceived cost-effectiveness and benefits of BeOpen in improving event safety and mobility.	Survey/Interviews	
KPI_HERN12_16	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to track real-time data about the crowd participating in main city events to improve security in mobility?	Frequency and extent of HVD usage by civil servants for event safety measures		# of times HVDs accessed.
KPI_HERN12_17	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to track real-time data about the crowd participating in main city events to improve security in mobility?	Frequency and extent of HVD usage by civil servants for event safety measures	BeOpen metrics	# of downloads per dataset.
KPI_HERN12_18	To what extent are HVDs made interoperable by the BeOpen Framework used by civil servants to track real-time data about the crowd participating in main city events to improve security in mobility?	Frequency and extent of HVD usage by civil servants for event safety measures		Perceived necessary HVDs for each use case.
KPI_HERN12_19	Under what conditions can the BeOpen Framework be reused in other public services management processes of the same local areas to track real-time data about the crowd participating in main city events to improve security in mobility?	Identification of replicability conditions (technical, governance, and resource requirements) for reuse in the same projects		Key characteristics of replicability scenarios
KPI_HERN12_20	Under what conditions can the BeOpen Framework be reused in other public services management processes of the same local areas to track real-time data about the crowd participating in main city events to improve security in mobility?	Identification of replicability conditions (technical, governance, and resource requirements) for reuse in the same projects	SWOT/Interviews	Perceived usefulness of replicability scenarios in terms of technical, financial, skills and governance requirements
KPI_HERN12_21	Under what conditions can the BeOpen framework be reused in the same public services management processes of other local areas to track real-time data about the crowd participating in main city events to improve security in mobility?	Condition for technical, financial and governance feasibility of reuse in the same project area		Key characteristics of replicability scenarios

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# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
KPI_HERN12_22	Under what conditions can the BeOpen framework be reused in the same public services management processes of other local areas to track real-time data about the crowd participating in main city events to improve security in mobility?	Condition for technical, financial and governance feasibility of reuse in the same project area		Perceived usefulness of replicability scenarios in terms of technical, financial, skills and governance requirements
KPI_HERN12_23	Under what conditions can the BeOpen framework be reused in other public services management processes of other local areas?	Condition for technical, financial and governance feasibility of reuse in other project areas	SWOT/Interviews	Key characteristics of replicability scenarios
KPI_HERN12_24	Under what conditions can the BeOpen framework be reused in other public services management processes of other local areas?	Condition for technical, financial and governance feasibility of reuse in other project areas		Perceived usefulness of replicability scenarios in terms of technical, financial, skills and governance requirements
KPI_HERN12_25	To what extent can the BeOpen Framework be applied on a bigger scale to track real-time data about the crowd participating in main city events to improve security in mobility?	Scalability of BeOpen's implementation to larger geographic areas or more complex events	BeOpen metrics	Extended data product functionality
KPI_HERN12_26	Which are the current and planned HVDs that will be made available for public services management processes that use the AI-driven approach to track real-time data about the crowd participating in main city events to improve security in mobility?	# of current and planned HVDs available for integration with AI systems.	BeOpen metrics	# of HVDs integrated by BeOpen Framework that use AI.
KPI_HERN12_27	Which are the current and planned HVDs that will be made available for public services management processes that use the AI-driven approach to track real-time data about the crowd participating in main city events to improve security in mobility?	# of current and planned HVDs available for integration with AI systems made available for the public		# of them that are open to the public.
KPI_HERN12_28	To what extent is the chosen AI-driven approach scalable and flexible to track real-time data about the crowd participating in main city events to improve security in mobility?	Degree of scalability and flexibility of the AI-driven approach for dynamic event monitoring	Interviews	Degree of scalability (Likert scale) to cover larger areas of the pilot location.

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# KPI	Evaluation question	KPI Indicator	SOURCE	METRICS
KPI_HERN12_29	To what extent is the chosen AI-driven approach scalable and flexible to track real-time data about the crowd participating in main city events to improve security in mobility?	Degree of scalability and flexibility of the AI-driven approach for dynamic event monitoring		Degree of flexibility (Likert scale) to cover larger areas of the pilot location.

3.5.3.3. Other data and physical measures

A part of the data from Use case 11 is used from a development partnership with an external technology company.

3.5.3.4. Stakeholder group

In both Herne use cases, important interest groups from the Herne city administration are involved, which are crucial for the road condition, the implementation of large-scale events and the digitalization of the city. This includes:

- ***The Civil Engineering and Transport Department with the Road and Engineering Department (Use case 11).*** This authority is responsible for monitoring the city's road network, their condition and maintenance. It also serves as a central point for external civil engineering inquiries relating to road space.
- ***The Public Order Department with the General Order Affairs Department (Use case 12).*** This authority is responsible for monitoring and carrying out municipal events in public spaces. Risk minimization, security concepts and compliance with legal requirements.
- ***The Digitalization Department with the Strategic IT Department and the Digitalization Department (Use case 11+12).*** This authority is responsible for the optimization and digitalization of internal processes, the data platforms as well as geodata management and the expansion of the digital service offering for its citizens.

3.5.3.5. Results of the survey

This section analyzes the results of the survey. 6 people answered for use case 11, and 5 people answered for use case 12. The following tables show which stakeholders from the different departments answered the survey for Use case 11 and Use Case 12.

Table 29 – UC11 – Respondents to baseline survey.

RESPONDANT	ORGANIZATION	ROLE	TYPE OF STAKEHOLDER
PERSON_HERNE_1	City of Herne Department of Roads / Civil Engineering	Team leader	Beneficiary / user
PERSON_HERNE_2	City of Herne Department of Roads / Civil Engineering	Project Manager	Beneficiary / user
PERSON_HERNE_3	City of Herne Department of Roads / Civil Engineering	Team	Beneficiary / user
PERSON_HERNE_4	City of Herne – Department of Digitization	Head of department	Beneficiary / user
PERSON_HERNE_5	City of Herne – Department of Digitization	Head of unit	Beneficiary / user
PERSON_HERNE_6	City of Herne – Department of Digitization	Staff Office	Beneficiary / user

Table 30 – UC12: Respondents to baseline survey.

RESPONDANT	ORGANIZATION	ROLE	TYPE OF STAKEHOLDER

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PERSON_HERNE_1	Municipal Public order office	Team leader	Beneficiary / user
PERSON_HERNE_2	City of Herne – Department of Digitization	Head of department	Beneficiary / user
PERSON_HERNE_3	City of Herne – Department of Digitization	Head of unit	Beneficiary / user
PERSON_HERNE_4	City of Herne – Department of Digitization	Staff Office	Beneficiary / user
PERSON_HERNE_5	City of Herne – Department of Digitization	Project Manager	Beneficiary / user

Although the sample may seem small at first glance, these people represent the key actors who are responsible for road maintenance in the city of Herne and the organization of the Herne fair. They are the main beneficiaries of the Herner pilots. All respondents are considered users and recipients of the data and services provided.

The aim of the survey was to obtain stakeholder opinions and gain valuable insights into the use of high-quality datasets (HVDs) for decision-making in road maintenance and risk minimization at the Herner Kirmes. This survey serves to assess the initial situation before implementing the BeOpen framework.

ASSESSMENT OF THE STAKEHOLDERS ON USE CASE 11

Current use of HVD

Over 57% of respondents indicate that all requested data categories (spatial data, earth observation and environmental data, meteorological and climate data, statistics, ownership and mobility data) were only slightly used before the experience with the BeOpen project.

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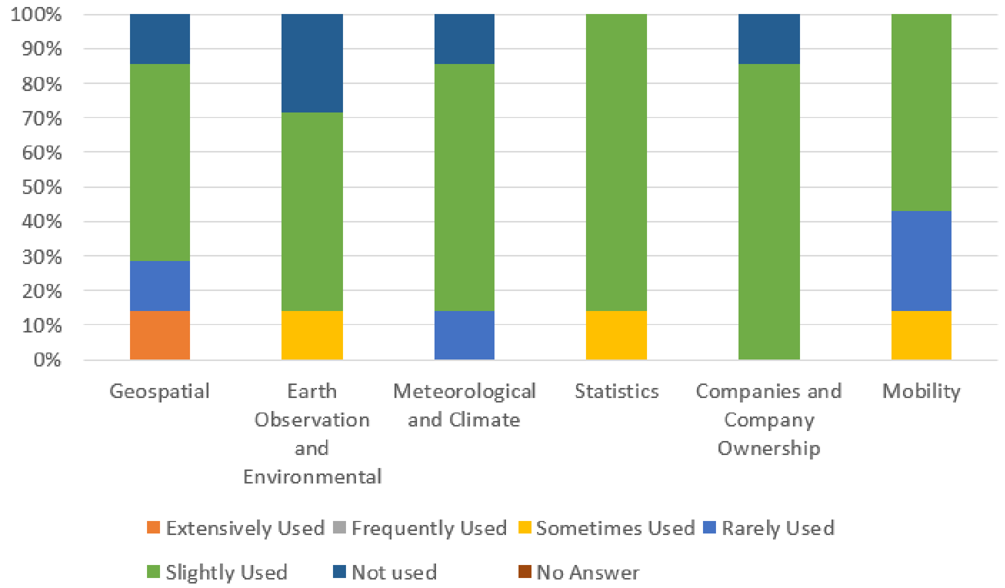
Figure 72 – UC11 – Q1: "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?".



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Relevance of HVD for Smart City Management

Respondents see differences between data categories when it comes to the importance of HVDs for effectively managing smart city functions and delivering smart services. They rate geospatial data and owner data as somewhat and marginally important, but they rate meteorological data, statistics and mobility data as higher, from important to very important.

Mobility data is the focus of road condition assessment. How frequently is the road used and what impact does this have on the condition of the road? The climate also has an impact on the lifespan of roads. How has the condition of the road developed over a certain period?

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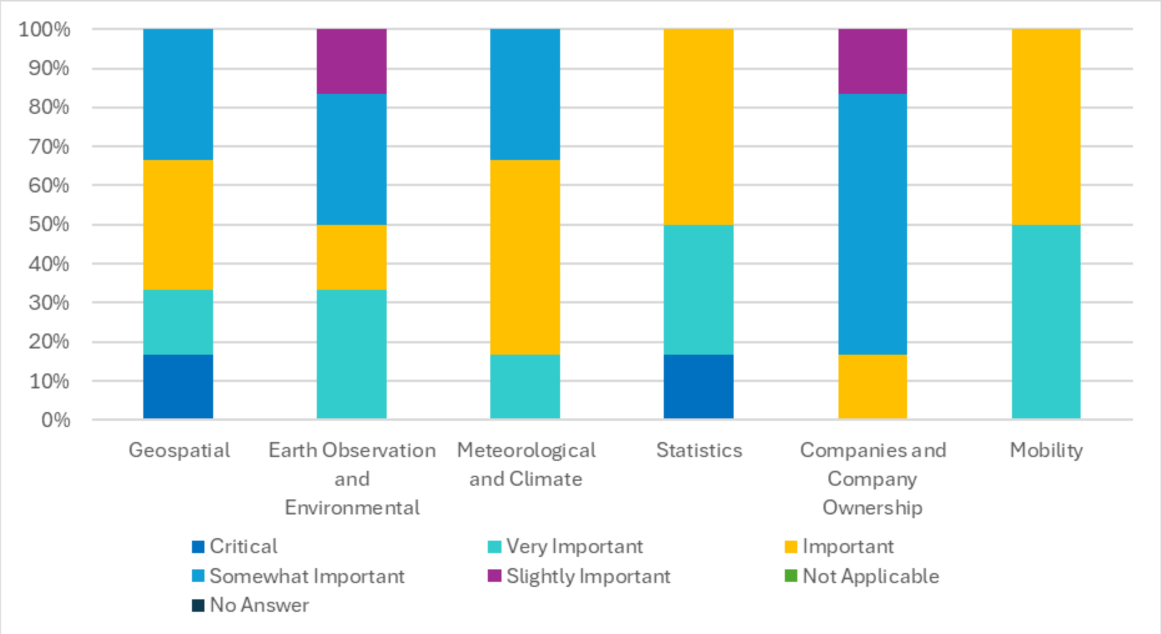
Figure 73 – UC11 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?".



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Data solutions in place and its effectiveness in road management

Respondents indicated that a data management solution for road condition assessment already exists. However, this solution was rated as moderately effective (71.43%). This shows that the existing system is helpful but still offers a lot of room for improvement.

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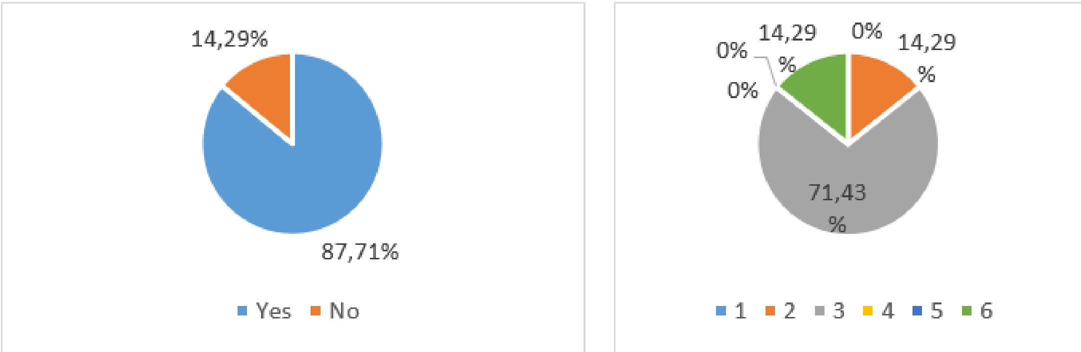
Figure 74 – UC11 – Q3 "Are there currently data management solutions to support management and decision-making regarding the maintenance and optimization of Herne road infrastructure? If yes, the solution currently used is".



***Completely Ineffective** (No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Slightly Effective** (Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Moderately Effective** (Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Very Effective** (Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
***Extremely Effective** (Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Data quality and accessibility

The data quality before the start of the BeOpen project was rated as moderate by 57.14% of those surveyed and poor by 42.86%. This relatively low, lower-middle quality rating shows that there is room for improvement when it comes to the accuracy, timeliness and curation of the source data.

The respondents also rated the accessibility of the data in the lower middle range, 42.86% moderate and 28.57% poor.

This shows that the stakeholders see the need. In particular, the timeliness of road condition data is an important point for action assessment.

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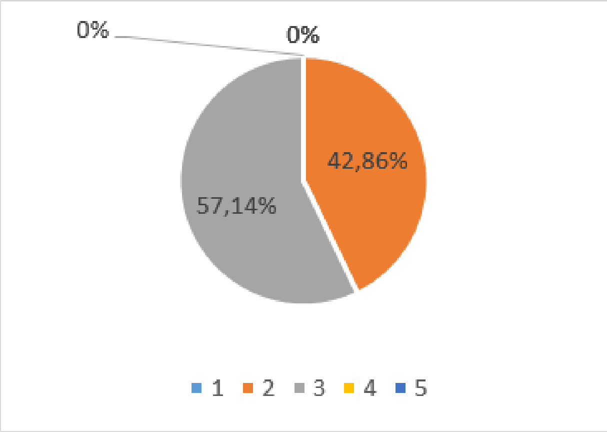
Figure 75 – UC11 – Q5 "How would you assess the data quality in the Herne use case before implementing the open framework, taking into account aspects such as accuracy, timeliness of updates, curation and appropriateness for supporting decision-making processes?"



Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*

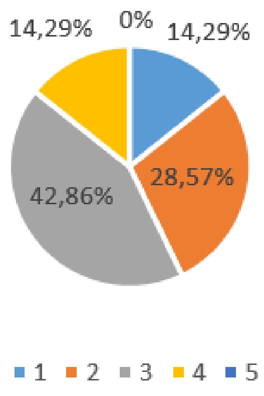
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*

Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*

Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*

Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Figure 76 – UC11 – Q6 "How would you assess the accessibility of the data in the Herne City use case, taking into account the qualitative aspects of retrieval, usability, technical interoperability and compatibility with existing decision-making support systems?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*

Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*

Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*

Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*

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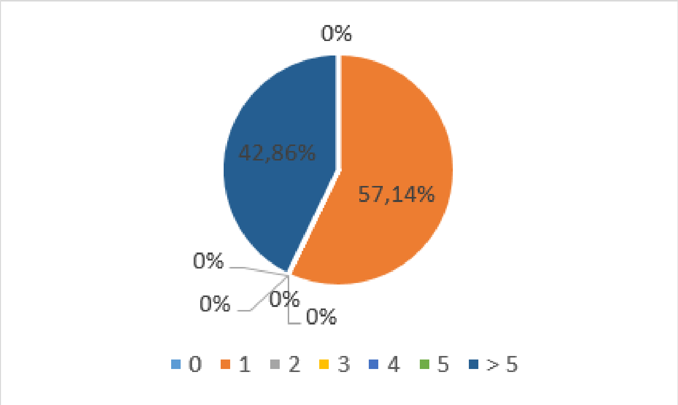
When assessing how many datasets were available before the start of the project, the answers vary greatly. 57.14% assumed one dataset and 42.86% assumed four datasets. This underlines the assumption that respondents vary in their level of knowledge about the data and datasets they use.

Figure 77 – UC11 – Q7 "How many datasets were available for general road infrastructure maintenance before the project began?"



ASSESSMENT OF THE STAKEHOLDERS ON USE CASE 12

The respondents' answers show that they do not use high value datasets (HVDs) in all categories. At least 50% each make minor use of statistical data, owner data and mobility data. Only in the geodata category was the answer given that HVDs are sometimes or rarely used.

This shows that the city of Herne does not have the necessary data for this area and that there is still great potential for improving the data. The different answers allow conclusions to be drawn about a non-uniform level of knowledge regarding the data.

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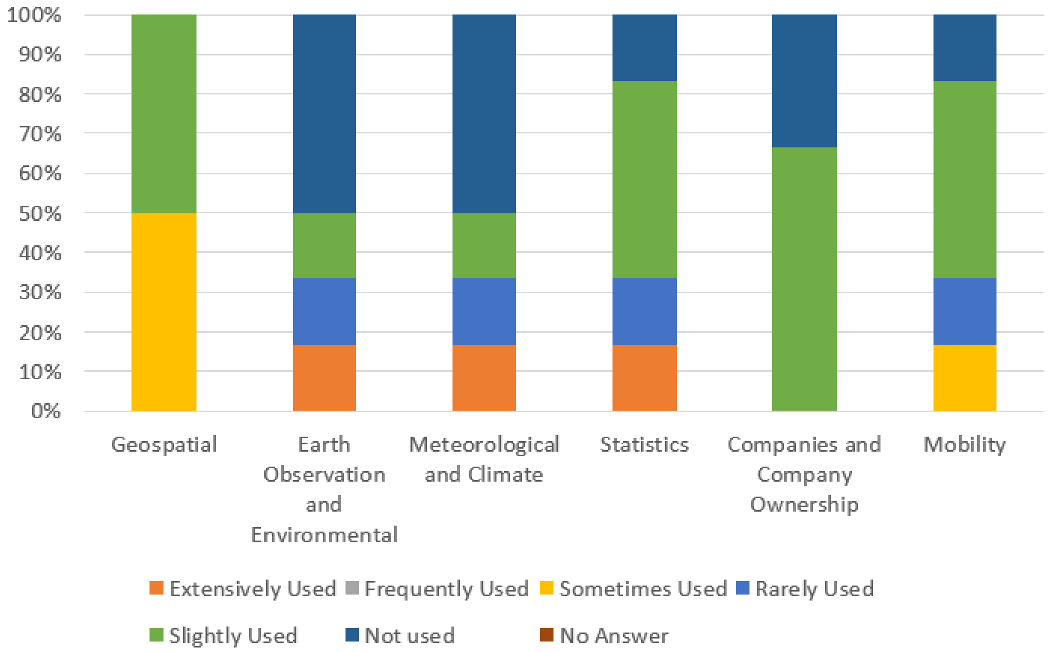
Current use of HVD

Figure 78 – UC12 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?"



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

When it comes to the importance of HVDs for effectively managing smart city functions and providing smart services, respondents rate the categories differently. Mobility data, statistical and meteorological data are rated more important with 50% sometimes and 50-16.76% often.

For the management of the fair, it is particularly important to measure the mobility data and the flow of visitors. Statistical considerations and climate data can also be included in the risk assessment.

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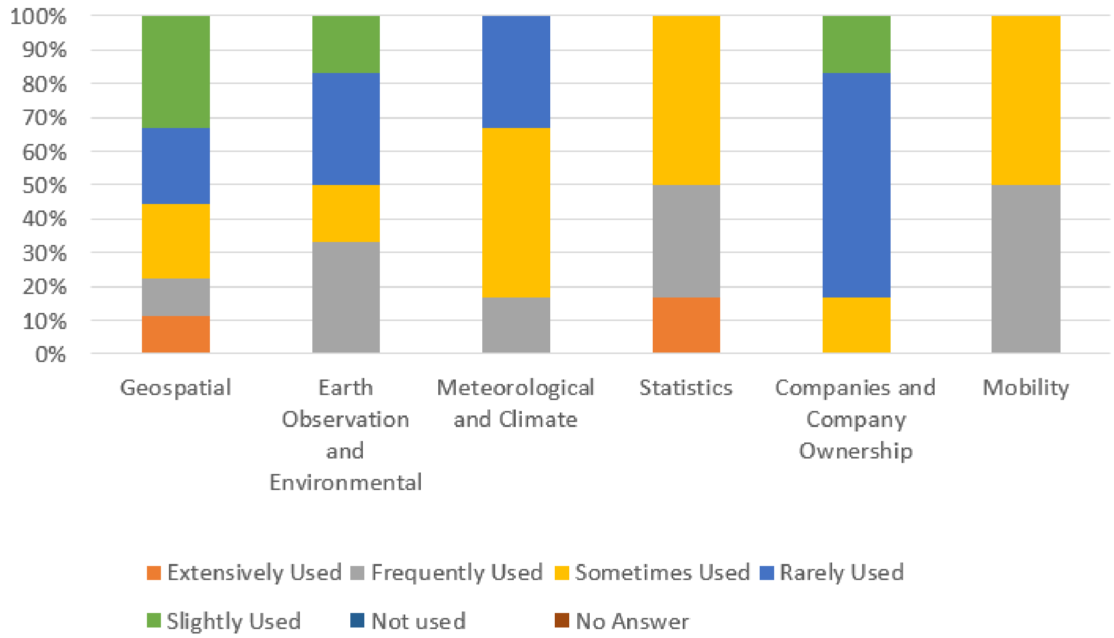
Figure 79 – UC12 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?".



***Note: Geospatial Data:** Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. **Earth Observation and Environmental Data**: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; **Meteorological and Climate Data:** Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; **Statistics:** Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. **Companies and Company Ownership Data:** Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. **Mobility Data**: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Data solutions in place and its effectiveness

Most respondents say that there are currently no data management solutions in Herne to support tracking, monitoring and management of crowds attending important city events to improve mobility safety. The individual opposite answer can be ignored because the initial situation appears to be different.

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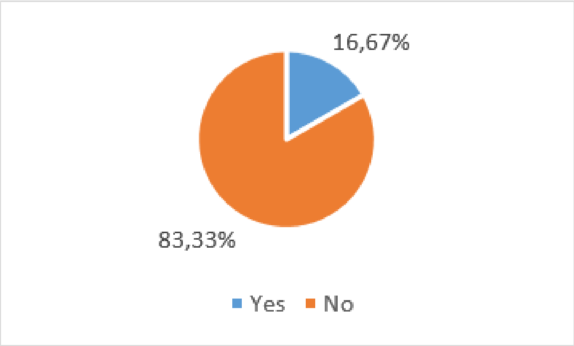
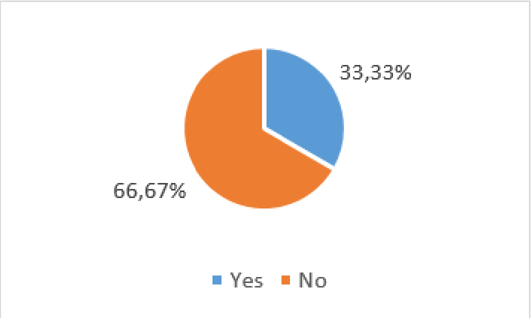
Figure 80 – UC12 – Q3 "Are there currently data management solutions to support tracking, monitoring and managing the crowds attending key city events to improve mobility safety? If so, the solution currently used is:

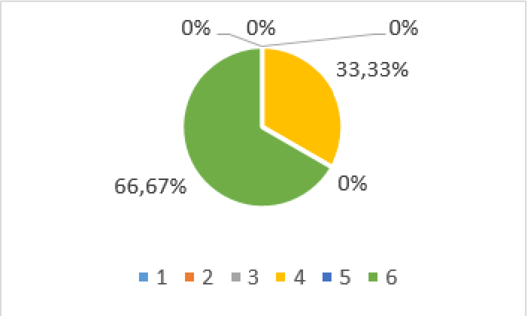


Data usage and effectiveness

When asked whether HVDs are currently being used to support tracking, monitoring and crowd management, 66.67% answered no, but 33.33% also answered yes. The yes answers also rate the available data as very effective. It appears that this data is only available to and can be used by certain stakeholders. Access to and knowledge of such datasets appears to be unevenly distributed.

Figure 81 – UC12 – Q4 "Are there HVDs to support tracking, monitoring and management of crowds attending major city events to improve mobility safety? How do you evaluate the contribution of these high-quality datasets (HVD) to the effectiveness of tracking, monitoring and managing the crowds participating in the most important city events to improve mobility safety?"





1. ***Completely Ineffective*** *(No impact on crowd tracking and management)*
2. ***Slightly Effective*** *(Minor impact on crowd tracking and management)*
3. ***Moderately Effective*** *(Moderate impact on crowd tracking and management)*
4. ***Very Effective*** *(Significant impact on crowd tracking and management)*
5. ***Extremely Effective*** *(Exceptional impact on crowd tracking and management)*
6. ***No Answer***

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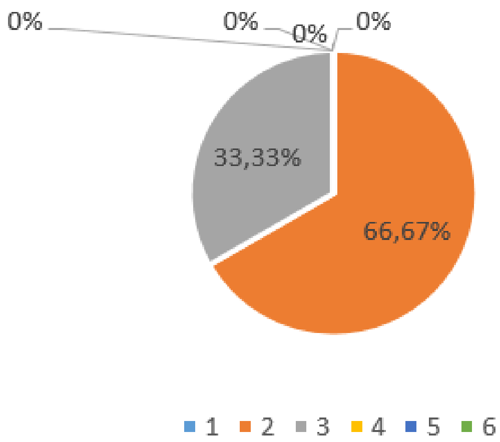
Data quality and accessibility

The majority rated the data quality as poor (66.67%) or moderate (33.33%). This relatively low, lower-middle quality rating shows that there is room for improvement when it comes to the accuracy, timeliness and curation of the source data.

The answers regarding data accessibility are similar. This reflects the fact that some of the respondents (16.67%) have good access to data, but 50% of respondents rate data accessibility as inadequate.

Figure 82 – UC12 – Q5 "How would you assess the data quality in the Herne use case before implementing the open framework, taking into account aspects such as accuracy, timeliness of updates, curation and appropriateness for supporting decision-making processes?"



1. No Improvement (Data quality remains very poor, with ongoing issues in accuracy, timeliness, curation, or appropriateness)

2. Slight Improvement (Minor improvements in one or more areas, but significant quality issues persist)
3. Moderate Improvement (Noticeable improvements in data accuracy, updates, or curation, but more work is needed)

4. Significant Improvement (Data quality has improved substantially, with few remaining issues in any area)
5. Complete Improvement (Data is now of excellent quality, accurate, timely, well-curated, and highly appropriate for decision-making)
6. No Answer

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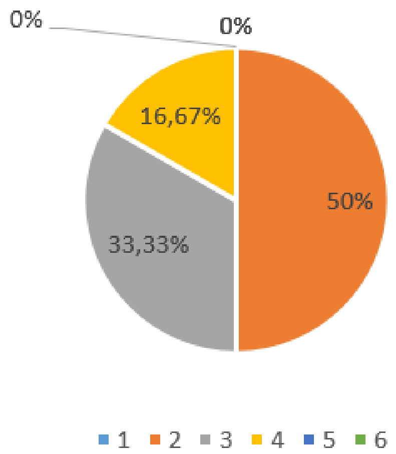
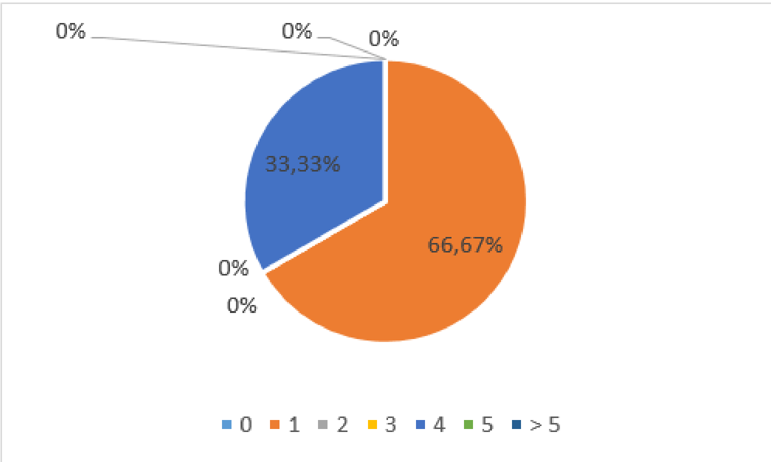
Figure 83 – UC12 – Q6 "How would you assess the accessibility of the data in the Herne City use case, taking into account the qualitative aspects of retrieval, usability, technical interoperability and compatibility with existing decision-making support systems?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*
Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*

Responses to the question about the number of datasets available for managing crowd tracking and security confirm that access to and knowledge of such datasets appears to be unevenly distributed. Over half of respondents only use one dataset, with 33.33% working with four datasets.

Figure 84 – UC12 – Q7 "How many datasets were available to manage crowd tracking and security?"



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3.5.4. Synthesis

The assessment of the initial situation by the stakeholders of the two projects shows that there is great potential for improvement and, above all, for improved accessibility of the data in the city of Herne. This is where the BeOpen framework can be of great help. Data-driven digital management with improved data and rapid accessibility of the required data can significantly simplify and accelerate decision-making.

For road condition recording, this means that current damage is immediately recognized, classified and displayed, allowing for a quick response. Visitor flows at the Herner Fair, measured in real time, can also improve risk assessment and shorten reaction times.

To measure impact, Herne will rely on a list of KPIs for each use case, aimed at analyzing the overall impact of the BeOpen project in terms of data usage, availability, accessibility and quality.

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3.6. Porto

3.6.1. Overview of use case

Porto BeOpen Pilot aims to support first responders and other emergency teams at the Porto Integrated Management Centre by strengthening emergency management and data-driven decision-making across the various phases of an incident (prevention, response, and recovery).

By leveraging the use of high-value datasets (HVDs), the Porto BeOpen Pilot seeks to enable more informed and timely decisions, improving the efficiency and effectiveness of responses.

The planned integration of real-time data into two digital services will provide a more comprehensive situational awareness, ensuring that critical resources are deployed where they are most needed. Ultimately, the use case aims to assess how quality data can enhance the operation of emergency services, optimizing forecast and response strategies and accelerating recovery efforts.

3.6.2. Use case rationale: digital service, HVD and intended impact

3.6.2.1. The challenge: pre-intervention situation in pilot site

As a starting point, it was essential to better assess the situation at the pilot site before implementing the BeOpen project framework, digital services, and pilot testing. Understanding the pre-intervention context was crucial, not only to scope the digital services to better meet stakeholders' needs but also to evaluate the expected impact of the BeOpen project.

To gain a clearer understanding of the pre-intervention situation and considering the proposed use case, Porto Digital identified key stakeholders—such as the Integrated Management Centre, Firefighters, Civil Protection, Municipal Police, and the Water Utility Municipal Company—and organized bilateral meetings in November 2023 and February 2024.

These meetings aimed to gather information on the specific needs and requirements for developing and refining the BeOpen Porto pilot. Led by Porto Digital’s Data & Systems Architecture team (technical) and Project Management team (management), the meetings were held both in-person and online.

From the information collected in project logs during these meetings, **several common issues were identified and categorized as challenges to be addressed by the pilot.** Based on these findings, a set of action points was proposed, including the development of specific digital services within the scope of the BeOpen project.

The scenario of issues to be tackled

Below, we describe the common threads of issues that constitute the status of pilot site before BeOpen project intervention:

i. **Dependency on data from external sources**

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As stakeholders have pointed out, meteorological monitoring and weather forecasting in Portugal are overseen by two organizations. The Portuguese Meteorological Agency (IPMA) oversees weather surveillance and issues weather warnings for various adverse meteorological conditions, including strong winds, heavy rainfall, snowfall, thunderstorms, cold spells, heatwaves, persistent fog, and sea disturbance. At the same time, the Portuguese Environment Agency (APA) manages the Water Resources Monitoring and Alert System (SVARH), a crucial support system for civil protection entities to safeguard people and property during flooding events. Unfortunately, both warning systems—those provided by IPMA and APA—offer data at a district scale, which limits the effectiveness of its usage inside city limits.

Thus, the challenges arising from reliance on external data sources, such as IPMA or APA, include:

1. **Time**: The lack of real-time data, or data that can be leveraged to proactively anticipate events and allocate resources in a timely manner.

2. **Space**: The limited granularity of the available data, which is typically provided at the district level and may not accurately reflect the situation at the municipality level.

To address this, it is vital to find new ways of obtaining and managing data on a municipal scale and ensure timely dissemination of information to enable effective decision-making. The initiative proposed to Porto municipal stakeholders is to obtain specific and quality data that can cross reliable geolocalisation and time factors and become useful for the anticipation of the necessary means.

We propose to leverage In-house data collection by taking advantage of the existing municipal sensing infrastructure.

ii. The decision making on each action is currently dominated by empirical knowledge

Due to the lack of real-time data, some stakeholders have reported that forecasting activities for extreme weather events currently rely on the empirical knowledge and field experience of emergency teams and first responders. While data is already being used by these teams, as confirmed by survey results, it is not real-time data. This reliance on expert knowledge reduces the effectiveness and efficiency of decision-making and resource allocation.

To address this challenge, our goal is to promote the use of HVD to support decision-making in resource management, complementing the empirical knowledge and experience of the teams. The expertise of the teams remains essential, as it provides valuable context to the "cold" datasets. This use case also seeks to identify areas with a higher likelihood of certain events, aiding in prevention and the development of more tailored response plans.

Data reuse is key to enabling innovative ways of ensuring the coordinated operation of the city, integrating both real-time and predictive information. As one of our stakeholders emphasized, "We must know exactly what is going to happen and where exactly it is going to happen."

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As a practical solution, we propose enhancing the processing, analysis, storage, and cataloging of HVD, which aligns with BeOpen's goals of integrating and ensuring the interoperability of HVDs for emergency and crisis management. Ultimately, consolidating the municipal catalog of HVD is a vital step in facilitating its reuse in the proposed pilot technological solutions for managing extreme weather events (both forecasting and response). We anticipate that the reuse of HVD in other projects and technological solutions will continue even after the project concludes.

iii. Extreme weather event forecast for a more resilient city

Unfortunately, in the face of climate change impacts, the primary action we can take is to alleviate the effects of extreme events, rather than prevent them or reduce their intensity. However, there are actions that can be implemented to strengthen a city's resilience to climate change and mitigate the potentially harmful impacts of these events.

Based on an analysis of the city's cartography, risk maps, and historical event data, we propose piloting a forecasting and georeferencing system for extreme weather events, specifically urban floods. This system will focus on heavy rainfall and flood events due to their frequency and significant impact on the city. It is important to note that not all heavy rainfall events lead to flooding, but most cause considerable disruptions, particularly to mobility, as agreed upon by our stakeholders.

Thus, the BeOpen solution for the Porto Pilot combines several elements, including artificial intelligence, predictive systems, and extensive use of HVD to enhance the response of public services in forecasting these events.

An important aspect of the pilot forecast system is its ability to cross-reference with the socioeconomic vulnerability map of the population. The overlap between areas most susceptible to floods and those that are socioeconomically vulnerable can provide valuable insights, aiding decision-making for the city's policymakers.

iv. Reinforcing communication related to event management

In the reaction phase of occurrence management, stakeholders have identified the importance of reinforcing communication, not only between emergency teams that are present on the Integrated Management Center, but also with the citizens.

At the Integrated Management Center level, the stakeholders have emphasized the importance of strengthening the efficiency of integrated management of means (both physical and human), preventing miscommunication issues and other subsequent challenges. The initiative is to continuously improve the teams' communication and articulation, preferably based on information that can be obtained, analyzed, and visualized in an instantaneous way. For that, real time information is key.

The enhancement of communication between emergency teams should be worked on in parallel with actions to improve communication with citizens. Based on our stakeholders' inputs during the bilateral meetings, the BeOpen pilot activities should also contribute to an equilibrium of the frequency of the alerts to the citizens, given that too many alerts may discredit first responders' action.

To help with these challenges, we propose the development of a single dashboard for the real time visualization of the emergency means.

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3.6.2.2. The prospected solution: digital services and HVDs

To provide an answer to the above identified challenges BePorto Pilot will be divided in two Digital Services:

1. ***Digital Service 1:* Forecast and georeferencing Machine Learning system for extreme weather events, specifically urban floods.** This Digital Service will be developed by Porto Digital, and it has the following main functions:

    - Cross data from past occurrences (flooding reports) provided by Porto firefighters (time that happened, weather conditions, specific location) with historical weather conditions data registered at parish level (granularity) by Porto Digital sensorial network, We will also include IPMA data - meteorological, seismic, and oceanographic service of Portugal – accessed by API, from where we intend to get forecast weather data for the next few days.

    - Based on this kind of input and after combining all sources, we want to set up a temporal series prediction model. This means that considering past events and all the information associated with that, the result we want to get is the probability of urban floods in the next few days (max 5 days) and where this can happen, with granularity focus on parishes and small zones, to be as specific as possible.

    Future data to integrate (until now): Rainwater system: We can get data from sensors that were set up in underground rivers and measure the level of water (in mm). When the rivers are full and the soil cannot absorb more water, the sensors issue warnings about possible urban floods. These sorts of sensors are provided by one of our stakeholders (Porto Water and Energy).

2. ***Digital Service 2: Dashboard for visualization of georeferenced emergence means.*** This system will be developed by Ubiwhere, and it has the following main functions:

    - Gather georeferenced location data from Porto firefighters' vehicles sensors and Porto Water and Energy – public entity responsible for distribution and supply of water to the population of the Porto area - vehicles sensors. This kind of information will give us georeferenced location in real time of these vehicles in the field.

    - The idea is to set up a single and shared dashboard where we will be able to visualize the emergency teams' vehicles in real time. This will help our stakeholders to be aware and have better management of their teams in the field, allocating and sending them to risk areas faster.

After engaging with all the stakeholders and understanding their perspectives on the project, the area of action for the pilot emerged as one of the main concerns. While the project will be applied to Porto city, there are areas where the risk of flooding is low, and stakeholders do not consider them necessary to monitor continuously.
In contrast, they identified two areas as particularly vulnerable to flooding. These include the Granja watershed (Eugénio de Castro, Serralves) and the Poço das Patas watershed (Rio Douro, Escarpa das Fontaínhas), which are of significant concern during unfavorable weather

conditions. These two areas should be considered the core of the project and monitored constantly.
In line with BeOpen's objectives, **the Porto Pilot Digital Services will reuse 11 datasets, including 3 High-Value Datasets (HVDs)**: Observed Meteorology from Porto Digital's sensory network, geolocation data for police and firefighters, and the Traffic Management System's CCTV footage. We hope that at the end of the project, some of the listed datasets can be opened, improved and become HVD.

Table 31 – Dataset selection for Porto Pilot Digital Services.

# Dataset	Dataset designation	Digital Service
DATASET_PORTO_1	Firefighters Occurrences	DS1/DS2
DATASET_PORTO_2	Observed Meteorology – Porto Digital sensory network	DS1/DS2
DATASET_PORTO_3	Drainage network sensing - LACROIX	DS1/DS2
DATASET_PORTO_4	Porto Water and Energy Floodings - TAGO	DS1/DS2
DATASET_PORTO_5	H2PORTO - NAVIA	DS1/DS2
DATASET_PORTO_6	Police and firefighters' geolocation buildings	DS2
DATASET_PORTO_7	Watersheds boundaries	DS2
DATASET_PORTO_8	Road way and street dimensions	DS2
DATASET_PORTO_9	Fire hydrants	DS2
DATASET_PORTO_10	Trees	DS2
DATASET_PORTO_11	Traffic Management System - CCTV	DS2

3.6.2.3. The result: expected outcomes

Considering the pre-intervention situation Porto Pilot is divided in a tripod that constitute, at the same time, its objectives and expected impact:

1. **FORECAST better**, using the occurrence log (parishes level is desired) and cross-referencing with the meteorological history to develop some forecasting exercises.

   This objective should be achieved with the *Digital Service 1: Forecast and georeferencing Machine Learning system for extreme weather events*, specifically urban floods, whose development is owned by Porto Digital.

2. **REACT better**, using data to help emergency teams and first responders to improve its communication efficiency and effectiveness, in the face of an extreme weather event. An improved communication process, based on real-time data and georeferenced alerts, will inevitably lead to a better allocation of means in the reaction phase of events management.

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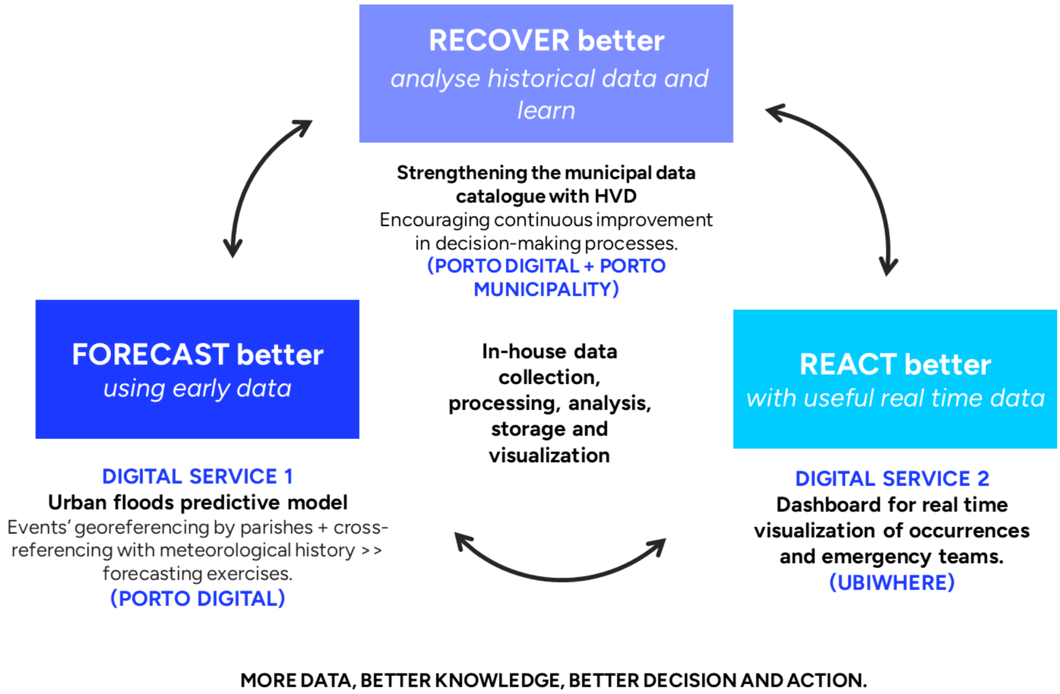
This objective should be achieved with the *Digital Service 2 – Dashboard for visualization of georeferenced emergence means,* whose development is owned by Ubiwhere.

3. **RECOVER better,** using data analysis to establish lessons learned from each occurrence, strengthening the municipal data catalogue with HVD, and encouraging continuous improvement of the decision-making processes. The expansion of in-house data collection, via new sensor installation, will allow the city to access original and relevant information.

   The development of these tasks is owned by Porto Digital and the Municipality of Porto.

Figure 30 - Porto Pilot strategic tripod: overview.



In addition to the information described there are other outcomes that we must expect, such as:

- **Enhanced Public Safety**: Faster and more effective response times contribute to the safety of the public by minimizing the duration of incidents and mitigating risks.
- **More informed and Data-Driven Decision-Making: Access** to urban mobility data empowers first responders to make data-driven decisions about incident management and resource deployment.
- **Community Resilience**: The project supports the development of community resilience by enhancing the ability to respond effectively to incidents and emergencies.

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- **Reduction in Environmental Impact**: More efficient response times and traffic management can reduce the environmental impact of incidents by minimizing fuel consumption and emissions.
- **Economic Benefits**: Reducing the duration and impact of incidents can lead to economic benefits by minimizing business disruptions and infrastructure damage.
- **Public Trust**: Efficient response to incidents and transparent use of urban mobility data can build public trust in first responders and local authorities.

3.6.3. Baseline assessment

3.6.3.1. Rationale

The baseline assessment serves as a reference point for understanding the pre-intervention status of the Porto Pilot, as well as the stakeholders' needs and expectations. It provides a foundation for adapting the project objectives to address the real challenges faced in Porto's city management and decision-making, particularly in emergency management. Additionally, it allows for the measurement of progress and the determination of success indicators (KPIs).
Based on the data collection activities outlined in Deliverable 4.1 – Validation Methodology & KPI, Porto Pilot (UC13) has selected the KPIs listed in the below Table.

Table 32 – Baseline assessment: data collection activities description.

Data collection activities	Description	Data collection documentation	Timeline	Stakeholders consulted
Bilateral meetings	Individual interviews with critical stakeholders and beneficiaries of our pilot were conducted to understand the main challenges and requirements, as well as to refine the pilot. These interviews have provided valuable information for the baseline assessment of our pilot. While not directly linked to KPI measurements, they are essential for understanding prior-intervention situations, building the case and the selection of KPI.	Project logs (meeting minutes)	M12 – M14	Porto Steering Committee
Surveys	Development of surveys to collect direct input from stakeholders, essential for helping to measure KPI.	Survey results	M23	Porto Steering Committee
Internal analysis of BeOpen metrics	Analysis of quantitative information to help measure KPI	Excel file	M20 – M23	Porto Steering Committee Porto Digital Data and Systems Architecture team

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Note: Porto Steering Committee is composed by Porto Integrated Management Centre, Firefighters, Civil Protection, Water Municipal Company

3.6.3.2. KPI selected

For the impact assessment task, Porto selected 22 KPIs related to Use Case 13, divided into two groups

1) **19 KPI (KPI_PORTO_1 to KPI_PORTO_18)** from the extended list of KPI proposed in Deliverable 4.1 – Validation Methodology & KPI, that intend to produce an overall impact analysis of BeOpen project in terms of Data usage, Data availability, Data accessibility, Data quality, Stakeholder engagement.

2) **4 Pilot specific KPI (KPI_PORTO_19 to KPI_PORTO_22)**, concerning the impact evaluation of the two developed Digital Services:

   a. *Digital Service 1* - False Positive Rate (FPR) (of all alerts we send, how many are false alerts?) and Recall (of all actual occurrences, how many did we alert to?);

   b. *Digital Service 2* - Reaction efficiency (Perceived impact in efficiency during pilot phase) and Reaction time (Perceived impact in reaction efficiency during pilot phase).

These KPIs were constructed and measured using information obtained from various data collection activities previously described (e.g., project logs, surveys, and BeOpen metrics). Table XX provides a comprehensive description of each KPI, including the source (e.g., survey, project logs, BeOpen metrics), metrics, metric units (e.g., Likert scale, number, percentage), measurement phase (baseline and/or impact assessment), and final measurement.

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Table 33 – UC 13 – Porto Pilot – Key Performance Indicators.

CRITERIUM	OBJECTIVE	# KPI	KPI	SOURCE	METRICS	METRIC UNIT	MEASUREMENT PHASE	MEASURE
Relevance	Use of Open Data of HVDs in public services management processes	**KPI_PORTO_1**	Degree of usage of data (HVD) in managing and decision-making of a smart city	Survey	Degree of usage of data (HVD) on public administrations' public services managing emergencies, such as urban floods (Integrated Management Center)	Likert scale	Baseline and impact assessment	Frequently used (45,83% of responses)
Effectiveness	Use of Open Data of HVDs in public services management processes	**KPI_PORTO_2**	Perceived relevance of HVD in managing and decision-making of a smart city	Survey	Degree of relevance of HVD in managing and decision-making of a smart city	Likert scale	Baseline and impact assessment	Very important (45,83% of responses)
Relevance	Data effectiveness	**KPI_PORTO_3**	Perceived data quality for effective managing and decision-making in case of urban floods emergencies	Survey	Perceived data quality for effective managing and decision-making in case of urban floods emergencies	Likert scale	Baseline and impact assessment	Poor quality (50% of responses)
Effectiveness	Data accessibility improvement	**KPI_PORTO_4**	Perceived data accessibility for managing and decision-making in case of urban floods emergencies	Survey	Degree of data accessibility in managing and decision-making in case of urban floods emergencies.	Likert scale	Baseline and impact assessment	Moderate Accessibility (75% of responses)
Effectiveness	Data quality improvement	**KPI_PORTO_6**	Number of datasets available for managing and decision-making in case of urban floods emergencies	Survey	Number of datasets available for managing and decision-making in case of urban floods emergencies	Number	Baseline and impact assessment	5
Degree of acceptance and use of AI driven approach	Assess the degree of maturity of the BeOpen stakeholders in an adopting an AI driven approach	**KPI_PORTO_7**	# AI experts and skilled personnel available at Pilot sites.	BeOpen metrics	Number of AI experts and skilled personnel available at Pilot sites.	Number	Baseline and impact assessment	1

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CRITERIUM	OBJECTIVE	# KPI	KPI	SOURCE	METRICS	METRIC UNIT	MEASUREMENT PHASE	MEASURE
Effectiveness	Data quality improvement	**KPI_PORTO_8**	HVD criteria score	BeOpen metrics	HVD criteria score	Number	Baseline and impact assessment	3,63
Effectiveness	Active community involvement	**KPI_PORTO_9**	# of co-creation sessions organized with Porto Steering Committee	Project logs	Number of co-creation sessions organized with Porto Steering Committee	Number	Baseline and impact assessment	5
Effectiveness	Active community involvement	**KPI_PORTO_10**	% of invited participants attending co-creation sessions (Porto Steering Committee)	Project logs	Percentage of invited stakeholders from Porto Steering Committee that have attended the co-creation sessions	Percentage	Baseline and impact assessment	83%
Effectiveness	Public services for citizens	**KPI_PORTO_11**	# of digital services developed in total over the course of the BeOpen project	BeOpen metrics	Number of digital services developed over the course of BeOpen	Number	Only impact assessment	n.a.
Degree of acceptance and use of AI driven approach	Assess the degree of maturity of the BeOpen stakeholders in an adopting an AI driven approach	**KPI_PORTO_12**	# of HVDs integrated by BeOpen Framework used for AI technologies and digital services	BeOpen metrics	Number of HVDs integrated by BeOpen Framework used for AI technologies and digital services	Number	Only impact assessment	n.a.
Replicability	New services, same local area	**KPI_PORTO_13**	# of replicability scenarios identified (same pilot city, different thematic)	Survey	Number of replicability scenarios identified at the end of the project	Number	Only impact assessment	n.a.
Effectiveness	Data quality improvement	**KPI_PORTO_14**	HVD that were improved and made available through BeOpen Framework	BeOpen metrics	Percentage of the total existent HVD that were improved and made available through the implementation of BeOpen Framework	Percentage	Only impact assessment	n.a.
Effectiveness	Data quality improvement	**KPI_PORTO_15**	Number of new tools from BeOpen Framework adopted for regular usage after pilot	BeOpen metrics	Number of new tools from BeOpen Framework adopted for regular usage after pilot	Number	Only impact assessment	n.a.

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CRITERIUM	OBJECTIVE	# KPI	KPI	SOURCE	METRICS	METRIC UNIT	MEASUREMENT PHASE	MEASURE
Relevance	Evidence-based policy	**KPI_PORTO_16**	Perceived importance of BeOpen Framework to evidence-based policy	Survey	Perceived importance of BeOpen Framework to evidence-based policy	Likert scale	Only impact assessment	n.a.
Scalability	Public services for citizens	**KPI_PORTO_17**	Perceived likelihood of additional features being developed to BeOpen digital services (same pilot city, same thematic)	Survey	Perceived likelihood of additional features being developed to BeOpen digital services	Likert scale	Only impact assessment	n.a.
Efficiency	Public services for citizens	**KPI_PORTO_18**	Perceived usefulness of BeOpen Digital Services to the total time and effort needed to development	Survey	Perceived usefulness of BeOpen Digital Services to the total time and effort needed to development	Likert scale	Only impact assessment	n.a.
Relevance	HVDs	**KPI_PORTO_19**	False Positive Rate (FPR) of the forecast system (Digital Service 1)	BeOpen metrics	Fraction of actual non-occurrences that end up being false alerts.	Binary classification 0; 1 (lower classification is better)	Only impact assessment	n.a.
Relevance	HVDs	**KPI_PORTO_20**	Recall (Digital Service 1)	BeOpen metrics	Fraction of actual occurrences that the system correctly alerted to.	Binary classification 0; 1 (higher classification is better)	Only impact assessment	n.a.
Relevance	HVDs	**KPI_PORTO_21**	Reaction efficiency (Digital Service 2)	Survey	Perceived impact in efficiency during pilot phase	Likert scale	Only impact assessment	n.a.
Relevance	HVDs	**KPI_PORTO_22**	Reaction time (Digital Service 2)	Survey	Perceived impact in reaction time during pilot phase	Likert scale	Only impact assessment	n.a.

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3.6.3.3. Other data and physical measures

In the current baseline assessment phase, some KPIs were measured using BeOpen metrics. This was the case for the **KPI HVD score**, which was obtained through the evaluation of these datasets using the Impact Assessment Tool and directly measured by Porto Digital's Data and Systems Architecture team.

In the impact assessment phase, scheduled for M30, the number of KPIs measured using BeOpen metrics will increase.

3.6.3.4. Stakeholder group

The Porto Steering Committee for the BeOpen project was informally established to ensure alignment between the project's objectives and the real needs of those impacted by it, primarily the teams at the Porto Integrated Management Centre.

Building on a sense of ownership and engagement across various aspects of BeOpen, the Porto Steering Committee also serves as a key source for nearly all the datasets used in the development of Digital Services. This involvement plays a crucial role in addressing trust issues related to data-sharing processes, facilitating more effective collaboration and application.

The Porto Steering Committee is composed of:

- **Porto Digital**, a partner in the BeOpen consortium and the technical lead for Porto city in the project.
- **Stakeholders/beneficiaries** who will benefit from the pilot results, including Águas do Porto (municipal water utility), Regimento de Sapadores Bombeiros (municipal firefighters), Centro de Gestão Integrada (Integrated Management Center), the Municipal Police, and Civil Protection.
- **Municipal data policymakers** from the Data Protection Municipal Department.

Figure 31 – BeOpen Porto stakeholder's ecosystem.

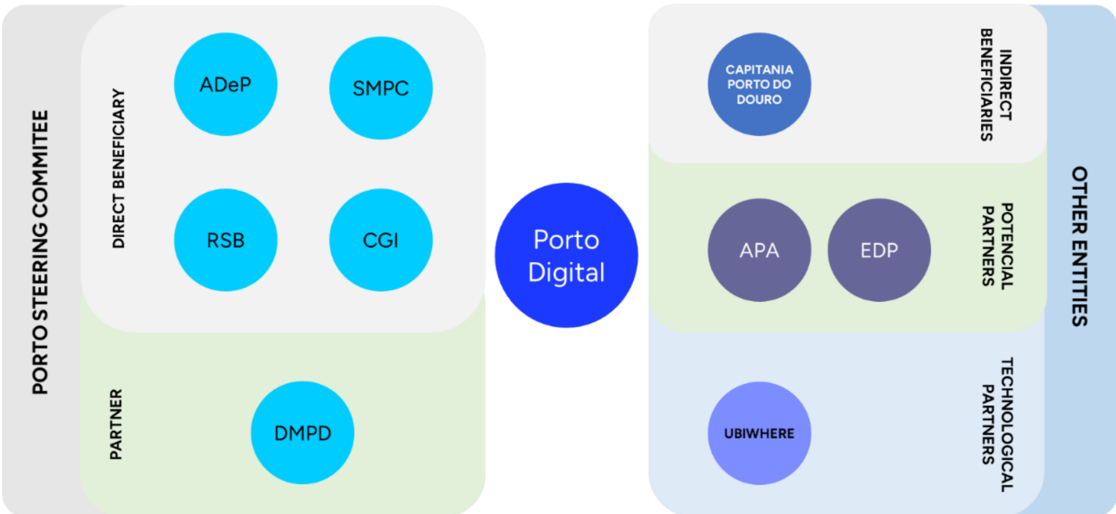

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Figure 32 – Porto Steering Committee periodic meetings.

3.6.3.5. Results of the survey

The following table provides information about the four stakeholders who responded to the survey related to *BeOpen Use Case 13 – Supporting first responders in assessing the impact of incidents with urban mobility data.*

- Table 34 – UC 13: Respondents to baseline survey.

RESPONDANT	ORGANIZATION	ROLE	TYPE OF STAKEHOLDER
PERSON 1_PORTO	Integrated Management Center	Manager	Beneficiary / user
PERSON 2_PORTO	Civil Protection	Operations Responsible	Beneficiary / user
PERSON 3_PORTO	Porto Water Municipal Company	Data Technician	Beneficiary / user
PERSON 6_PORTO	Firefighters	Commander	Beneficiary / user

Although the sample may seem small, these individuals represent the key entities involved in emergency management, specifically urban floods, in the city of Porto, and are the main beneficiaries of the Porto Pilot: the Integrated Management Center, Civil

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Protection, Porto Water Municipal Company, and Firefighters. All respondents are categorized as beneficiaries/users of the data and services provided.

The survey data aimed to complement stakeholders' feedback obtained in bilateral meetings, providing insights into the use of HVDs for managing and making decisions about urban floods, with a focus on Porto as a pilot use case. This survey assesses the baseline situation before the implementation of the BeOpen framework.

The survey data highlights key areas where Porto's flood management practices are both strong and in need of improvement.

Below is a comprehensive analysis of the data provided across various categories:

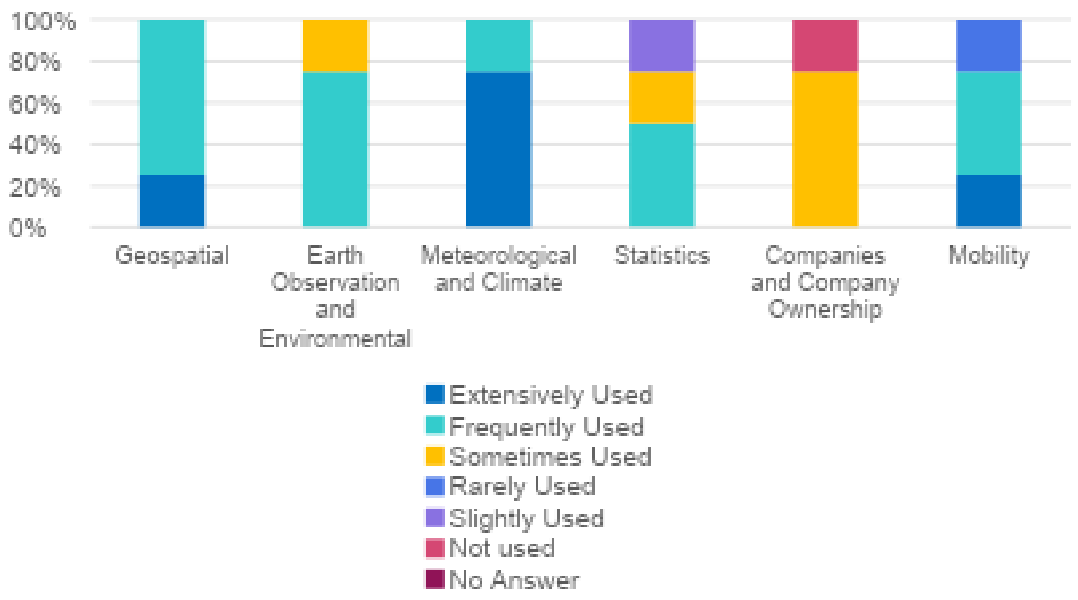
Current use of HVD

75% of the respondents claim that geospatial data, earth observation and environmental data, as well as meteorological and climate data, are extensively used in Porto's management and operations before the BeOpen project experience.

First, while data is being used, it is important to note that this does not necessarily mean high-quality or useful data (e.g., real-time or granular data) is being utilized, as will be further discussed.

Second, this result indicates that Porto already has some maturity in integrating data (and HVD) as a powerful tool for decision-making processes, especially concerning emergencies like urban floods. This maturity provides a head start advantage in optimizing pilot results and ensuring that both digital services and their planned outcomes are sustainable after the project's completion.

Figure 85 – UC13 – Q1 "To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?".



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__Note: Geospatial Data:__ Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. __Earth Observation and Environmental Data__: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; __Meteorological and Climate Data:__ Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; __Statistics:__ Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. __Companies and Company Ownership Data:__ Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. __Mobility Data__: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.

Relevance of HVD for Smart City Management

Regarding the perception of criticality of HVD for smart managing a city, the most part of Porto stakeholders indicated Geospatial Data, Earth Observation and Environmental Data, Meteorological and Climate and Mobility as a critical or very important thematic to be considered.

100% of respondents indicated that meteorological and climate data—specifically, the observed meteorology data obtained from Porto's Digital sensor network—are **very important** for smart city management. This unanimous agreement highlights the central role of weather forecasting in both flood prediction (Digital Service 1) and response (Digital Service 2), confirming the inputs gathered during bilateral meetings.

Geospatial data, like the one that is being used on Porto Digital Service 2, is considered critical by 50% of the respondents and very important by 25%. Datasets as street width, fire hydrants position or watersheds boundaries have great relevance on building physical context and, therefore, improve decision making during an emergency reaction.

Regarding statistics and companies, though its importance is acknowledged, are considered secondary to more operational data in urban flood management.

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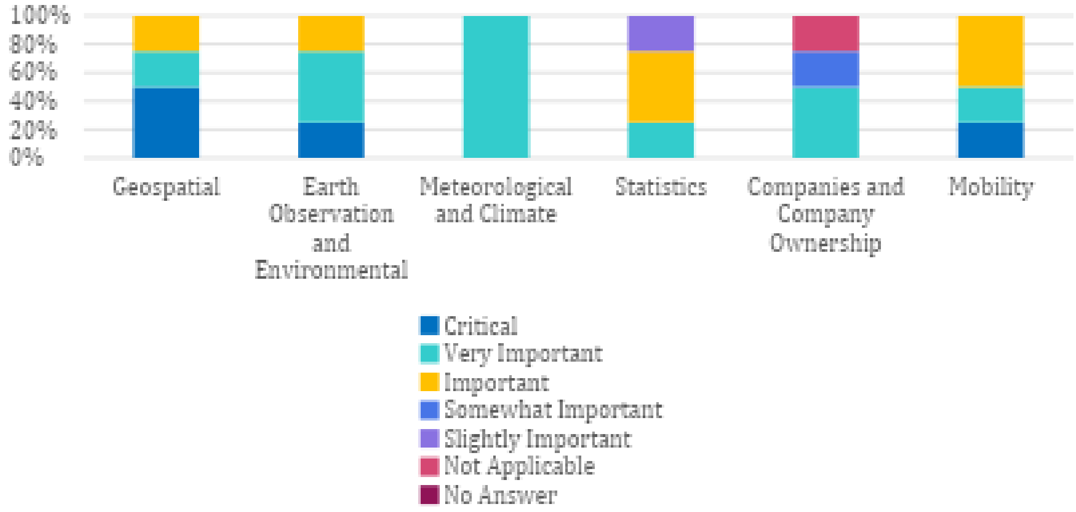
Figure 86 – UC13 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?".



*Note: **Geospatial Data:** Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. **Earth Observation and Environmental Data**: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; **Meteorological and Climate Data:** Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; **Statistics:** Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. **Companies and Company Ownership Data:** Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. **Mobility Data**: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Data solutions in place and its effectiveness in urban flood emergencies management

100% of respondents reported using a data management solution for flood management.

Of the solutions in place, the majority were considered moderately effective (75%), with 25% rating them as slightly effective. This suggests that existing systems provide some benefit, but there is room for improvement, particularly in prediction accuracy, coordination, and resource allocation. However, most of the respondents (75%) characterized the solution as "Moderately Effective" with moderate impact on all the analyzed features.

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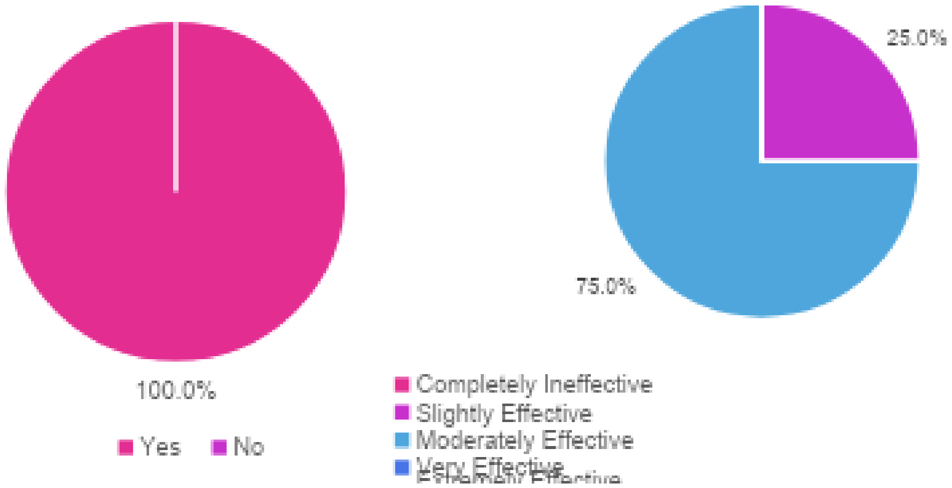
Figure 87 – UC13 – Q3 "Are currently data management solutions in place to support the management and decision-making on the occurrence of city floods, on the response and mitigation of their effects and on the increased effectiveness of the protection response?" If yes, the solution currently in use is:



Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Data usage and effectiveness on urban flood decision making and management

100% of respondents confirmed that high-value datasets (HVDs) are already used to support the management, decision-making, and mitigation efforts related to city floods in Porto. Nevertheless, perceptions related to the effectiveness of HVD usage to

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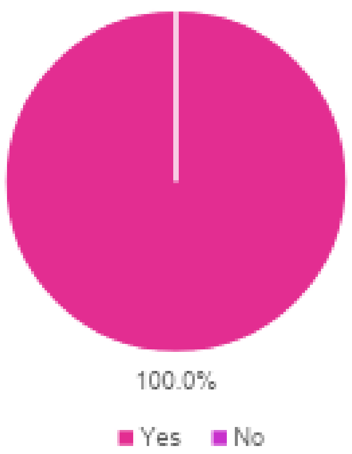
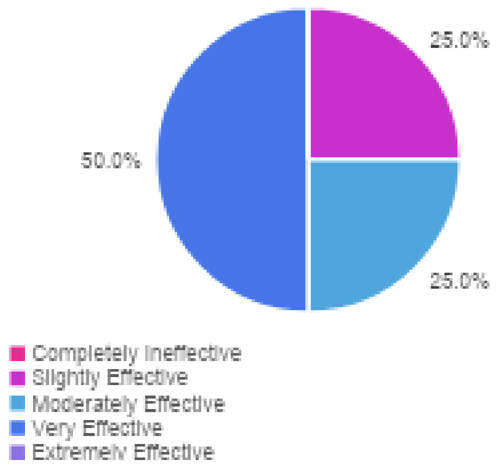
managing emergencies as urban floods are mixed: **50%** rated it as either moderately or slightly effective, indicating room for improvement in this criterion.

As a reminder prior to BeOpen, Porto has a moderate number of datasets available for flood prediction and management, mainly from IPMA or APA. Unfortunately, both the warning systems, whether from IPMA or APA, provide information on a supra municipal scale, leading to disproportionate outcomes and delays in emergencies forecast at the city level. Thus, although available, existing data is not effective in contributing to the robustness of flood management strategies.

Figure 88 – UC13 – Q4 "Are there HVDs in use to support the management and decision-making on the occurrence of city floods, on the response and mitigation of their effects and on the increased effectiveness of the protection? How would you rate the contribution of these high-value datasets (HVDs) to the effectiveness of the management and optimisation of the maintenance of Porto floods?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

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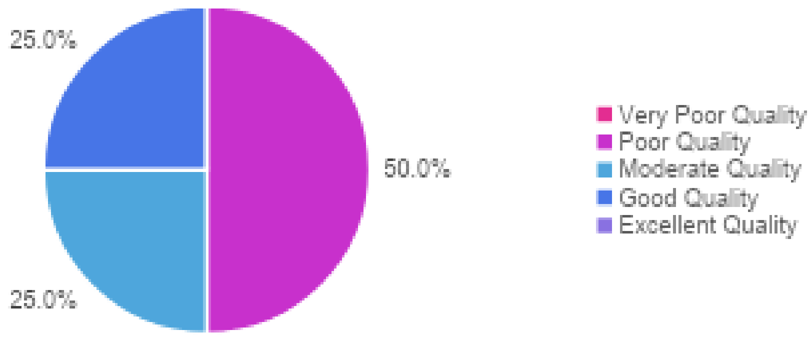
Data quality and accessibility

50% of the respondents rated data quality as poor, 25% as moderate and only 25% as good. The relatively low-quality rating (with half of respondents indicating poor quality) suggests issues with the accuracy, timeliness, and curation of data before the BeOpen framework was implemented.

Figure 89 – UC13 – Q5 "How would you rate the data quality in the Porto use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, curation, and appropriateness for supporting decision-making processes?"



Very Poor Quality *(Data is inaccurate, outdated, poorly curated, and inappropriate for decision-making)*
Poor Quality *(Data is available but has significant issues with accuracy, updates, curation, or appropriateness)*
Moderate Quality *(Data quality is acceptable but requires improvement in one or more areas, such as accuracy or timeliness)*
Good Quality *(Data is accurate, timely, well-curated, and mostly appropriate for decision-making processes)*
Excellent Quality *(Data is highly accurate, regularly updated, expertly curated, and fully appropriate for decision-making).*

Also, 75% of respondents indicated that data is moderately accessible, meaning data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges and only 25% rated this parameter as good.

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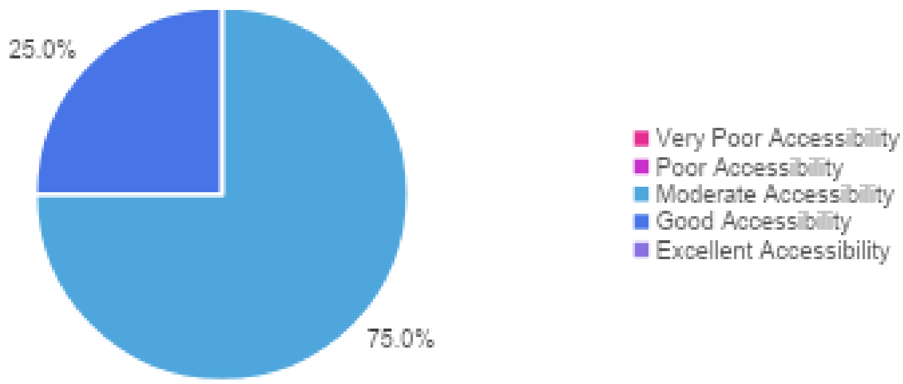
Figure 90 – UC13 – Q6 "How would you rate the data accessibility in the Porto use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



Very Poor Accessibility *(Data is highly complex, difficult to retrieve, with significant technical, interoperability, and compatibility barriers)*
Poor Accessibility *(Data is retrievable but requires considerable effort or specialized tools, and faces technical or compatibility issues with existing systems)*
Moderate Accessibility *(Data is somewhat accessible, but may require some effort, and there are moderate technical or interoperability challenges)*
Good Accessibility *(Data is generally easy to retrieve and use, with few technical or compatibility barriers, and interoperates well with existing systems)*
Excellent Accessibility *(Data is highly intuitive, easily retrievable, fully compatible, and seamlessly interoperates with existing systems, supporting decision-making without technical issues)*

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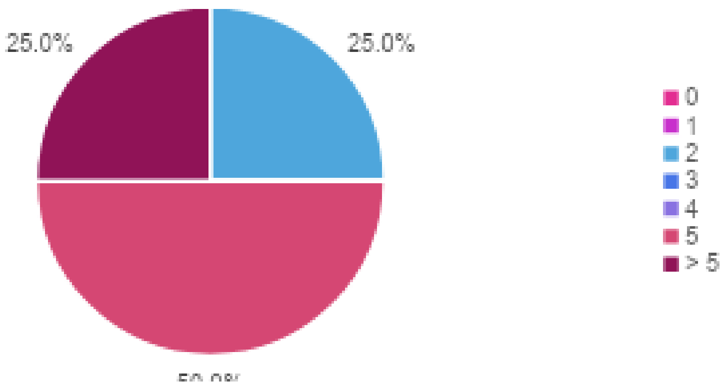
These two indicators' performance confirm stakeholders' feedback during bilateral meetings and the need for improvement in data quality to better support decision-making. As a reminder, Porto Steering Committee stakeholders have identified shortage of real time data and low granularity as some of the main challenges.

Data availability

Regarding data available before the BeOpen framework implementation, 25% of respondents had 2 datasets, 50% had 5 datasets, and 25% had more than 5 datasets. The divergence of responses suggests that data is available and used by certain stakeholders, but access and knowledge of such datasets are unevenly distributed. This confirms communication among stakeholders has room for improvement.

Figure 91 – UC13 – Q7 "How many datasets were available for the flood prediction, management, mitigation and first response before the start of the BeOpen project?"



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3.6.4. Synthesis

Porto's baseline assessment highlights the significant potential and contribution of the BeOpen framework to improve data-based decision making and optimize response regarding urban floods emergencies in the city.

Porto is already at a high level of maturity in its municipal digital transition strategy, valuing data and data-driven digital management as crucial tools even before the BeOpen pilot, which gives the city a great head-start in adopting new practices. However, there is still room for improvement to optimize emergency management across its phases (forecast, reaction and recovery).

Gaps in the quality and accessibility of data is one of the most crucial aspects to be tackled. While stakeholders acknowledge the importance of data for effective flood management, 50% of them rate the current data quality as poor, according to survey results. The city's current systems, while moderately effective from the stakeholders' perspective, could benefit from more granular, real-time data to enhance both forecasting and decision-making.

The pre-intervention situation at the pilot site also highlighted communication constraints. Transparency and even stakeholder's knowledge of datasets available needs to be improved, based on feedback from bilateral meetings and surveys results. The uneven perception of availability of datasets across stakeholders confirms the need for better communication and more trust in data sharing. BeOpen will directly contribute to reinforce the Integrated Management Center role as the most important aggregator entity of emergency teams in the city.

To address these challenges, the Porto Pilot in BeOpen project proposes enhancing municipal data collection, integrating real-time data into digital services, and developing a robust catalog of HVDs. Based on a strategic tripod - FORECAST, REACTION and RECOVERY - BeOpen Porto Pilot is designed to address these gaps by supporting first responders and emergency teams that are present at the Porto Integrated Management Centre with its two Digital Services.

To measure impact, Porto will lay upon a list of 22 KPIs related to Use Case 13 aimed at analyzing the overall impact of the BeOpen project in terms of data usage, availability, accessibility, quality, and stakeholder engagement. Four pilot-specific technical KPI will evaluate the impact of two developed Digital Services: Digital Service 1, focusing on False Positive Rate (FPR) and Recall, and Digital Service 2, assessing Reaction Efficiency and Reaction Time

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3.7. Naples

3.7.1. Overview of use case

The Urban Plan for Sustainable Mobility (PUMS) is a strategic planning tool with a ten-year time horizon, capable of developing an organic and systemic vision of urban mobility at medium and long term, with the primary objective of improving accessibility through sustainable mobility and transport systems, also improving the usability of public space. The PUMS sets objectives and actions, in coordination with urban and environmental plans of the municipal territory (PUC, PAESC) and regulates all modes of public/private transport, circulation and parking, also improving the quality of road and urban space with a sustainable approach, promoting the use of collective public transport and cyclo-pedestrian mobility, reducing pollution and impact on urban space.

PUMS actions need a monitoring process, based on a detailed knowledge framework set in the 2020 baseline plan, which defines a list of indicators to be monitored. Data collection activities are expensive for a Public Administration, because the information to be collected derives from multiple sources. Data collection and optimization through a set of tools implemented by BeOpen will support monitoring activities. The city Administration will implement digital services to view, share with citizens and manage information.

3.7.2. Use case rationale: Digital service, HVD and intended impact

Bringing citizens closer to the policymaking process is a relevant issue for Public Administrations. Citizen participation and monitoring of government actions is based on a City Accountability strategy, built on events, visualization tools and data sharing.

This issue is addressed with unsatisfactory tools. Decision making is participated through events, forums and meetings based on qualitative propositions without a strong data driven and quantitative analysis. To solve this critical issue, the city will develop a web visualization tool that reports on sustainable mobility features. The activity starts from a series of datasets that have been collected, standardized, licensed for open data sharing and improved to represent a HVD collection in the field of Mobility, Climate and Urban planning.

This web map tool is apt to be shared to promote participation in public decision, accounting to citizens public decisions and planning (DS n.1).

The second digital service is a monitoring tool built on the web map, measuring elements related to the monitoring of the sustainable mobility parameters, such as the number of recharging stations for electrical mobility, or the extension of cycle paths. Appropriate updating will ensure a constant interchange of information to citizens on public decision making (DS n.2)

The services are scalable, new datasets may be implemented. The BeOpen project is working on improving the following list of datasets:

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Table 35 – Dataset selection for Naples Pilot Digital Services.

# Dataset	Dataset designation
DATASET_NAPLES_1	Mobility hubs
DATASET_NAPLES_2	Metro line1 stations passenger flow
DATASET_NAPLES_3	Mobility charging stations
DATASET_NAPLES_4	Parking locations
DATASET_NAPLES_5	Road and railway network, cyclepaths
DATASET_NAPLES_6	Public transport networks
DATASET_NAPLES_7	Traffic restriction areas, ZTL and pedestrian only areas
DATASET_NAPLES_8	Heat exposure on public facilities / schools/ census tracts
DATASET_NAPLES_9	Public space and green parks
DATASET_NAPLES_10	Green index on administrative units/on parks and public space

Data collection and data integration have been the first step, allowing the Administration to understand which data are useful and can support decision making. Dataset improvement has allowed data owners to investigate specific aspects of data sharing and has included standardization, metadata implementation, accessibility checking.

The digital services will give access to information to new groups of users that will request additional information or open new data that will undergo the same process. This iterative approach needs a definite strategy, with the use of the BeOpen tools in addition to GIS management tools and data sharing opportunities. The impact of BeOpen on the city organization has been to clarify all the aspects of data sharing, from Data integration to licensing and sharing, allowing Napoli officers and Decision makers to define an appropriate Open Data Strategy for support planning processes.

3.7.3. Baseline assessment

3.7.3.1. Rationale

Sustainable Mobility planning has been outsourced and has supplied a set of data and devised a list of indicators to monitor sustainability parameters. These data have been integrated in the Napoli GIS environment and have undergone geospatial analysis to improve the level of information. The same process has been applied to data from Urban Planning and Climate change analysis, with datasets derived from EU project Spotted. In addition to this existent information, new datasets have been collected.

Baseline evaluation is focused on a plurality of methodologies.

A simple enumeration of dataset provided for sharing, highlighting that data from Mobility domain have never been shared before BeOpen by the Municipality. This quantitative

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assessment is expressed by the project metrics and will be related to the number of datasets collected – improved – shared – created or modified in the BeOpen process

An approach at evaluating Quality parameters of the datasets selected is assessed through the tools set up by BeOpen.

Stakeholder involvement extends this evaluation process, conducted through surveys developed to assess the impact of the data and services. Internal (to the Municipality) and external stakeholders, express:

- the level of use of datasets in their area of interest,
- their interest in digital services
- potential use of digital service in participation strategies

More quantitative information will derive from measurable interaction with citizens (rate of downloading or request for data) or other stakeholders.

3.7.3.2. KPI selected

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Table 36 – UC14 – Naples Pilot – Key Performance Indicators.

#	Evaluation question	KPI - Indicator (what we are really evaluating?)	Source (means of verification)	Metrics
KPI_NAP_1	To what extent the quality of data has been improved to make available and interoperable HVDs on mobility and urban environment for better re-design of public spaces and streamline citizens' participations in planning activities?	Effectiveness - Degree of data accuracy/reliability achieved with BeOpen Framework adoption with respect to the current solution in place.	BeOpen metrics	assess dataset increase and quality
KPI_NAP_2	To what extent the availability of HVDs has been improved to make available and interoperable HVDs on mobility and urban environments for better re-design of public spaces and streamline citizens' participation in planning activities?	Effectiveness - # of compliant HVDs made available to the public through BeOpen Framework.	BeOpen metrics	assess dataset increase and quality
KPI_NAP_3		Effectiveness - % Percentage increase in the availability of high-value datasets through BeOpen Framework compared to the baseline.	Interviews	assess dataset increase and quality
KPI_NAP_4	How much additional data does the framework provide to stakeholders to better contribute with available and interoperable HVDs on mobility and urban environment to a re-design of public spaces and citizens' participation in planning activities?	Effectiveness - Ratio of data used by civil servants/policymakers in their public services/decision-making management processes after BeOpen compared to the baseline.	Survey/Interviews	assess dataset increase and quality
KPI_NAP_5	To what extent has BeOpen been integrated with existing technical ecosystems to make available and interoperable HVDs on mobility and urban environment to be used for better re-design of public spaces and streamlined citizens' participation in planning activities?	Effectiveness - Degree of interoperability of BeOpen Framework with existing technical ecosystems in the Pilot site.	BeOpen metrics	# of (interoperable) datasets published
KPI_NAP_6	Are you planning to design co-creation sessions to design digital services? Yes/No	Effectiveness - Rate of adoption of the co-creation approach	Project logs	active community involvement, sessions realized or programmed
KPI_NAP_7	Please specify for which HVDs areas are you going to adopt a co-creation approach	Effectiveness - # HVDs areas where the co-creation approach will be applied	Project logs	
KPI_NAP_8	To what extent are relevant authorities using the BeOpen Framework and with the interoperable HVDs on mobility and urban environment for better re-design of public spaces and to promote citizens' participation in planning activities?	Effectiveness - # policies based on HVDs made available through BeOpen Framework	Survey to/Interview with policymakers	# of digital service created (included the two prepared for the project) or programmed on BeOpen # of plans for which the data will be used # of monitoring activities implemented
KPI_NAP_9	Has civil servants' perceived quality of services increased with HVDs on mobility and urban environment for better re-design of public spaces and streamlined citizens' participation in planning activities?	Effectiveness - Perceived quality of public services (Likert scale)	Survey	assess quality increase in digital services/in policies
KPI_NAP_10	What differences are there between public services management processes before and after the BeOpen Framework on HVDs on mobility and urban environment for	Effectiveness - Perceived state of public services management processes before and after the BeOpen Framework.	Survey	assessment on digital services quality

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#	Evaluation question	KPI - Indicator (what we are really evaluating?)	Source (means of verification)	Metrics
	better re-design of public spaces and streamlined citizens' participation in planning activities?			
KPI_NAP_11	How has the BeOpen Framework impacted public institutions working in public services management processes offering available and interoperable HVDs on mobility and urban environment for better re-design of public spaces and streamlined citizens' participation in planning activities?	Effectiveness - Civil servants' perceived improvement in public services management processes compared to the current practices.	Survey to/Interviews with policymakers	assessment on data driven policies
KPI_NAP_12	Have public authorities used the BeOpen solution in their decision-making processes with HVDs on mobility and urban environment for better re-design of public spaces and citizens' participation in planning activities?	Effectiveness - Ratio of decision-making processes based on BeOpen versus decision-making processes not based on BeOpen. (qualitative question)	Survey to/Interviews with policymakers "	assessment on data driven policies
KPI_TECH	Have SMEs been accessing/reusing the data made available by the BeOpen Framework - HVDs on mobility and urban environment for better re-design of public spaces and citizens' participation in planning activities?	Effectiveness - # of SMEs accessing and reusing HVDs from the BeOpen Framework.	Survey to SMEs	economic outcomes
KPI_NAP_13	Was BeOpen worth the invested time and effort designing, developing, and implementing solutions to make available and interoperable HVDs on mobility and urban environment for better re-design of public spaces and streamlined citizens' participation in planning activities?	Efficiency - Perceived costs and benefits of use case	Surveys (Qualitative questions)	assess importance of new HVDs and new digital services for data availability, when planning
KPI_NAP_14	What is the return on investment (ROI) by using the BeOpen Framework in evidence-based policy for public services management processes and using HVDs on mobility and urban environment for better re-design of public spaces and streamline citizens' participation in planning activities?	Efficiency - HVDs fully integrated and interoperable in Pilot site before and after BeOpen.	CBA	data availability
KPI_TECH_	To what extent are HVDs made interoperable by the BeOpen Framework being used by civil servants, for a better re-design of public spaces and planning activities?	Relevance - # of times HVDs are accessed AND downloaded	BEOPEN metrics	data availability
KPI_TECH_	To what extent can BeOpen increase the current download rate of mobility related datasets?	Relevance - Expected increase by 70% on present download rate of mobility related datasets.	BeOpen metrics	data quality, data availability
KPI_NAP_15	How easy is it for policymakers to gain access to and make use of the HVDs through BeOpen Framework for policymaking -	Relevance - Perceived ease of use and access to data	Interviews with policymakers	data availability
KPI_NAP_16	To what extent is the granularity of BeOpen data sufficient for public services management processes on mobility and urban environment, re-design of public spaces and citizens' participation in planning activities?	Relevance - Observed level of data granularity for selected public services management processes	BeOpen metrics	data quality
KPI_NAP_17	How relevant are the BeOpen Framework and the available and interoperable HVDs for policies on mobility and urban environment, re-design of public spaces and citizens' participation in planning activities?	Relevance - % of HVDs integrated through BeOpen Framework found useful for evidence-based policymaking	Interviews with policymakers	data quality, data availability
KPI_NAP_18		Relevance - Perceived usefulness of BeOpen in data driven policy		data quality, data availability

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#	Evaluation question	KPI - Indicator (what we are really evaluating?)	Source (means of verification)	Metrics
KPI_NAP_19	How relevant is the BeOpen Framework in providing public services with data on mobility and urban environment, and contributing to re-design of public spaces and citizens' participation?	relevance - is the BeOpen Framework useful for public services management processes?	Interviews to policymakers	Degree of BeOpen Framework found useful for public services management processes.
KPI_NAP_20	How useful is it to use HVDs on mobility and urban environment in public services management processes, re-design of public spaces and citizens' participation in planning activities?	% of public authorities/policymakers/critical stakeholders indicating the usefulness of HVDs for public services management processes AND the need of interoperable data.	Interviews to public authorities/ policymakers/ critical stakeholders	Degree ofHVD datasets found useful for public services management processes.
KPI_NAP_21	Under what conditions can the BeOpen Framework be reused in other public services management processes of the same local areas to make available and interoperable HVDs on mobility and urban environment, to be used for better re-design of public spaces and citizens' participation in planning activities?	Perceived usefulness of replicability scenarios in terms of technical, financial, skills and governance requirements	SWOT/Interviews	assess flexibility and modularity in public services design, assess openness to AI
KPI_NAP_22	Which is the degree of development of an AI strategy and governance of AI in the public authority in charge for the provision for selected public services with the use of available and interoperable HVDs on mobility and urban environment?	Development of an AI strategy ON DATA, aligned with urban safety and mobility goals (Likert scale)	Interviews	assess flexibility and modularity in public services design
KPI_NAP_23	To what extent does the AI-driven approach help in improving community engagement on mobility and urban environment issues, re-design of public spaces and citizens' participation in planning activities?	Degree of capability to collect feedback from and provide insight to local communities with respect to the current practices.	Interviews/survey	assess active involvement of communities and usefulness of community involvement in designing services

3.7.3.3. Other data and physical measures

Some of the datasets used in BeOpen derive from Spotted CEF telecom Project.

3.7.3.4. Stakeholder group

Stakeholders have been selected from Comune di Napoli organization units (other than the areas directly involved in BeOpen), planners from Città Metropolitana di Napoli and Open Data professionals.

Decision makers belong both to the technical environment of the city (mobility, urban planning, energy planning sectors) and to political decision makers.

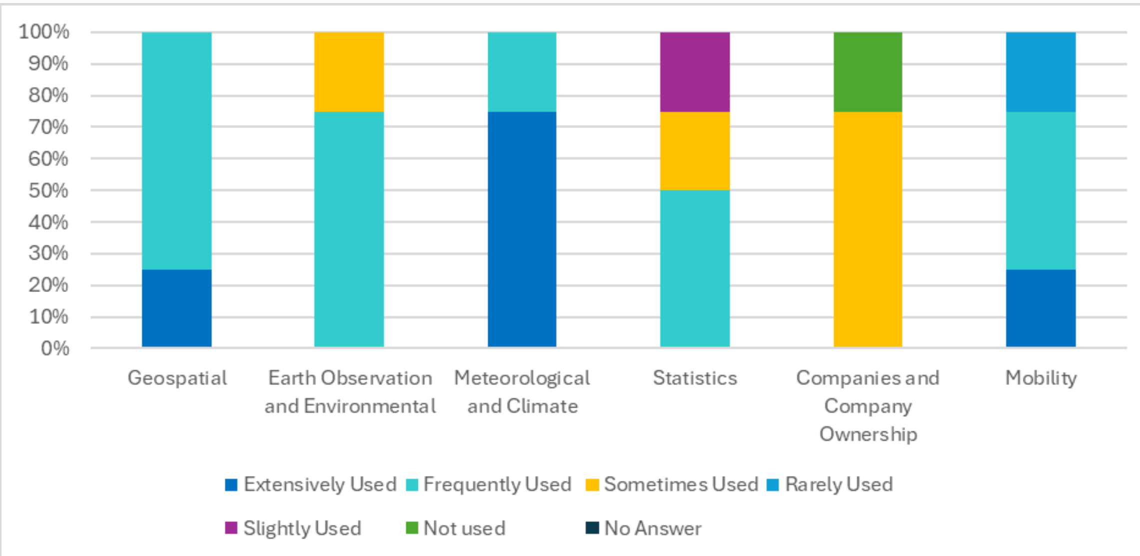
Technical executives have a clear vision centred on Data using, quality improvement, data access and retrieval. They know about Projects, present or future, and plans with relative knowledge framework, and can understand about potential use of the data provided and possible additional processing.

Staff professionals from the Mayor and his Assessors have been involved in internal information and survey responses, with the aim of evaluating BeOpen tools with relation to the city overall vision and the strategies that the city will implement.

3.7.3.5. Results of the survey

Stakeholders' response has been provided after a general briefing on the project's results so far by the project’s involved personnel, but specific calls have been needed for additional briefing, mostly to define which datasets are those intended for responses. Extracting some statistics for responses to the survey supports the following considerations (a full statistical report for all responses is available in the project’s cloud)

Figure 92 – UC14 – Q1 “To what extent are the following categories of High Value Datasets (HVDs) used in your city's management and operations prior to the BeOpen project experience?”.



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__Note: Geospatial Data:__ Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring. __Earth Observation and Environmental Data__: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management; __Meteorological and Climate Data:__ Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors; __Statistics:__ Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis. __Companies and Company Ownership Data:__ Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities. __Mobility Data__: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.

Statistical data are less relevant/less used, while Company and business data seem a relevant Data typology. The result is surprising, as stakeholders belong to a Public Administration, focused on providing services to citizens, and statistics are used to calibrate services. It must be observed that Company data intended by responders include datasets used for consultation rather than data owned and maintained by the local Municipality, Frequent use is related to data consulting from databases owned by different entities, not direct data collection, detention and sharing from the Municipality.

Meteorological and climate data are considered as less relevant, because the city is developing a climate change assessment process but is not mature on a climate related data strategy. Climate risk assessment has been the object of multiple EU projects, but the impact (i.e. Clarity) has been to raise awareness rather than build a solid data strategy.

Answers document a relevant presence for Mobility data (main area for BeOpen activities in Napoli) so we know there is still an area for implementing BeOpen activities.

Relevance of HVD for Smart City Management

Critical areas of interest in Data are expressed by the responses to a second set of questions.

Marked stress is expressed with Climate change related and Environmental parameters data and in the field of statistical evaluation. Less importance is given to Meteorological data.

Again, a marked importance is given to Company and business data. The weight given to this kind of information, is explained with the exigency of having a solid knowledge framework of the productive system, to drive planning activities in the urban field.

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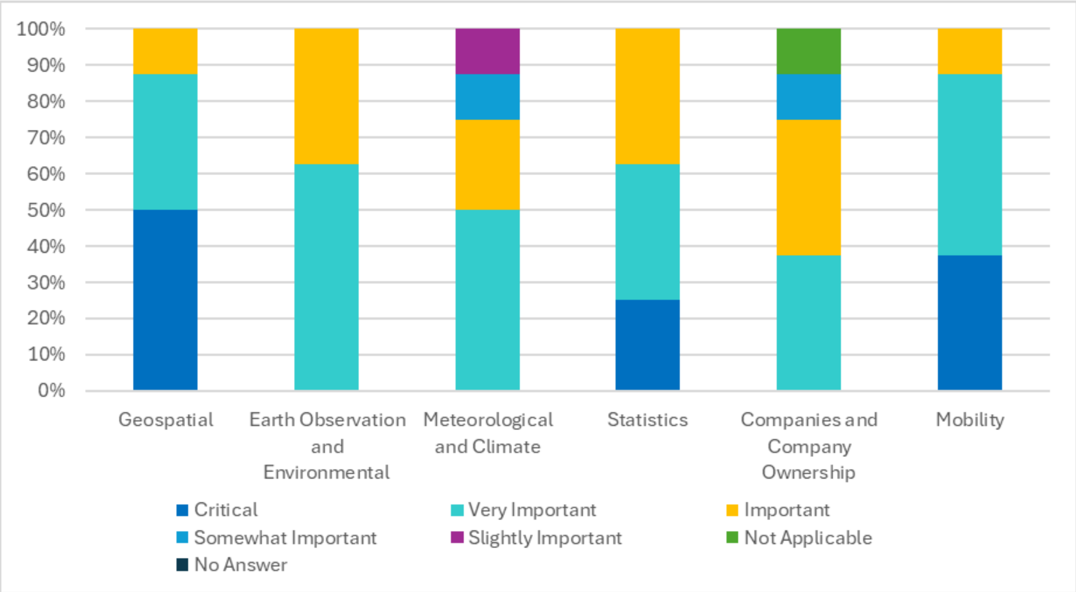
Figure 93 – UC14 – Q2 "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?".



Note: Geospatial Data: *Includes datasets related to geographic locations, such as maps, property boundaries, and transport networks. Valuable for urban planning, navigation, and environmental monitoring.* ***Earth Observation and Environmental Data****: Covers data from satellites and observation systems for weather, air quality, water levels, and climate change. Critical for sustainability and disaster management;* ***Meteorological and Climate Data:*** *Involves weather-related data like forecasts, historical climate data, and real-time monitoring. Supports agriculture, transport, and tourism sectors;* ***Statistics:*** *Includes economic, social, and demographic data collected by national statistical agencies. Used to inform policy decisions, academic research, and market analysis.* ***Companies and Company Ownership Data:*** *Includes business registers, ownership structures, and financial information, essential for transparency, reducing fraud, and supporting economic activities.* ***Mobility Data****: Information related to the movement of goods and people, such as transport infrastructure, traffic data, and public transport schedules. Facilitates better transport planning and smart city development.*

Napoli has not defined a Smart City and Digital Twin strategy, based on a group of datasets to be collected or re-organized. We see, nonetheless, that there is a marked awareness of the central role of data in this specific field.

Mobility data (central in BeOpen Napoli use case) are considered extremely critical/strategic by all responders.

Figure 94 – UC14 – Q3 "Are there HVDs in use to support decision-making and citizens' participation in Napoli focused on mobility infrastructure and public urban space? If yes, the solution currently in use is:

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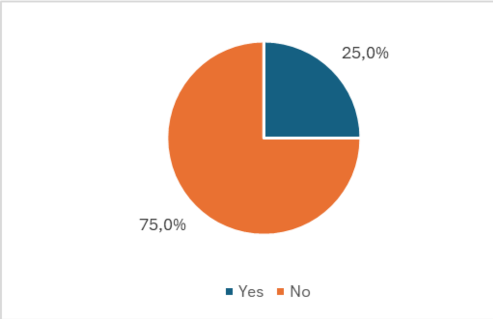

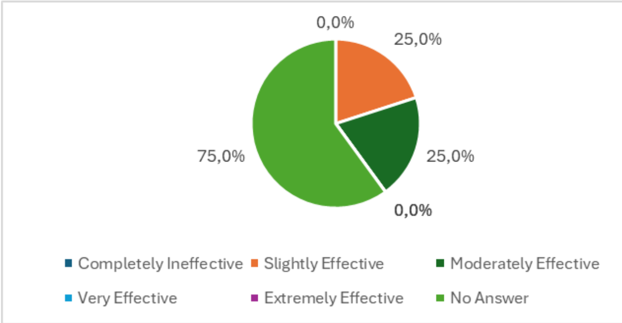

Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Answers clearly document the absence of digital services that support procedures, planning and decision making, exceptions made for single responses (on Mobility management, NdR).

The answers document that participation strategies are informed with value datasets. This leads to two possible interpretations: data have a value but are not used in a correct way – or data are shared but there is no response from potential re-users. Impact assessment could investigate this issue further.

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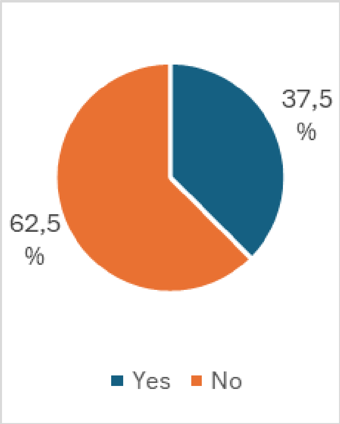
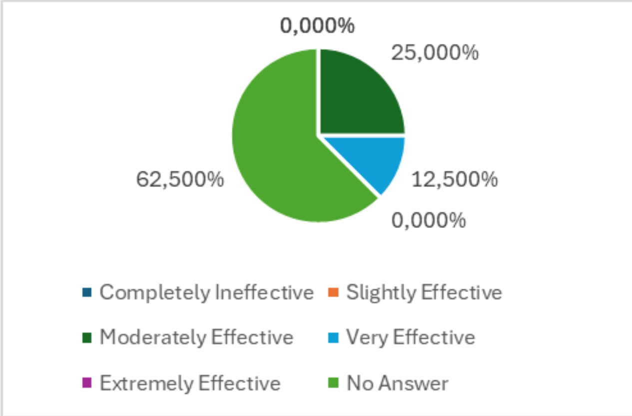
Figure 95 – UC14– Q4 "Are there HVDs in use to support decision-making and citizens' participation in Napoli focused on mobility infrastructure and public urban space? How would you rate the contribution of these high-value datasets (HVDs) to the effectiveness of decision-making on Napoli in the field of mobility infrastructure and public urban space?"





Completely Ineffective *(No impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Slightly Effective *(Minor impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Moderately Effective *(Moderate impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Very Effective *(Significant impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*
Extremely Effective *(Exceptional impact on data-driven long-term planning for better flood resilience; prediction accuracy using rainfall, groundwater, and historical flood data; on response times due to real-time alerts and tracking; on coordination among emergency services; on efficient resource allocation for emergency interventions; physical and economic damage to infrastructure, property, and overall recovery costs; on human impact and increased public safety through timely warnings, evacuations, and reduced casualties)*

Responses attest that decision making is evaluated as moderately fed by datasets – it means that some data are existing, accessible to decision makers and are currently used, but most responses do not express an opinion on effectiveness. Impact assessment will measure how this opinion will grow for the additional data provided by the project.

3.7.4. Synthesis

The city is not a mature environment for open data. Officers must approach the appropriate tools to respond to European regulatory requests for sharing, as the present

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scenario is unsatisfactory and far away from the best tools of possible use. Technical difficulties and lack of resources make the situation worse.

Having experienced with BeOpen a complete process, approaching Open data culture and testing innovative digital tools has helped the Administration to gain awareness, needed to build its Open Data Strategy.

The Baseline assessment detects that there is a diversification between Areas of the city organization as to data and management systems. The motive lies in a consolidated GIS environment, but outside the planning area there is dissatisfaction in the tools used to manage information, and a poor quality of data is generally assessed. There is expectation in compulsed stakeholders of the role that the BeOpen process could have in decision making. The aim is to give complete evidence of improvement in the data used (that is not all the data initially intended) to win over residual resistance to data sharing.

Impact assessment should give evidence of what has been improved in the process regarding data, from data management to sharing, allowing every aspect to be clarified.

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3.8. Vilnius

3.8.1. Overview of use case

Rapid growth of invading species and the resulting destruction of other naturally occurring species is a major ecological problem nowadays. The city of Vilnius is looking for solutions able to limit the spread of Sosnowski's hogweed, a dangerous plant that can injure people. The aim of the use case is to monitor and project the expansion of invading plants so that the city could control the spread and eventually eradicate them.

3.8.2. Use case rationale: digital service, HVD and intended impact

Vilnius' use case intends on creating a machine learning model to identify the invasive species of Sosnowski hogweed from UAV images and with the help of *Latitudo 40* technical partners explore the possibility of using satellite data to identify where the invasive species lie. As the model is developed, it will be utilised for an Image inference API, where external users would be able to provide their own images, and receive an output - a json format coordinates file of the detected species. For ease of use to the stakeholders, the data gathered by *ID Vilnius* (tight-knit partner of the local government) is visualized on a map, which is a way to have a clear overview of the situation in the city.

Other than the identification, ID Vilnius is also modelling the projected expansion of the hogweed, where the modelling would be done at least once a year, considering the timeframe of the plant's maturity. The output would showcase the risk of expansion if no actions would be taken to eradicate the patch in question.

The digital service of Sosnowski's hogweed identification will be the base for an invasive species HVD. During the modelling phase, meteorological information from a weather station will be utilized, in concrete – wind data. The owner of the data is the Lithuanian Hydrometeorological Service, but the data is open and has already been integrated into the ID Vilnius system for "Lungs of the city", now it will be utilized in the Vilnius use case. The visualizations will have three contextual datasets that can also be helpful in prioritizing flight areas, since covering the whole city with UAVs is difficult.

■ Table 37 – Dataset selection for Vilnius Pilot Digital Services.

Dataset	Use
Natural framework	Contextual, supporting role
Extensively and intensively used green spaces	Contextual, supporting role
Green area accessibility zone	Contextual, supporting role
Invasive species	DS labels collected into a comfortable geospatial format for visualizing
Wind data Meteo.lt API	Modelling of invasive species expansion

The High Value Datasets (HVDs) produced by the Vilnius pilot adhere to open data principles, ensuring accessibility, interoperability, and reusability. These datasets are:

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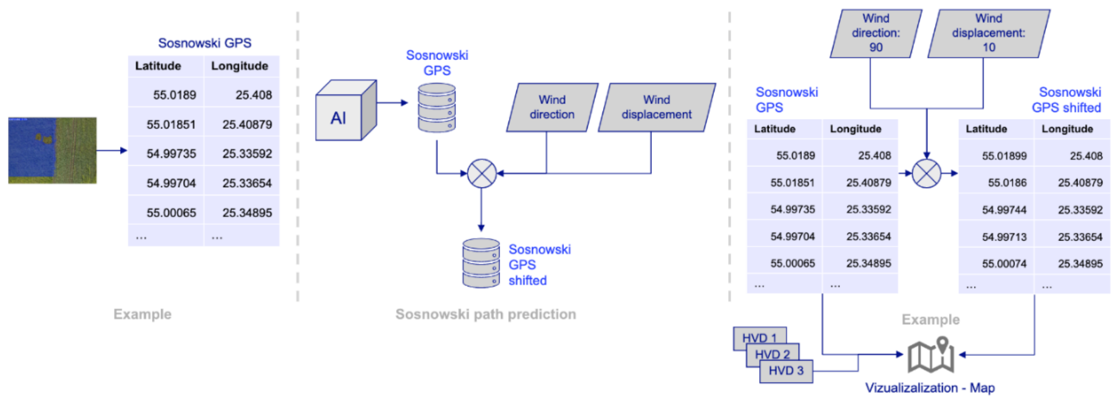
- Dublin Core Metadata Standard: All datasets are described using the Dublin Core standard, ensuring rich and structured metadata for better discoverability and interoperability.
- CC BY 4.0 License: The datasets are made available under the Creative Commons Attribution 4.0 license, enabling free use, sharing, and adaptation as long as appropriate credit is given. No sensitive data is included, ensuring compliance with privacy regulations.
- Free Accessibility: The datasets are provided at no cost, promoting transparency and encouraging widespread use by various stakeholders, including researchers, public authorities, and the general public.
- CKAN API Integration: The datasets are accessible through the CKAN API on the Vilnius open data portal, enabling seamless programmatic access for developers and data users.

The rapid growth of invasive species and its impact on native flora and fauna is a significant ecological concern today. In response, the city of Vilnius is seeking effective solutions to contain and manage the spread of Sosnowski's hogweed, a hazardous plant that poses risks to human safety. The goal of this use case is to monitor and predict the expansion of invasive plants, allowing the city to implement control measures and eventually eradicate them.

The architecture of the Vilnius pilot's digital service is a comprehensive system designed to detect and predict the spread of Sosnowskyi, combining machine learning, environmental data, and web map visualization. It integrates multiple components into a seamless pipeline that processes raw data, generates predictions, and provides actionable insights through an interactive mapping platform. The figure outlines the whole pipeline.

○ *Figure 96 – UC15 – Digital service of Vilnius pilot.*



The pipeline begins with GPS coordinates collected from locations where Heracleum Sosnowskyi has been detected (labels). These data points serve as the foundation for the entire system. The collected labels are processed and stored in a central database, where it is used to train an AI algorithm capable of recognizing patterns and predicting the potential spread of the invasive species.

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The AI model analyzes environmental variables, including wind direction and wind displacement, which are critical in determining how seeds or particles from Heracleum Sosnowskyi may travel over time. By integrating these factors, the algorithm generates a dataset of shifted GPS coordinates, simulating how the species is likely to spread under specific conditions. This predictive capability is planned to be further enhanced by incorporating High Value Datasets (HVDs), the first being the output of the DS – invasive species HVD. This dataset is given more context through other HVDs such as natural framework, green spaces accessibility data in a user-friendly digital map. The contextual HVDs also have the potential to serve as input for prioritizing and planning drone flights to cover sensitive areas and collect data.

The output of this analysis is a refined map of both current locations and predicted future spread of Heracleum Sosnowskyi. This information is visualized through an intuitive mapping interface, enabling stakeholders to easily identify affected areas and prioritize eradication efforts. The map not only highlights existing infestations but also provides forward-looking insights that help planners and environmental managers allocate resources effectively and mitigate the ecological impact of the invasive species. The supporting HVDs show sensitive areas, where the reachability of greenspaces by citizens is high or showcase natural areas that need protection. This information could be helpful in setting priorities, planning data collection since it's not possible to cover the whole city with drones. The meteorological wind data is utilized to predict the possible spread of the invasive species identified in collected RGB images.

3.8.3. Baseline assessment

3.8.3.1. Rationale

The baseline assessment for the Vilnius pilot use case is essential for establishing a clear understanding of the current status and spread patterns of Sosnowski's hogweed within the city limits. Given the plant's rapid growth and potential to harm both human health and local ecosystems, this baseline will provide an initial, measurable framework to evaluate the effectiveness of monitoring and intervention efforts over time. By documenting the current distribution of the invasive species, this baseline will serve as a reference against which future data can be compared. Furthermore, the baseline assessment will aid in establishing an invasive species high-value dataset (HVD) that documents hogweed spread. This dataset will not only inform ongoing local efforts but will also enhance data accessibility for broader research and practical applications, including external stakeholders' utilization through the Image inference API.

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3.8.3.2. KPI selected

Table 38 – UC15 – Vilnius Pilot – Key Performance Indicators.

#	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics
KPI_VLN_1	How much additional data does the framework provide to stakeholders for better monitoring and predicting the expansion of invasion plants?	Ratio of data used by civil servants in their public services management processes related to invasive species after BeOpen compared to the baseline.	Survey	# of used datasets
KPI_VLN_2	How much additional data does the framework provide to stakeholders for better monitoring and predicting the expansion of invasion plants?	Ratio of data used by policymakers in their public services management processes related to invasive species after BeOpen compared to the baseline.	Survey	# of used datasets
KPI_VLN_3	Have new HVDs been made available for better monitoring and predicting the expansion of invasion plants?	# of new HVDs made available, which aid in dealing with invasive species.	External data sources	# of new datasets
KPI_VLN_4	To what extent have HVDs been made discoverable through European Union member states' open data portals for better monitoring and predicting the expansion of invasion plants?	HVD criteria score	BeOpen metrics	HVD criteria score
KPI_VLN_5	To what extent have HVDs been made discoverable through the European Data Portal with HVD for better monitoring and predicting the expansion of invasion plants?	Ratio of HVDs discoverable through the European Data Portal versus datasets that are not discoverable.	External data sources	# of datasets from ID Vilnius available through the portal
KPI_VLN_6	To what extent are HVDs reusable and available for better monitoring and predicting the expansion of invasion plants?	Ratio of HVDs related to better monitoring, eradication and predicting the expansion and that are reusable compared to the baseline.	External data sources	# of reusable HVD related to invasive species monitoring and prediction
KPI_VLN_7	Has civil servants' perceived quality of services increased with available HVDs for better monitoring and predicting the expansion of invasion plants?	Perceived quality of public services (Likert scale).	Survey	Likert scale
KPI_VLN_8	How many public services have been developed over the course of the BeOpen project with available HVDs for better monitoring and predicting the expansion of invasion plants?	# of public services developed in total over the course of the BeOpen project.	Project logs	# of public services developed
KPI_VLN_9	Is there the potential for additional services being developed beyond the end of the BeOpen project with available HVDs for better monitoring and predicting the expansion of invasion plants?	Perceived likelihood of further services being developed.	Survey/Interviews	Likert scale
KPI_VLN_10	Was BeOpen worth the invested time and effort designing, developing, and implementing solutions with	Perceived costs and benefits of use case.	Survey/Interviews	Likert scale

#	Evaluation question	KPI - Indicator	Source (means of verification)	Metrics
	available HVDs for better monitoring and predicting the expansion of invasion plants?			
KPI_VLN_11	Was BeOpen worth the invested time and effort in improving public services management processes with available HVDs for better monitoring and predicting the expansion of invasion plants?	Actual costs of public services management processes before and after BeOpen.	Survey/Interviews	Likert scale
KPI_VLN_12	To what extent can BeOpen contribute to reduce Sosnowski's hogweed invasion?	Sosnowski hogweed invasion reduction by 50% and the perceived possible benefit of preventing the emergence of other invasive species in Vilnius territory.	Interviews	Likert scale
KPI_VLN_13	To what extent can BeOpen provide a better forecast of the spread of invasive species based on wind, temperature, surface temperature, and plants' vegetation data?	Qualitative assessment after the use case (Likert scale).	Statistics	ML quality metrics
KPI_VLN_14	To what extent is the granularity of BeOpen data sufficient for policymaking on better monitoring and predicting the expansion of invasion plants?	Perceived necessary level of data granularity for policymaking.	Interviews	Likert scale
KPI_VLN_15	How complete are the provided datasets in relation to policy needs for better monitoring and predicting the expansion of invasion plants?	# of desired datasets found missing from the available data.	Interviews	Likert scale
KPI_VLN_16	How complete are the provided datasets in relation to selected public services management processes for better monitoring and predicting the expansion of invasion plants?	# of desired datasets found missing from the available data.	Interviews	Likert scale
KPI_VLN_17	How useful is it to use HVDs in public services management processes for better monitoring and predicting the expansion of invasion plants?	% of public authorities/policymakers/critical stakeholders indicating the usefulness of HVDs for public services management processes.	Interviews to public authorities/ policymakers/ critical stakeholders	Likert scale
KPI_VLN_18	To what extent is the existing technological infrastructure adequate for the development, deployment and maintenance of AI-based services that use available HVDs for better monitoring and predicting the expansion of invasion plants?	Degree of adequacy of existing technological infrastructure for AI-applications management processes.	Interviews	Likert scale
KPI_VLN_19	To what extent is the chosen AI-driven approach scalable and flexible using available HVDs for better monitoring and predicting the expansion of invasion plants?	be adaptable to changing urban conditions and needs of the use case.	Interviews	Likert scale
KPI_VLN_20	To what extent is the chosen AI-driven approach scalable and flexible using available HVDs for better monitoring and predicting the expansion of invasion plants?	be adaptable to be adopted for other public services management processes.	Interviews	Likert scale

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3.8.3.3. Other data and physical measures

According to the invasive species in Lithuania dataset that is owned by the Ministry of Environment, the area Sosnowski hogweed occupies in the city is 411395 square meters. The observations in Vilnius territory were made mostly in 2020-2021, but the weed is still findable in observed areas in the orthophoto of the city in 2022. Some of the areas were used in collection of drone data.

3.8.3.4. Stakeholder group

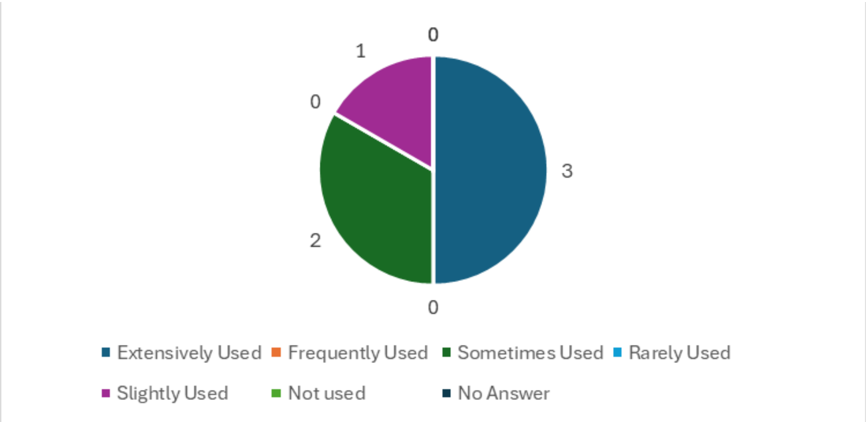
The selected stakeholder is part of Vilnius city municipality and coordinates all eradication processes in the city. The main contact person has been aiding ID Vilnius with data collection.

3.8.3.5. Results of the survey

The survey aimed to establish baseline metrics regarding the use and impact of High-Value Datasets (HVDs) in the context of smart city management within the Vilnius City pilot use case. The survey responses, completed by a single stakeholder, provide critical insights into the initial conditions prior to the implementation of the BeOpen framework.

Key categories of HVDs, such as Geospatial Data, Earth Observation Data, and Mobility Data, were reported as extensively or frequently utilized. Geospatial Data and Mobility Data were identified as extensively used resources, emphasizing their importance in urban planning and transport infrastructure. Meanwhile, Meteorological and Climate Data, along with Statistical Data, were cited as "sometimes used," highlighting moderate integration into decision-making processes. The city has not yet created many solutions utilizing weather related data. Most of what is created is usually part of a once-a-year analysis mostly used by city planners. A lot of current solutions in the making are highly focusing on mobility data.

Figure 97 – UC15 – Different HVD categories usage by Vilnius municipality.



Respondents consistently rated Geospatial Data, Earth Observation Data, and Mobility Data as "critical" to the effective management of smart city functions, reflecting their integral role in urban planning, environmental monitoring, and transport systems.

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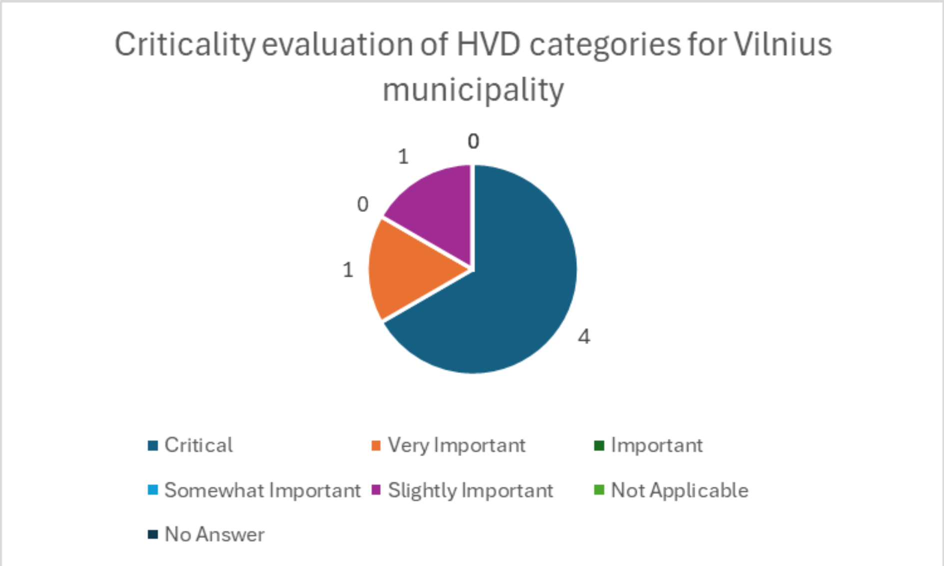
Statistical Data was also rated as critical, underscoring its value in informing policy and market analysis. However, data related to Companies and Company Ownership was deemed slightly important, indicating limited immediate relevance to the respondent's operational focus.

Figure 98 – UC15 – Criticality evaluation of HVD categories for Vilnius municipality.



Before the BeOpen project, the data quality was assessed as "moderate," with room for improvement in areas such as accuracy and timeliness. No HVDs are currently used for managing the invasive species. Data accessibility was rated as "good," indicating relatively easy retrieval and use, with minimal technical barriers to integration. Normally most of the Sosnowski locations come from local citizens and councillors' reports. Local authorities and their genuine work are very important, as well as creating a system that is attractive to citizens of all technical backgrounds. Therefore, for the specific challenge of monitoring and combating invasive species like Sosnowski's hogweed, the respondent acknowledged the presence of existing data management solutions. These solutions were rated as "moderately effective," suggesting a satisfactory but not comprehensive impact on addressing invasive species management challenges. The current datasets used are from two different platforms (national and city scale) with ROIs (regions of interest) from different time periods.

■

3.8.4. Baseline assessment

Vilnius city municipality has long been using citizen reports and national datasets to plan their invasive species management processes. Often private landowners are difficult to collaborate with and these areas have higher potential to be susceptible to the spread of invasive species. The councillors of different parts of the city have varying computer skills which hinders effective reporting and renewal of information. Even if a solution seems simple, workshops and engagement with the local authorities would need to be in place.

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Data scattering across different platforms does not help the situation. The pilot intends to have a dataset that would be constantly renewed and would not require additional outside information that is also dated. The maps of Vilnius are flooded with data and sometimes hard to navigate, even with thematic maps separated. The Sosnowski hogweed locations should be available to everyone, but the map for management – separate with as minimal and well-thought-out selection of layers as possible, integrating already available data that the stakeholder and civil servants are already familiar with.

The city has yet to fully utilize meteorological data, most likely due to the fact that it is not as abundant as other types of data (geospatial, mobility). ID Vilnius has bought data from mobile operators and is currently researching and implementing mobility related solutions and services quite heavily. The BeOpen pilot is a chance to delve deeper into lesser-known data as to further expand the knowledge base for future expansion of data driven devices in city infrastructure. All datasets related to city planning like the geospatial HVDs and earth observation data are highly used not only in the municipality, but also the enterprises in close collaboration with it as separate, or internal units. Many solutions have been created for management of street infrastructure and road quality, monitoring of containers, parking spaces and the environmental theme is relatively new and currently is not as highly supported as other thematics.

Overall, the stakeholder is satisfied with the existing solutions, mainly because they lack such technical knowledge themselves. Companies such as ID Vilnius help them see the vision on how the solutions could be improved, what services could be created and what good it can bring to the city.

4. The aggregated analysis of the baseline survey in all eight pilot cities

4.1. Introduction

The baseline survey conducted as part of the BeOpen project aimed to establish an initial understanding of the current state of open data practices and the utilisation of high-value datasets (HVDs) among participating smart cities. This survey serves as a foundational step in assessing the readiness, challenges, and opportunities for cities in adopting and leveraging HVDs to enhance smart city applications.

In the analysis, we will present the aggregated data from the survey, providing a snapshot of the current landscape. Key areas of focus include the availability and accessibility of high-value datasets, the technical and organisational capabilities of cities to manage these datasets, and the perceived barriers to implementation. Quantitative results will be complemented by a brief commentary to contextualise the findings, highlighting trends, disparities, or noteworthy observations that may inform subsequent phases of the project. This initial analysis will guide further efforts in tailoring interventions and developing frameworks that align with the needs and realities of the participating cities.

The baseline analysis will serve as a reference point for the subsequent impact assessment, which will evaluate the benefits of implementing high-value datasets and smart applications in the participating cities. By comparing the impact assessment findings with the baseline, we will identify measurable progress and key areas for further improvement, ensuring an evidence-based approach to policy and practice development.

The comparison between the baseline and the impact assessment will also include an evaluation of the effects of newly implemented digital services developed within BeOpen. This will allow the quantification of how these services, which leverage high-value datasets, contribute to enhancing urban operations, citizen engagement, and overall smart city functionality.

4.2. High Value Datasets pre-existing the BeOpen implementation

4.2.1. Geospatial datasets

The baseline survey examined how geospatial high-value datasets were being utilised across the eight pilot cities. These datasets, which include maps, property boundaries, and transport networks, form the backbone of urban planning and decision-making processes, facilitate navigation, environmental monitoring, and infrastructure development.

The mode or most frequently selected categories for the use of geospatial data are **"Extensively Used"** and **"Frequently Used"**, each representing approximately 24% of the responses, showing that a significant proportion of cities were already leveraging geospatial data extensively or frequently for mobility and urban space

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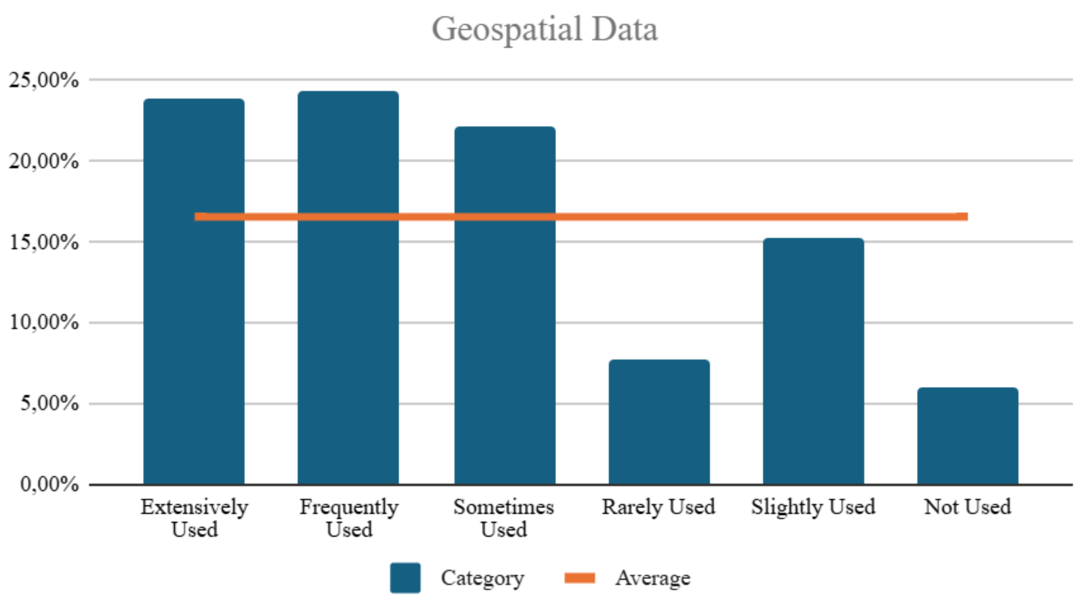
decision-making prior to the BeOpen project, demonstrating the dominant role of geospatial data in urban planning and related activities and its critical importance for navigation, environmental monitoring, and infrastructure planning (Figure 99).

Figure 99 – Aggregated answers to Question 1 (Baseline) for Geospatial Data: "To what extent are the following categories of High Value Datasets (HVDs) used in your city's mobility and urban space decision-making environment previous to the BeOpen project experience?"



4.2.2. Earth observation and environmental datasets

Focusing on Earth Observation and Environmental data, the baseline survey assessed their use in the eight pilot cities to support environmental monitoring and urban resilience. These datasets are indispensable for tracking ecological changes and informing strategies for sustainable urban development.

The mode or most frequently selected category for the use of these datasets is "Sometimes Used" representing 27% of responses (Figure 100). This suggests a moderate level of integration of Earth Observation and Environmental datasets in urban space decision-making prior to the BeOpen project. Additionally, 22% of stakeholders reported "Frequently Used" while only 15% indicated "Extensively Used" reflecting that the widespread application of these datasets is still in development. However, their role remains vital for informed urban planning, environmental monitoring, and addressing sustainability challenges in cities.

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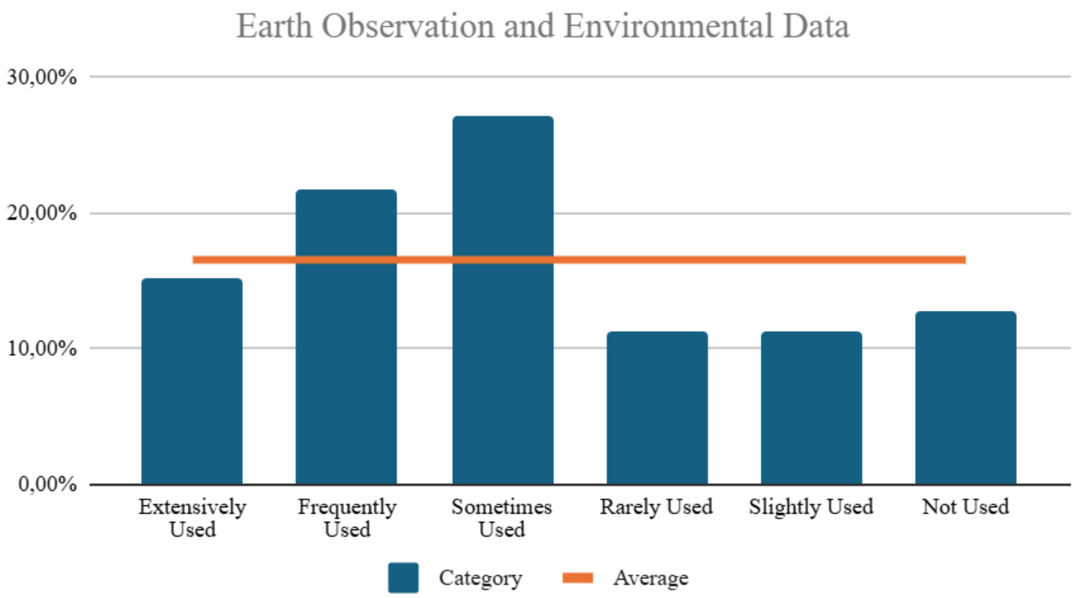
Figure 100 – Aggregated answers to Question 1 (Baseline) for Earth Observation and Environmental Data: "To what extent are the following categories of High Value Datasets (HVDs) used in your city's mobility and urban space decision-making environment previous to the BeOpen project experience?"



4.2.3. Meteorological and climate datasets

The baseline analysis targeted meteorological and climate datasets, exploring their role in climate monitoring, forecasting, and resilience planning. These datasets are vital for enabling cities to address environmental challenges and adapt to changing climatic conditions effectively.

The mode or most frequently selected category for the use of these datasets is "Sometimes Used" representing 27% of responses (Figure 101). This indicates a moderate level of reliance on meteorological and climate data for urban space decision-making prior to the BeOpen project. Additionally, 19% of stakeholders reported "Frequently Used", while only 14% indicated "Extensively Used" highlighting that these datasets, while critical for addressing climate challenges and supporting urban planning, are not yet fully integrated into decision-making processes across the pilot cities. Their use is essential for enhancing climate resilience, forecasting, and environmental adaptation strategies.

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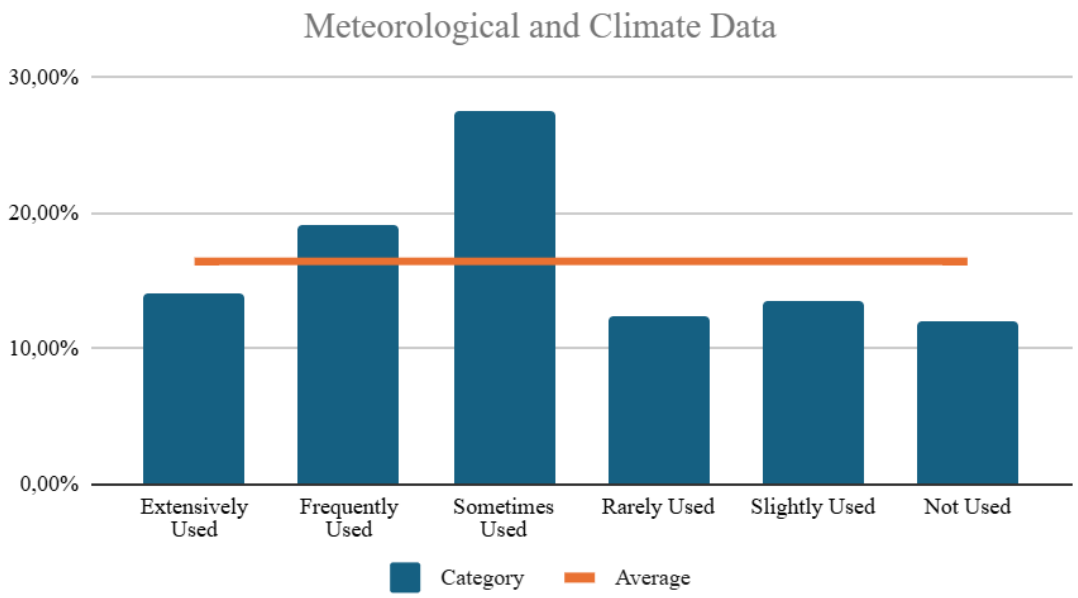
Figure 101 – Aggregated answers to Question 1 (Baseline) for Meteorological and Climate Data: "To what extent are the following categories of High Value Datasets (HVDs) used in your city's mobility and urban space decision-making environment previous to the BeOpen project experience?"



4.2.4. Statistics datasets

Investigating the use of economic, social, and demographic datasets, the survey shed light on their application across the eight pilot cities. These datasets provide critical insights into population trends, economic conditions, and social structures, serving as a foundation for evidence-based urban policymaking.

The mode or most frequently selected category for the use of these datasets is "Sometimes Used" representing 32% of responses (Figure 102). This indicates a moderate level of application of such data in urban space decision-making prior to the BeOpen project. Additionally, 22% of stakeholders reported "Frequently Used", while only 5% indicated "Extensively Used", showing limited integration of these critical datasets into comprehensive decision-making processes. Their use is fundamental for addressing socio-economic challenges, enhancing demographic analysis, and improving the alignment of policies with urban needs.

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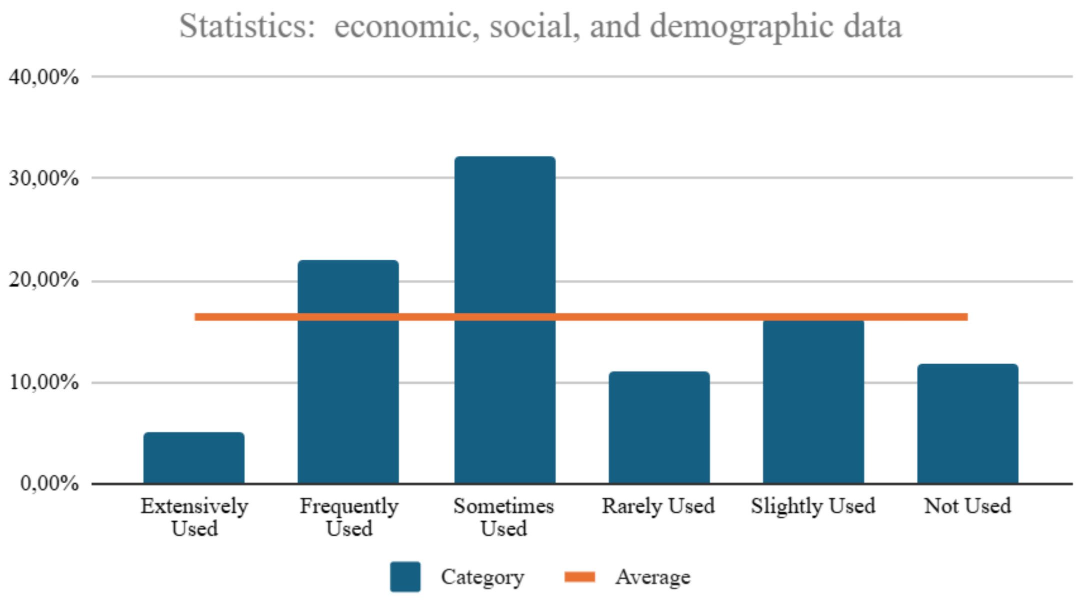
Figure 102 – Aggregated answers to Question 1 (Baseline) for Statistics: Includes economic, social, and demographic data: "To what extent are the following categories of High Value Datasets (HVDs) used in your city's mobility and urban space decision-making environment previous to the BeOpen project experience?"



4.2.5. Company and companies ownership datasets

The baseline survey explored the availability and application of datasets related to companies and their ownership structures within the pilot cities. These datasets are key to understanding business operations and economic activities, which can guide urban governance and economic planning.

The mode or most frequently selected category for the use of these datasets is "Slightly Used", representing 29% of responses (Figure 103). This suggests a limited level of integration of company-related data into urban space decision-making prior to the BeOpen project. Additionally, 24% of stakeholders reported "Sometimes Used", while only 2% indicated "Extensively Used", highlighting the minimal reliance on these datasets despite their potential value in fostering economic development and enhancing business-related policymaking processes. Their use could be instrumental in understanding local economies and informing strategic decisions to support urban growth.

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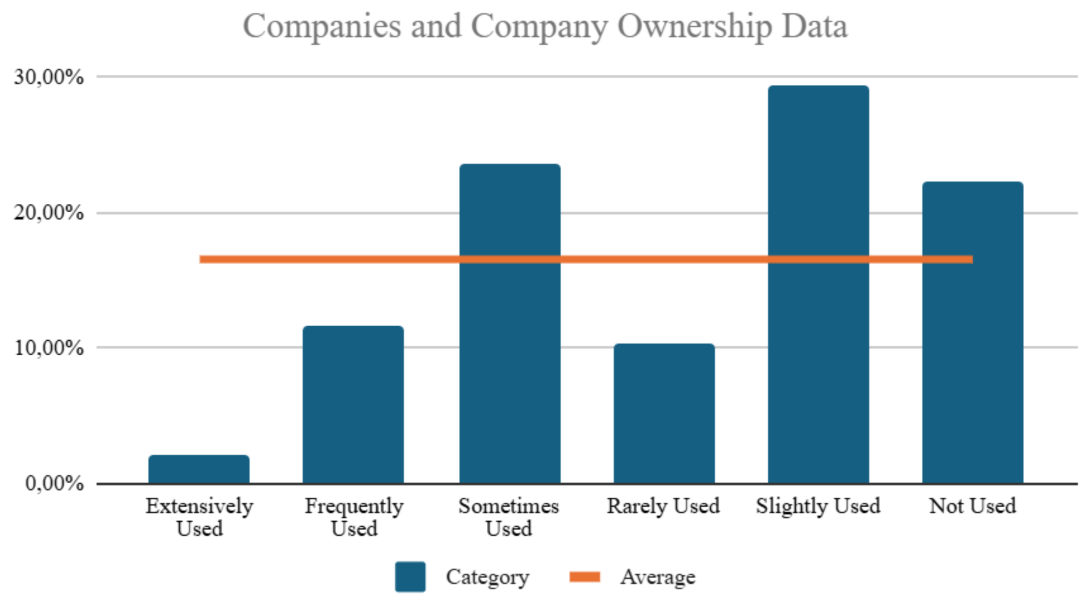
Figure 103 – Aggregated answers to Question 1 (Baseline) for Companies and Company Ownership Data: "To what extent are the following categories of High Value Datasets (HVDs) used in your city's mobility and urban space decision-making environment previous to the BeOpen project experience?"



4.2.6. Mobility datasets

Evaluating mobility datasets, the baseline survey revealed their significance in tracking transport patterns, infrastructure use, and mobility trends. These datasets enable cities to develop smarter transportation systems and promote sustainable mobility solutions.

The mode or most frequently selected category for the use of these datasets is "Frequently Used", representing 22% of responses (Figure 104). This highlights a relatively strong reliance on mobility data in urban decision-making prior to the BeOpen project. Additionally, 19% of stakeholders reported "Extensively Used", while 17% indicated "Sometimes Used", showcasing a fairly balanced integration of these datasets. Despite this, there is still room to enhance their application for optimising transport systems and fostering smarter, more sustainable mobility solutions.

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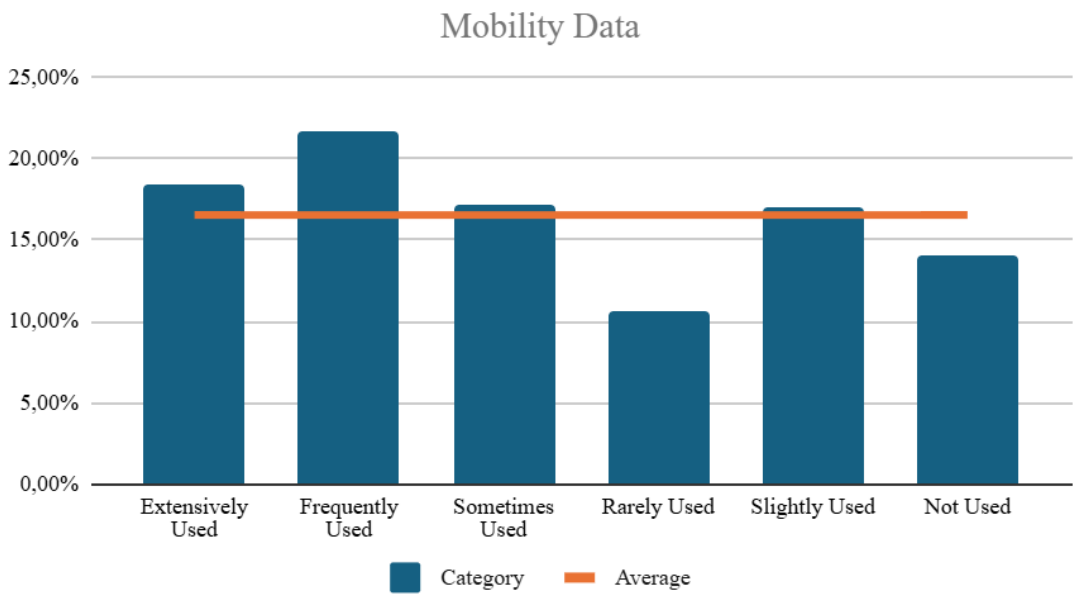
Figure 104 – Aggregated answers to Question 1 (Baseline) for Mobility Data: "To what extent are the following categories of High Value Datasets (HVDs) used in your city's mobility and urban space decision-making environment previous to the BeOpen project experience?"



4.3. Assessment of the critical importance of different types of High Value Datasets in the eight pilot cities

4.3.1. The critical importance of geospatial data

The survey emphasised the indispensable role of geospatial datasets in urban planning. By providing comprehensive information on geographic location and infrastructure, these datasets enable cities to make informed decisions that enhance navigation, environmental monitoring, and strategic planning.

The mode or most frequently selected category is "Very Important", representing 39% of responses, followed by "Critical" at 31% (Figure 105). This underscores the significant reliance on geospatial datasets for urban space decision-making. An additional 21% of stakeholders rated these datasets as "Important", while only 8% considered them "Somewhat Important", and none regarded them as "Slightly Important" or "Not applicable". These findings highlight the essential role of geospatial data in navigation, environmental monitoring, and infrastructure planning, reaffirming its central importance in urban contexts.

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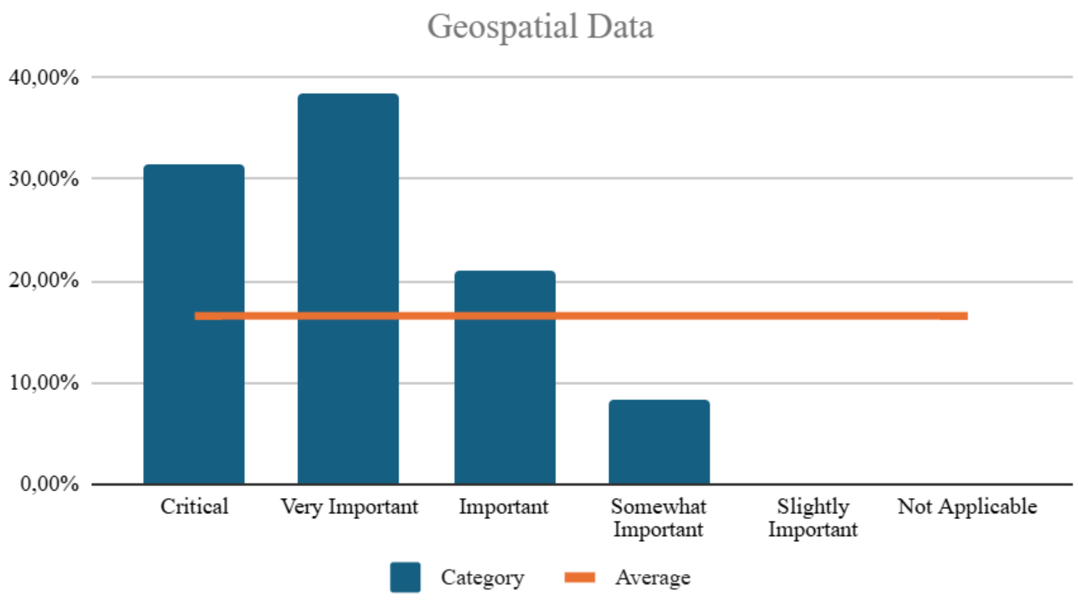
Figure 105 – Aggregated answers to Question 2 (Baseline) for Geospatial Data: "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



4.3.2. The critical importance of earth observation and environmental data

The analysis highlighted the essential role of Earth Observation and Environmental datasets in promoting sustainable urban development. These datasets help cities monitor environmental changes and implement resilience strategies that address pressing ecological challenges.

The mode or most frequently selected category is "Very Important", representing 43% of responses, followed by "Important" at 26% and "Critical" at 20% (Figure 106). This indicates a strong recognition of the value of these datasets in urban decision-making. Only 6% of respondents considered them "Somewhat Important" and 3% rated them as "Slightly Important", with none deeming them "Not Applicable". These findings highlight the growing importance of leveraging environmental data to address sustainability and resilience challenges in urban settings.

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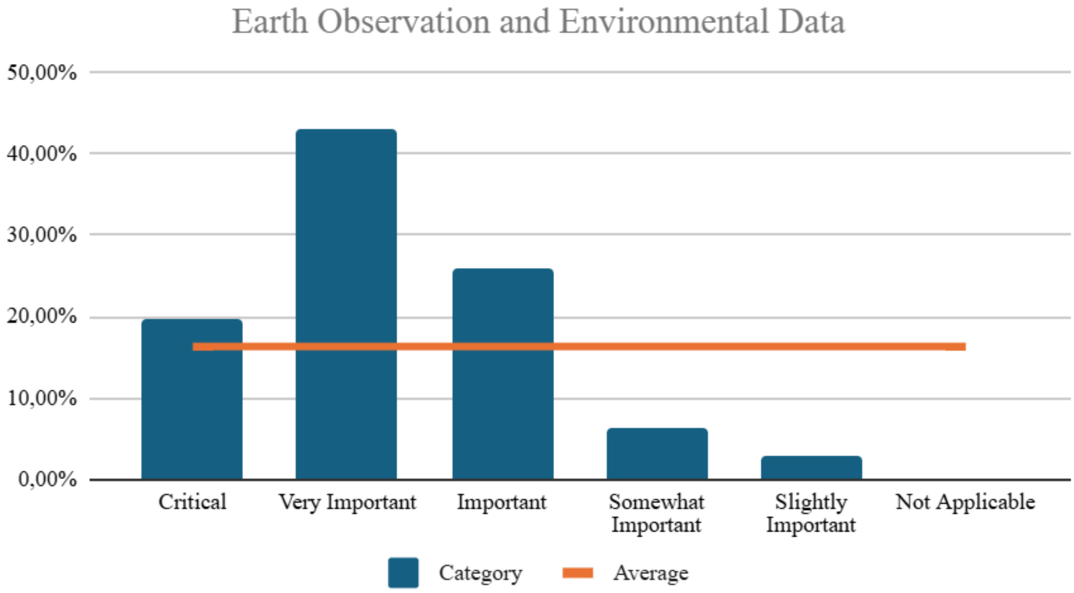
Figure 106 – Aggregated answers to Question 2 (Baseline) for Earth Observation and Environmental Data: "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



4.3.3. The critical importance of Meteorological and Climate Data

Assessing meteorological and climate data, the baseline survey showcased their importance in building urban resilience. These datasets empower cities to forecast climatic trends and respond effectively to environmental shifts, supporting long-term sustainability goals.

The mode or most frequently selected category is "Very Important" accounting for 47% of responses, followed by "Important" at 22% and "Critical" at 19% (Figure 107). A smaller proportion of stakeholders rated these datasets as "Somewhat Important" (7%) or "Slightly Important" (2%), with only 1% considering them "Not Applicable". This underscores the significant role of meteorological and climate data in fostering climate resilience and guiding sustainable urban development strategies.

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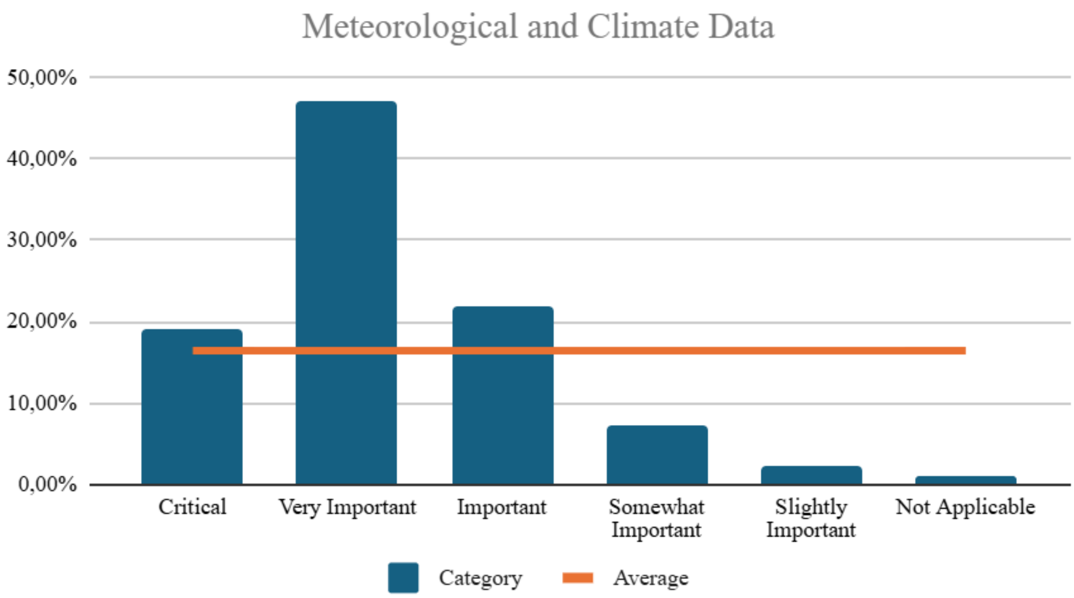
Figure 107 – Aggregated answers to Question 2 (Baseline) for Meteorological and Climate Data: "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



4.3.4. The critical importance of statistical economic, social, and demographic data

The survey underlined the importance of economic, social, and demographic datasets in shaping urban policies. These datasets offer valuable insights into societal dynamics and economic conditions, enabling cities to craft inclusive and growth-oriented strategies.

The mode or most frequently selected category is "Very Important," representing 43% of responses, followed by "Important" at 33% and "Critical" at 10% (Figure 108). A smaller proportion of respondents rated these datasets as "Somewhat Important" (7%) or "Slightly Important" (5%), with only 1% considering them "Not Applicable". These findings highlight the central role these datasets play in shaping informed policies and addressing socio-economic challenges in urban areas.

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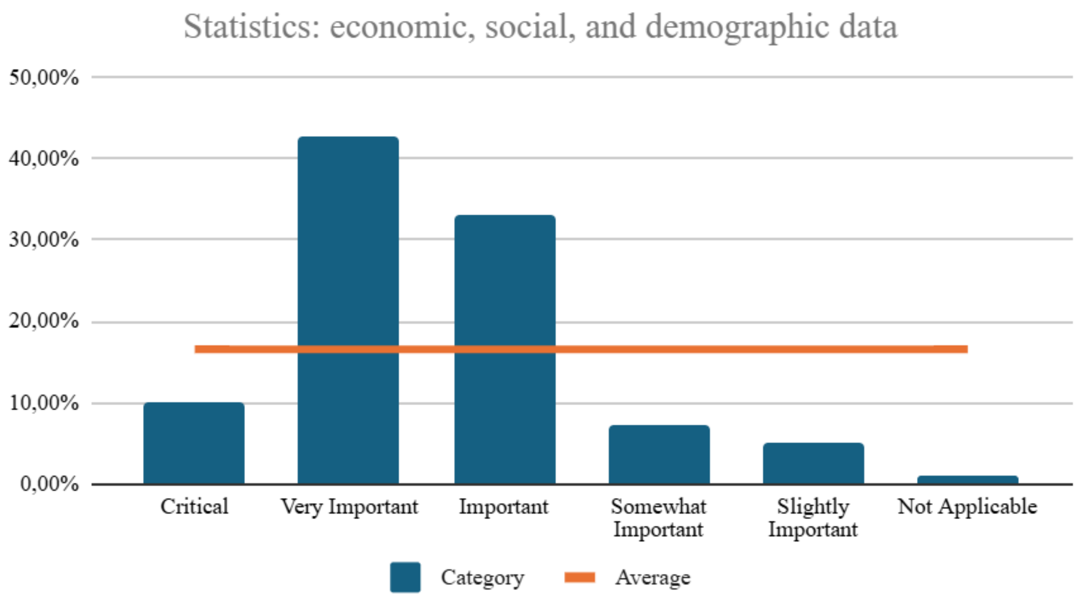
Figure 108 – Aggregated answers to Question 2 (Baseline) for Statistics Data: "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



4.3.5. The critical importance of companies and company ownership data

Highlighting company-related datasets, the survey revealed their utility in economic governance and business strategy development. These datasets provide a clear picture of ownership structures and economic activity, which are essential for informed decision-making.

The mode or most frequently selected category is "Very Important", accounting for 34% of responses, followed by "Important" at 26% (Figure 109). Additionally, 18% of respondents rated these datasets as "Slightly Important", while 16% considered them "Somewhat Important" and only 1% marked them as "Critical". These results reflect a moderate recognition of the value of these datasets, highlighting the potential for greater integration to support urban economic planning and governance strategies.

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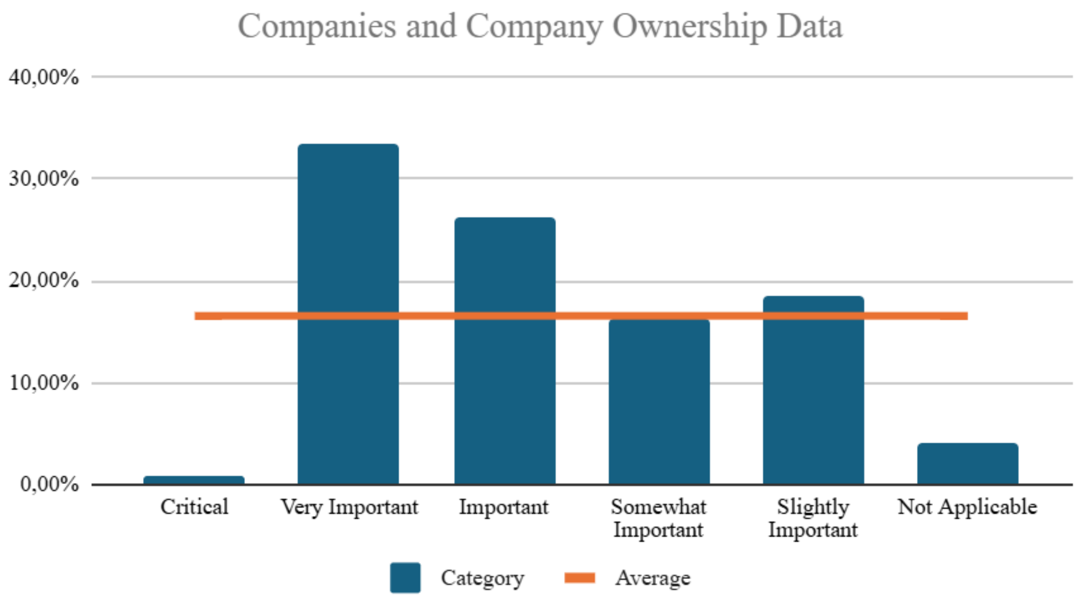
Figure 109 – Aggregated answers to Question 2 (Baseline) for Companies and Company Ownership Data: "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



4.3.6. The critical importance of Mobility Data

The analysis reaffirmed the significance of mobility datasets in urban transport planning. These datasets allow cities to optimise infrastructure use, track transportation patterns, and implement sustainable mobility initiatives.

The mode or most frequently selected category is "Very Important," representing 40% of responses, followed by "Critical" at 29% and "Important" at 21% (Figure 110). Only 1% of stakeholders rated these datasets as "Somewhat Important" or "Slightly Important", while 8% marked them as "Not Applicable". These findings highlight the essential role of mobility data in shaping sustainable transport systems and enhancing urban mobility solutions.

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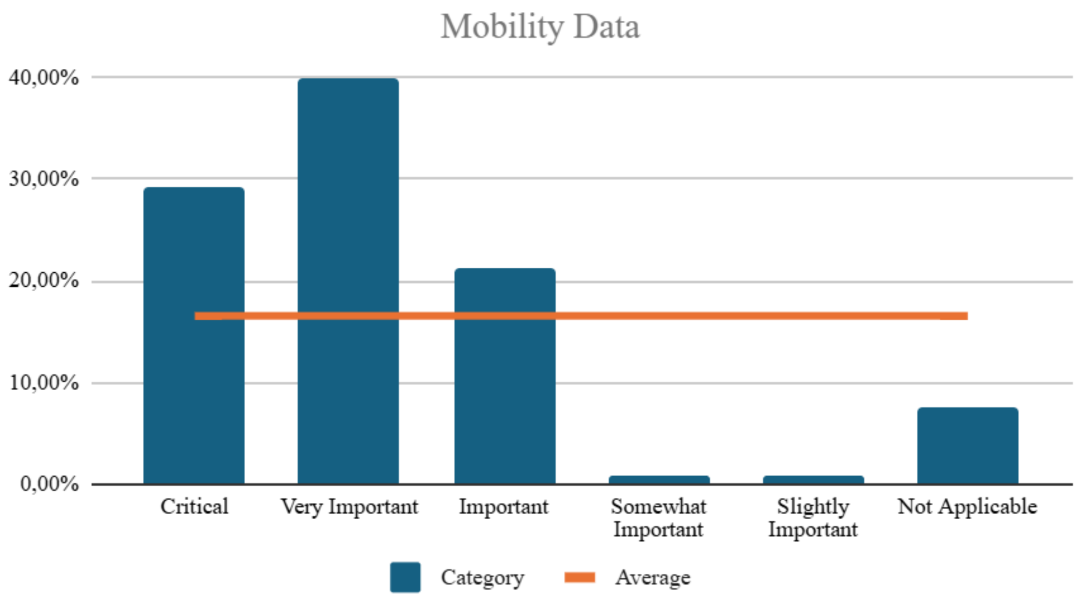
Figure 110 – Aggregated answers to Question 2 (Baseline) for Mobility Data: "How critical are the following categories of High Value Datasets (HVDs) for the effective management of smart city functions and the delivery of smart services?"



4.3.7. The current availability of data management solutions for mobility infrastructure and public urban space

The survey examined the effectiveness of data management solutions in mobility infrastructure and urban space. These tools are critical for enabling data-driven strategies that enhance decision-making and optimise urban transport systems.

The mode or most frequently selected category is "Moderately Effective" representing 35% of responses (Figure 111). This is followed by "Very Effective" at 13% and "Slightly Effective" at 12%, while only 3% of respondents considered these solutions "Completely Ineffective". Notably, none of the cities rated their data management solutions as "Extremely Effective", suggesting room for improvement in optimising these systems to better support urban transport planning.

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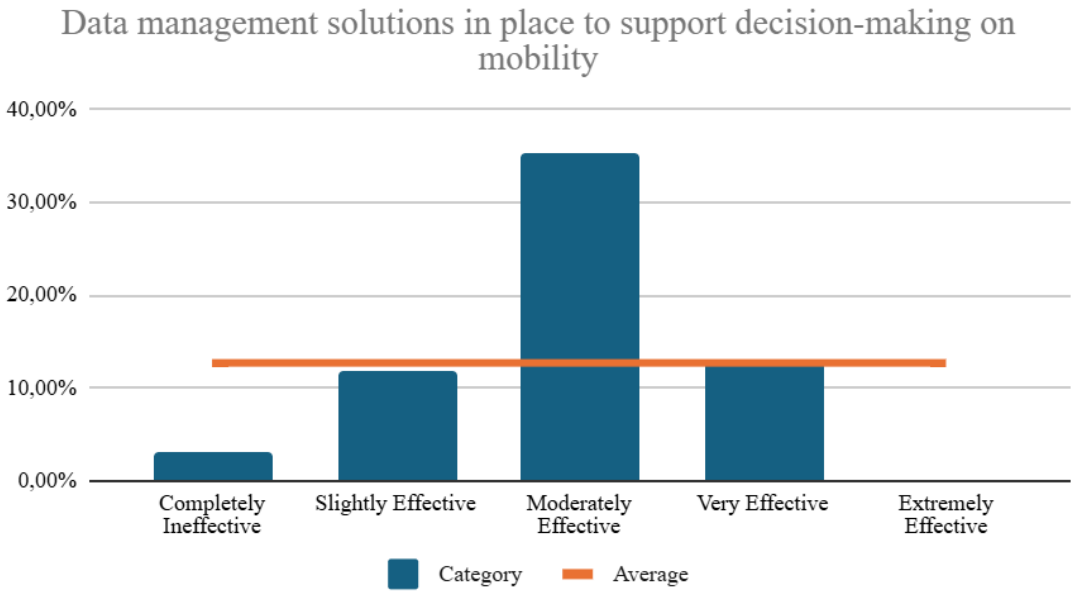
Figure 111 – Aggregated answers to Question 3 (Baseline): "Are currently data management solutions in place to support decision-making on the Region and citizen's participation to public decisions focused on mobility infrastructure and public urban space? If yes, the solution currently in use is:"



4.4. Current situation in terms of High Value Datasets and digital services in the pilot cities

4.4.1. HVDs in use to support decision-making and citizens' participation on the Region focused on mobility infrastructure and public urban space

The baseline investigated how high-value datasets support decision-making and citizen participation in mobility infrastructure and urban spaces. These datasets play a pivotal role in enabling cities to address urban challenges and engage with their citizens more effectively.

The mode or most frequently selected category is "Moderately Effective", representing 24% of responses (Figure 112). This is followed by "Slightly Effective" at 16% and "Very Effective" at 15%, while 3% of respondents considered the datasets "Extremely Effective". Only 1% rated them as "Completely Ineffective". These results highlight a mixed perception of HVDs' impact, indicating their potential but also the need for more refined integration into decision-making processes to maximise their effectiveness.

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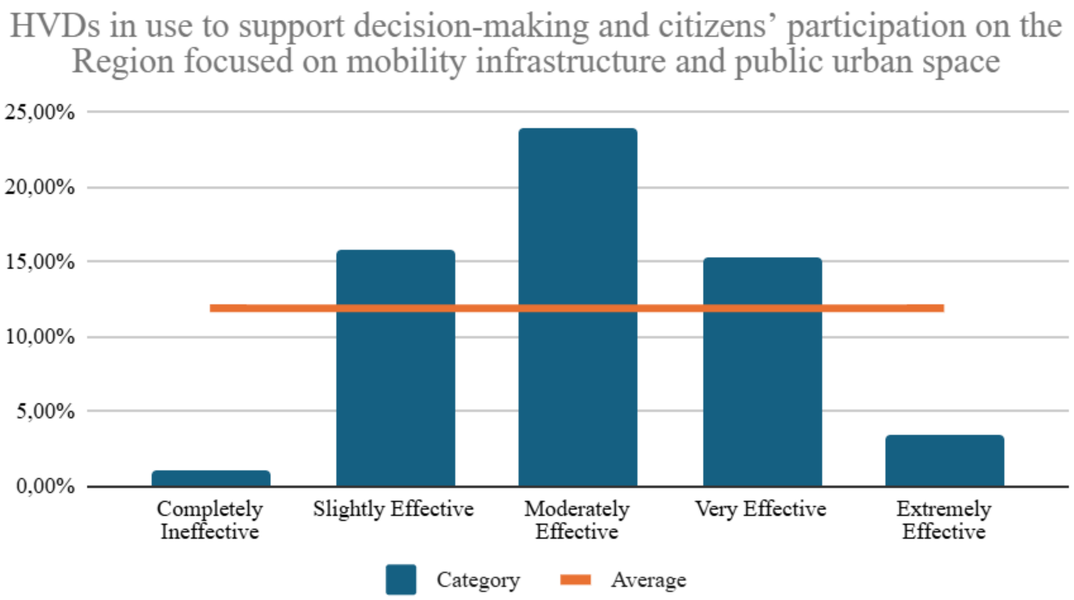
Figure 112 – Aggregated answers to Question 4 (Baseline): "Are there HVDs in use to support decision-making and citizens' participation in the Region focused on mobility infrastructure and public urban space? How would you rate the contribution of these high-value datasets (HVDs) to the effectiveness of decision-making on the Region in the field of mobility infrastructure and public urban space?"



4.4.2. Rating the data quality in the Region before the BeOpen pilot experimentation

Evaluating the quality of datasets in the Region use case, the survey assessed how well existing data met decision-making requirements. High-quality datasets are crucial for ensuring accurate analysis and effective urban planning.

The mode or most frequently selected category is "Moderate Quality," representing 46% of responses (Figure 113). This is followed by "Poor Quality" at 26% and "Good Quality" at 16%, while 11% of respondents rated the data as "Very Poor Quality" and only 1% considered it "Excellent Quality". These findings reveal a significant gap in data quality, underscoring the need for improvement to enhance the effectiveness of regional decision-making processes and optimise the use of high-value datasets.

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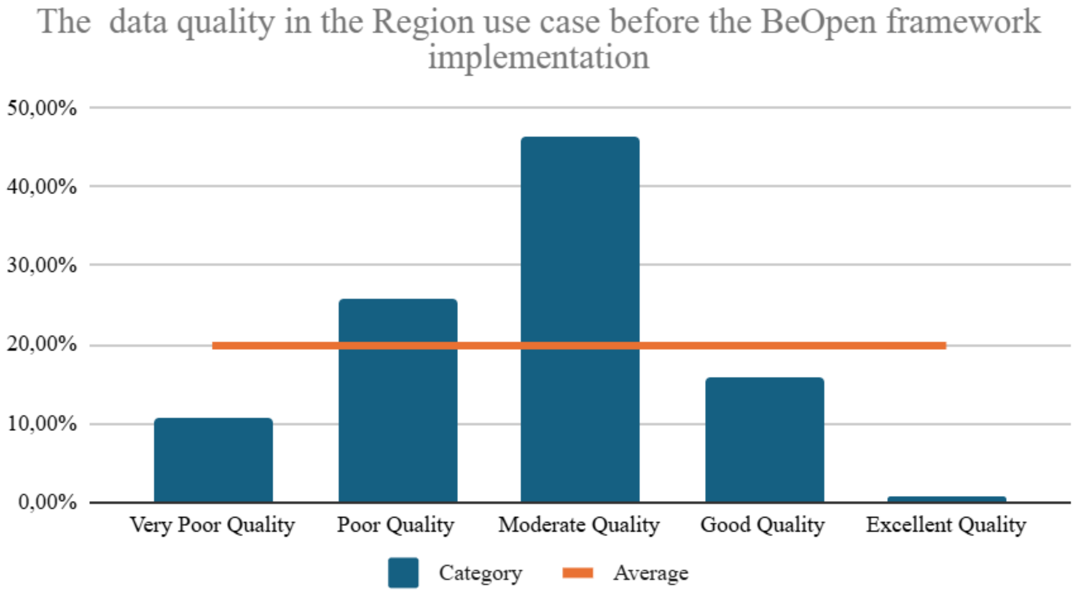
Figure 113 – Aggregated answers to Question 5 (Baseline): "How would you rate the data quality in the Region use case before the BeOpen framework implementation, considering aspects such as accuracy, timeliness of updates, management, and appropriateness for supporting decision-making processes?"



4.4.3. Rating the data accessibility in the Region and the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility

The survey focused on data accessibility in the Region use case, highlighting the ease of data retrieval and use. Accessible datasets are fundamental to enable seamless decision-making and foster collaboration among urban stakeholders.

The mode or most frequently selected category is "Moderate Accessibility", accounting for 35% of responses (Figure 114). This is followed by "Poor Accessibility" and "Good Accessibility" each at 23%, while 15% of respondents rated accessibility as "Very Poor" and only 4% considered it "Excellent". These results underscore the uneven state of data accessibility across the Regions, indicating the need for improvements to enable more seamless access and better utilisation of high-value datasets.

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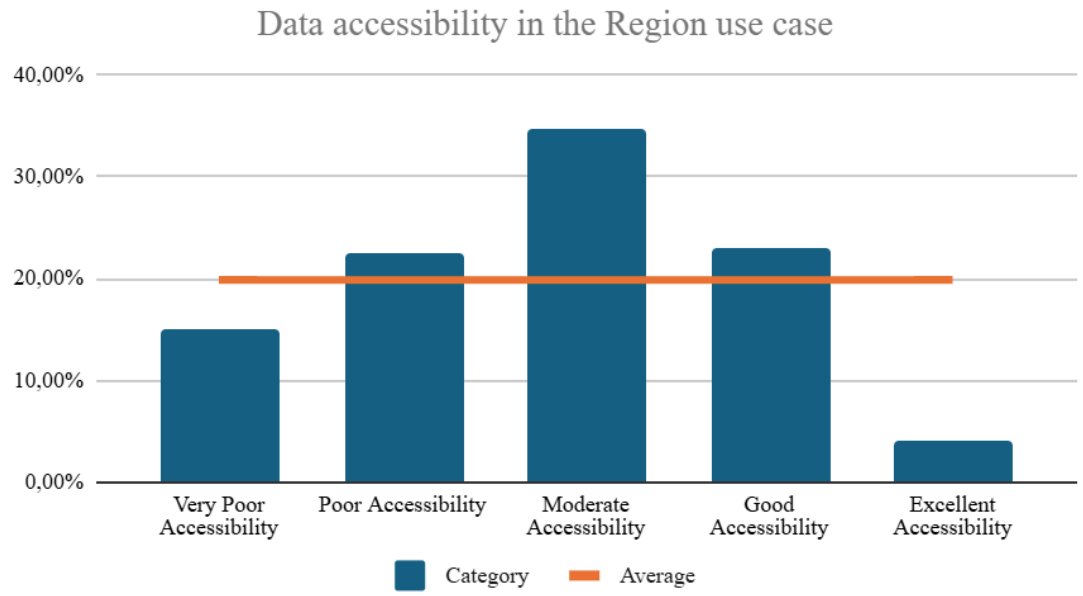
Figure 114 – Aggregated answers to Question 6 (Baseline): "How would you rate the data accessibility in the Region use case, considering the qualitative aspects of retrieval, ease of use, technical interoperability, and compatibility with existing systems to support decision-making processes?"



4.4.4. The number of datasets available as HVDs before the start of the BeOpen project

The baseline survey investigated the number of datasets classified as high-value datasets available in the pilot cities before the BeOpen project. The availability of multiple datasets is critical for supporting comprehensive urban analysis and informed decision-making.

The mode or most frequently selected category is "2 datasets", representing 23% of responses (Figure 115). This is followed by "0 datasets" at 17% and "1 dataset" at 16%, while fewer respondents reported having access to 3 datasets (14%), 4 datasets (10%), 5 datasets (11%), or more than 5 datasets (8%). These findings suggest a limited initial availability of HVDs, highlighting the need for expanded access and integration of such datasets to support enhanced urban decision-making processes.

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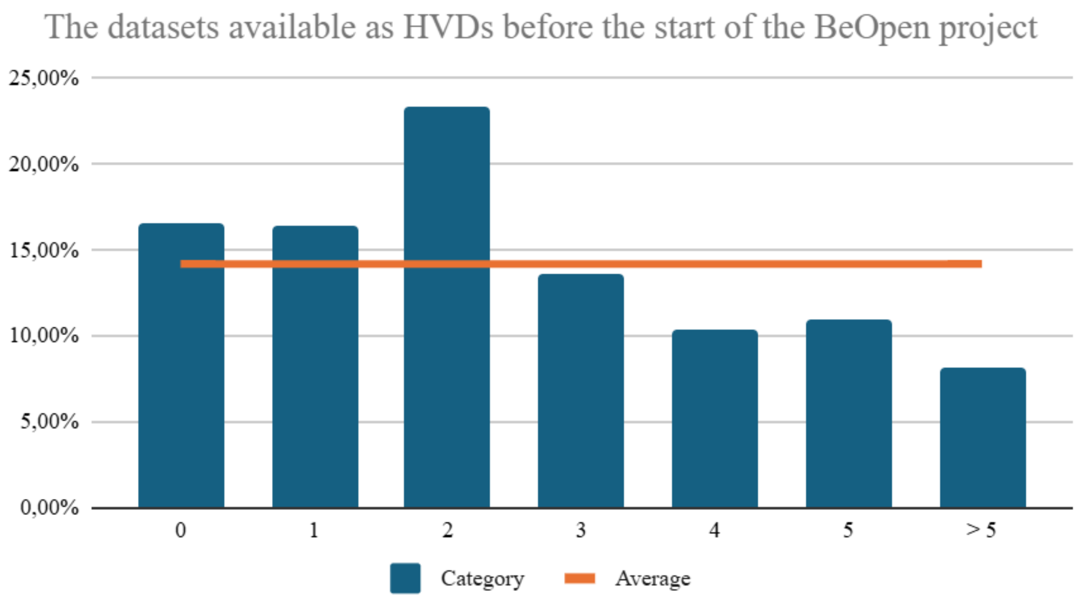
Figure 115 – Aggregated answers to Question 7 (Baseline): "How many datasets were available as HVDs before the start of the BeOpen project?"



4.5. Conclusions of the aggregated baseline survey analysis

The baseline survey conducted as part of the BeOpen project provided a comprehensive analysis of the current landscape regarding high-value datasets (HVDs) and their application in smart city decision-making across the eight pilot cities. This investigation revealed the state of availability, accessibility, quality, and effectiveness of data, highlighting both existing challenges and significant opportunities for improvement. It also rated the critical importance of existing and prospective datasets as well as their number and rating of their quality.

Geospatial data emerged in the views of stakeholders of the eight cities as a critical resource, with its frequent or extensive use reflecting its central role in urban planning, navigation, and infrastructure management. Meteorological, environmental, and statistical datasets are attributed moderate to high levels of importance, underscoring their value in addressing climate resilience, sustainability, and socio-economic challenges. However, the integration of company-related data and mobility datasets demonstrated gaps in widespread adoption, emphasizing the need for better tools and strategies to leverage their potential fully.

Despite the evident recognition of the importance of these datasets by stakeholders of the BeOpen pilots, issues with data quality and accessibility remain pressing. A significant portion of the respondents identified their data as being of moderate quality and accessibility, with a smaller number rating these aspects as either good or poor. These findings suggest uneven performance in data management across the pilot cities, limiting the full utilisation of HVDs in enhancing decision-making processes.

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The evaluation of data management solutions further reinforced these observations, with the majority rating them as only moderately effective. While some systems were perceived as very effective, the absence of an “extremely effective” rating highlights the scope for improving the technical infrastructure supporting data use. Similarly, the effectiveness of HVDs in fostering citizen participation and supporting mobility-related decision-making was found to be mixed, indicating the need for more refined integration approaches.

Another notable insight was the limited availability of HVDs prior to the project’s start. Most cities reported having access to two or fewer datasets, highlighting the need for expanded resources to support comprehensive urban planning. The BeOpen framework offers an opportunity to address these gaps by enhancing the availability and usability of HVDs, ultimately aiming to empower smart cities with data-driven decision-making capabilities.

This baseline assessment establishes a clear starting point for future impact evaluations. By comparing these findings with the outcomes of the BeOpen implementation, it will be possible to measure progress in addressing data-related challenges and improving the integration of HVDs into urban governance. The insights gained from this survey are critical for informing the design of interventions and ensuring that the BeOpen framework aligns with the specific needs of participating cities.

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5. Comparison of the baseline assessment of BeOpen pilot use cases impact measurement and evaluation approach

If we focus on the baseline of each of the use cases of the pilot cities, for each of them we can see a great difference from the point of view of the knowledge or use of the HVDs to implement in the BeOpen project. In addition, the surveys that have been carried out for each of the use cases of the different pilot cities show us the knowledge and use of available HVDs.

For the use case of Attica pilot (UC1), the baseline is based on a set of data obtained from satellite images of the Earth (orography, direction and speed of the wind or forest mass, among others), history over time of wildfires that have occurred and other events that may be the origin of the fires and that, as can be seen, are data obtained both over time and from measurements and from the observation of the environment. In this sense, it can be concluded from the surveys carried out that, in general, the use of measurable or obtained from observation of the environment HVDs are quite or very important, while those that focus on mobility or company data are less important, as well as for decision-making by the Attica response service and wildfire management, with survey's respondents perceiving poor or scant quality in the data used or that these are not available.

In the Spanish pilot use cases, the baseline is based on real-time and historical measurements over time at weather stations, pedestrian counting, lighting measurement noise, air pollution and other, in general, measurable in the environment. However, other data that depend on other services outside the city council cannot be measured directly and must be subject to a prior screening process.

From the surveys carried out for the use cases of the Cartagena pilot, it can be concluded that, in general, the use of measurable or obtained from observation of the environment HVDs are quite or very important. In the case of security and protection in the city centre (UC2), the use of environmental monitoring is of great importance, while those that focus on company data, although the use of all of them is considered to be of quite of great importance, with measures to monitor these aspects that could be considered adequate, with moderate effectiveness and the majority believes that the measures adopted and monitoring for decision-making are effective, with a criterion of quality and accessibility of the data adequate (between moderate and excellent) and a criterion in the number of available data between 2 and 5. In the case of LED lighting (UC3), all HVDs used are of quite or great importance, all of them being considered important or very important, with measures to monitor these aspects that could be considered moderate, with moderate effectiveness and the majority believes that the measures adopted, monitoring for decision-making and a criterion of moderate quality and accessibility of the data adequate (between moderate and good) and more than half of the respondents estimate that the number of available data is 2. In the case of heat islands (UC4), the use of environmental observation is quite important, moderate measures to monitor heat islands, with moderate effectiveness and the majority think

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that the measures adopted and monitoring for decision-making are effective, with an acceptable criterion of quality and accessibility of data (the majority thinks between moderate and good) and half of the respondents estimate that the number of available data is 3.

From the surveys carried out for the use cases of the Molina de Segura pilot, it can be concluded that the use of measurable or obtained from the observation of the environment HVDs are of considerable of very important in the case of security and protection in the city centre (UC5), while those that focus on company or mobility data are less important, with a moderate effectiveness and quality of data and a criterion based on the number of available data between 3 and 5. In the case of LED lighting (UC6), the use of observation of the environment is of less importance, while those that focus on measurable, statistical or mobility data are of greater importance, although for the former their use is considered to be of considerable or great importance (except for meteorological data), with a moderate effectiveness and quality of data and a criterion based on the number of available data between 3 and 5. In the case of heat islands (UC7), the use of observation of the environment is of relative importance, except for company and mobility data, whose use is considered to be of importance (except for company data), moderate measures to monitor heat islands, with moderate effectiveness and moderate or good data quality and a criterion on the number of available data between 3 and 5.

The use cases of the Torre Pacheco pilot present different baselines. In the case of security and protection in the city centre (UC8), the use of HVDs based on environmental observation and statistics is of great importance, while those that focus on business and mobility data are not as important, although it is considered that the use of all of them is, in general, of quite or great importance, with measures considered basic or moderate, with moderate effectiveness and the majority think that the measures adopted and monitoring for decision-making are moderate, with a criterion of quality and accessibility of the data between poor and moderate and a criterion in the number of available data between 1 and 2. In the case of LED lighting (UC9), HVDs is used quite a lot, except for meteorological data, all of which are considered important or very important, with measures to monitor these aspects that could be considered acceptable, with a mild effectiveness, adoption of measures and monitoring for decision-making and a criterion of quality and accessibility of the data, and more than half of the respondents estimate that the number of available data is 0. In the case of heat islands (UC10), HVDs are not used frequently although they are considered to be of great importance, with hardly any means to monitor heat islands, poor effectiveness of the measures adopted and monitoring for decision-making and quality and accessibility of data and most respondents estimate that the number of available data is 1 or 2.

The Herne pilot studies two cases with different baseline values. The main aspects of the baseline of AI tools for street management investments (UC11) can be summarised as follows: overall, most HVDs are hardly used, although all of them have been rated as important or even very important, except for those related to geospatial or Earth observation and environmental aspects. A large majority of respondents believe that data quality in decision-making has been assessed as moderate, although this is considered to be slightly or moderately effective. Overall, data quality and accessibility have been rated as poor or moderate, with a disparity in available data ranging from 1 for half of respondents to more than 5 for the other half. The main aspects of the baseline for large-scale event management and civil protection (UC12) can be summarized as follows: overall, for the majority of respondents, HVDs are used sporadically, and all of

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them are rated as important or critical, except for geospatial, Earth observation, environmental and commercial data. A large majority of respondents believe that there are no solutions for tracking crowds; those who responded favorably assessed that the quality of data for decision-making was very effective. Overall, the quality of HVDs has improved slightly while accessibility has been rated as poor or moderate, with a disparity in available data ranging from 1 for 2/3 of respondents and 4 for the rest.

The main aspects of the baseline for the Porto pilot (UC13) can be summarized as follows: most HVDs are frequently used, except those related to companies, and all of them have been rated as important or even very important, even being considered critical. The quality of the data in decision making was evaluated as moderate while half of the respondents consider that the increase in protection is very effective. The accessibility of the data has been rated as moderate and half of the respondents indicate up to 5 data available.

The baseline for the use case of Naples pilot (UC14), geospatial, Earth observation, meteorological or statistical data are of little relevance while those of companies and mobility are more relevant and are considered to be highly used. In addition, in general, citizens do not participate in the decisions or in the development of HVDs. The last results of the surveys are not incorporated, it is not possible to know the number of data available.

The baseline for the use case of Vilnius pilot (UC15) is shown in section 3.8.3.5 of this deliverable, and the main aspects can be summarised as HVDs such as geospatial data, Earth observation data and mobility data were reported as widely or frequently used. Geospatial data and mobility data were identified as widely used resources while weather and climate data, along with statistical data, were mentioned as sometimes used. However, data related to businesses and business ownership were considered slightly important, indicating limited immediate relevance to the respondent's operational focus. Data quality was assessed as moderate, data accessibility was rated as good, indicating easy use. Since the results of the surveys are not incorporated, it is not possible to know the number of data available.

In summary, although we start from very different bases for each use case, in general almost all of the HVD that are going to be used are considered important or very important for the development of the BeOpen project, with some of the study parameters being less necessary in some specific cases. In addition, the HVD must be such that they allow an adequate definition of the model, since in many of the use cases we start from data that offer poor information or that are not available to the stakeholders.

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6. Conclusions

The main conclusions of this monitoring and evaluation process are as follows:

1. Monitoring and evaluating the impact of the use of digital content and high-value data in public administration is very difficult due to the subjectivity of the end user. This is because high-value datasets (HVD) correspond to public sector information, distributed across six data themes in an easily accessible and reusable format that public sector bodies must make available, with the potential to generate significant benefits for the economy, society and the environment, fostering innovation and social advances in various sectors and avoiding duplication of existing high-value datasets.

2. The proposed methodology responds to the need to evaluate the impacts of the use cases in the different municipalities included in this Project, since it includes a wide range of indicators. Performance indicators or Key Performance Indicators (KPI) are metrics that are used to measure processes and evaluate their performance over time and allow close monitoring of the results. With this data, it is possible to evaluate management and adopt measures to improve performance. The definition of these metrics and the analysis to be carried out, based on the results, must be a strategic action, so it is necessary to identify the performance indicators to be monitored. Effectiveness indicators are also used when the objective is to compare projects and how each has contributed to overall success.

3. The proposed indicators represent quantitatively and qualitatively the expected impacts on the administrations, despite their difficulty in evaluation, with surveys being a fundamental tool in this process. It is essential to choose KPIs that meet the needs of each segment. Although there is no formula, some points can help in the choice:

- It is necessary to ensure that the data and information necessary to analyze a given KPI can be tracked. This will make it possible to identify the indicators that can be evaluated in the company.
- Quantity does not always represent quality and in many cases, less is more. List the most relevant KPIs that contribute to intelligent decision-making and provide relevant results without interfering with the analysis.
- Permanently evaluate the KPIs to identify errors and adopt improvements based on the surveys.

4. The different pilots and use cases included in this Project represent a significant sample of the benefits of using digital content, the interoperability which ensures their replicability. By using real data sources from the environment, obtained through sensors and open platforms, among others, it provides a series of advantages:

- Increased performance: by using real-time data for modelling, it allows for better decisions to be made.
- Improved planning: with the use of technologies based on artificial intelligence (AI) and machine learning, virtual simulations can be carried out to predict failures and problems before they occur.

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- Cost reduction: the improvement in data management generates benefits equivalent to 25% of total expenditure on infrastructure and allows systems to be monitored and controlled remotely.
- Customisation and flexibility: the creation of virtual models allows immediate adaptation to environmental conditions.
- Impulse of experimentation and innovation: digital twins provide a safe and controlled environment to test new ideas and solutions, without the risks and costs associated with physical experiments. Among other things, they allow for experimentation with large objects or projects that, due to their size, do not usually lend themselves to experimentation in real life.
- Improving sustainability: it allows for identifying inefficient areas, thus optimizing the use of resources.

5. The complementarity of the use cases and their indicators ensures synergies between them and the exchange of information. Use cases can be related to each other. These relationships can be:

- Extend: a use case adds behaviours (extension points that may be optional) to the behaviour of a general use case. The specialized use case can only alter the behaviour of the marked extension points.
- Include: the use case includes the complete behaviour of a general use case, which allows the hierarchical composition of use cases, as well as reuse between use cases.
- Generalization-specialization: the specialized use case specifies the extra steps that need to be added to the general use case, to represent a functionality different from the original one.

The exchange of information between use cases will occur through the relationships indicated above.

6. The baselines, or starting points, objectively show the starting point from which the digital content is introduced and will allow the progress of the scope and planning, cost and final evaluation of the Project, as it is completed. Baselines differ from objectives in that they focus on the status of the Project, while the objective focuses on the results and will allow us to evaluate how the status of a project has contributed over time to the achievement of the objectives. The BeOpen Project baselines for each of the Use Cases are indicated in the previous section.

7. The correct evaluation of the impact on the use of data, digital content and therefore the implementation of data-based municipal governance is the fundamental tool for replicability and the development of new capabilities based on the learning obtained, giving way to a process of continuous improvement.

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