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OUTPUT 1.1

TOOLKIT FOR INFORMED DECISIONS AND ACTIONS FOR THE MANAGEMENT OF TOURISM FLOWS IN DESTINATIONS

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Abbrevations

API	Application Programming Interface
DMO	Destination Management Organisations
GIS	Geographic Information System
HERIT-DATA	Heritage and Sustainable Tourism Data Management (project acronym)
ICT	Information and Communication Technologies
IoT	Internet of Things
MQTT	Message Queuing Telemetry Transport
NGSI	Next Generation Service Interfaces

Executive summary

The **TOURISMO Toolkit** has been developed within the framework of the **Interreg Euro-MED Programme** to support Mediterranean destinations in addressing the increasing challenges related to tourism pressure and flow management. Building on a **data-driven approach**, the Toolkit provides different instruments and a structured framework to better understand, monitor and manage tourism dynamics in a more sustainable and informed way.

The Toolkit capitalises on the results of **Work Package 1** (WP1) of the project, and translates them into a coherent set of components that can be used by public authorities, Destination Management Organisations (DMOs) and other relevant stakeholders.

The methodology follows a step-by-step approach, including **the analysis of tourism patterns in pilot areas, the revision and enrichment of existing indicator frameworks, and the use of digital tools for data visualisation**. It offers a flexible structure that can be adapted and transferred to other Mediterranean contexts, contributing to the wider objective of promoting more sustainable and resilient tourism models across the region.

As a result, the TOURISMO Toolkit provides **a practical reference for destinations aiming to improve their capacity to manage tourism flows, enhance the visitor experience, and mitigate potential negative impacts on local communities and environments**.

Output 1.1	
Output Title	Toolkit for informed decisions and actions for the management of tourism flows in destinations
Programme Output Indicator	11116: Jointly developed solutions
Measurement Unit	Solution
Target Value	1,00
Delivery period	Period 5, 25 - 30
Output Description	TOURISMO joint solution will support the management of tourism flow during high season, improve data collection and effective change in tourism practices, and promote “responsible tourism” practices, through using state-of-the-art equipment in specific areas/buildings and exploiting HERIT-DATA's analytics processes. TOURISMO will offer solutions for the establishment of knowledge networks for enabling knowledge transfer on data collection and conducting research on innovative tourism practices.

1. Introduction

This document forms part of the TOURISMO project, a project partially funded by the European Commission's Interreg Euro-MED Programme.

This is the final outcome of the first phase of the project, in which the 10 project partners have been working, drawing on their experiences, on new methodologies to improve tourist flows in their cities or areas of interest, taking into account the increase in tourism in most locations and the desire to preserve their heritage.

As a result of this work, we present the toolkit, which can help other cities and tourist destinations to plan for the effective management of tourist flows whilst working to preserve their heritage.

In this first section of the document, we will explore the context in which the work has been carried out and define the objectives and scope of the toolkit.

1.1. Interreg Euro-MED Programme

Interreg is a European Union (EU) instrument designed to improve cooperation between regions within the EU. It promotes regional development, cohesion, and the reduction of economic disparities. It is part of the EU's Cohesion Policy and is supported by the European Regional Development Fund (ERDF).

For the period 2021-2027, the fund will enable investments to make Europe and its regions:

- More competitive and smarter
- Greener, low-carbon and resilient
- More connected by enhancing mobility
- More social, supporting effective and inclusive employment, education, skills, social inclusion and equal access to healthcare
- Closer to citizens.

Interreg includes 86 programmes divided into four types:

- Cross-border (64 programmes)
- Transnational (13 programmes)
- Interregional (4 programmes)
- Outermost Regions (5 regions)

The transnational programmes, grouped as Interreg B, refer to large areas of Europe. They support a wide range of project investments related to innovation, environment, accessibility, telecommunications, urban development and governance. Interreg Euro-MED is part of this kind of programme. It aims to make the Mediterranean region smarter and greener and improve the governance between its stakeholders. The programme includes 69 regions of 14 countries from the Northern shore of the Mediterranean, from Lisbon to Cyprus. It includes 10 EU Member States and 4 countries from the Instrument for Pre-accession Assistance (IPA). Around 140 million people live in this area.

The programme has embedded the objectives into missions for a more comprehensive approach. The four missions are:

1.- Innovative Sustainable Economy Mission, to strengthen an innovative sustainable economy and to

boost a fair transition to a circular economy

2.- Natural Heritage Mission focused on protecting, restoring and valorising the natural environment and heritage

3.- Green Living Areas Mission, to improve the lives of Mediterranean citizens by promoting the development of green living areas

4.- Sustainable Tourism Mission focused on fostering circular tourism considering the sustainability of ecosystem services.

The programme provides funds for projects developed and managed by public administrations, universities, private and civil society organisations. The total programme budget amounts to almost €300 million for the 2021-2027 period. Six kinds of projects are foreseen in the programme:

- Thematic Community projects that aim at establishing conditions for the reuse of results, the development of synergies and the increase of coordination between thematic projects working towards the same mission by articulating a community of Interreg Euro-MED project partners and implementing transfer and mainstreaming strategies of Euro-MED thematic project results.
- Institutional Dialogue projects contributing to the implementation of transfer and mainstreaming strategies by engaging with local, regional and national authorities, and setting up long-lasting conditions for a permanent institutional and social dialogue to bridge the transnational dimension with the local solutions.
- Study projects that perform analyses to better address a thematic issue and open the door to the development of new instruments, policies, strategies, and action plans.
- Test projects that experiment with common instruments, policies, strategies and action plans already developed to validate concrete solutions to be transferred.
- Transfer projects that optimise and share validated common instruments, policies, strategies and action plans to have the stakeholders adopt them.
- Strategic territorial projects that conduct studies, test solutions and transfer results addressing the strategic topics of a specific type of territory.

1.2. TOURISMO project

The “Tourism Innovative and Sustainable Management of Flows – TOURISMO” project forms part of the Sustainable Tourism Mission, alongside 11 other pilot projects approved in various calls for proposals. The project’s main objective is to tackle one of the sector’s most pressing challenges today: overtourism. It does so by using innovative technologies that offer new solutions and novel services to monitor and manage tourist flows. By exploiting the foundations laid by its predecessor HERIT-DATA, TOURISMO will keep boosting innovation through new methodologies and tools in areas with high tourism pressure. Better flow handling will be implemented through the development of a monitoring & decision-making support management structure and testing in 8 MED pilot sites.

The project is divided into three main activities:

- The first one is the design and setup of solutions' deployment. This task aims at analysing touristic habits and flows, revising the set of tourism indicators to be collected, gathering complementary data and specifying the pilot actions in the selected pilot areas. In parallel, the HERIT-DATA platform is being fine-tuned.
- The second one is the implementation and evaluation of some pilot interventions in the 8 MED pilot sites. The objective is to integrate collected data with complementary data to make tourism flow predictions and measure the impact of pilots. Additionally, this task will deliver a framework on certifying destinations as sustainable.
- Finally, the project partners will scale up the project results through local workshops, facilitating further adoption of the tested solutions by developing use-case scenarios and ensuring sustainability of the approach. They will facilitate the replication of the project results to other MED territories, and this document is one tool to work to achieve this objective.

The project is led by the Development Agency of South Aegean Region – READ S.A. (Greece) and the partnership is composed of:

- University of Florence – UNIFI (Italy)
- Foundation for Research and Innovation – FRI (Italy)
- Valenciaport Foundation - FV (Spain)
- Development Agency of Lemesos - ANELEM (Cyprus)
- Varna Economic Development Agency - VEDA (Bulgaria)
- Public Institution RERA S.D for Coordination and Development of Split Dalmatia County (Croatia)
- Malta Regional Development and Dialogue Foundation (Malta)
- Kinno Innovation Intermediaries (Greece)
- Santa Maria la Real Foundation of Historical Heritage - FSMLR (Spain)



Figure 1: TOURISMO pilot areas

1.3. Document overview and objectives

This Toolkit brings together the main results of **Work Package 1** and organises them into a structured and accessible format, **designed to be replicated and adapted in other Mediterranean destinations.**

The document is divided into three main parts. First, it introduces the TOURISMO project context and the motivation behind the development of the Toolkit. Second, it describes the methodology followed during Work Package 1, including the different analytical and technical activities carried out. Finally, it presents the Toolkit itself, structured into key components that support the analysis, monitoring and management of tourism flows.

The main objective of this document is to provide a practical reference for public authorities, DMOs and other tourism stakeholders. It aims to support more informed decision-making processes by providing a **structured framework, indicators and tools** that help better understand tourism dynamics and their impacts on destinations.

1.4. Scope of the Toolkit and key methodology

The approach is based on promoting a more sustainable management of tourism flows through data-driven methods. As an Interreg Euro-MED project, it is mainly designed to be applied in the Mediterranean region, while still being flexible enough to adapt to different contexts.

The Toolkit compiles the **key elements to analyse tourism patterns** in the pilot areas, as well as the structure of an indicator system and a platform first developed in the **HERIT-DATA project** and later adapted within **TOURISMO.** It also includes guidance on how to identify and organise relevant datasets, and some recommendations on what data processing and visualisation solutions should ideally offer.

2. Methodology behind the Toolkit

2.1. Activity 1.1 Analysis of touristic habits and tourism flows in the selected locations

Activity 1.1 aimed to analyse existing data on current tourism flows, tourist profiles, and behaviours to understand how these flows are generated, monitored, and managed in each pilot area of the TOURISMO project. This analysis was conducted **using a common document format** to ensure consistency across the different locations and through **one-on-one interviews** with each pilot area partner to interpret the situation of tourist flows from a spatial perspective, showing how tourist movements are distributed within each area.

A central component of the activity was the interpretation of tourism flows from a spatial perspective. This involved identifying main access points, typical visitor routes, areas of concentration and locations where congestion or pressure is most evident. By mapping these elements, each pilot was able to highlight its specific dynamics, as well as critical points that require attention when designing flow management strategies.

In parallel, Activity 1.1 included a mapping of key stakeholder typologies involved in tourism within each pilot area. This exercise helped to identify the main actors influencing tourism dynamics, their roles and their level of involvement, providing a first overview of the governance context in which tourism flows are managed.

The main output, Deliverable D.1.1.1 "Report on Current Situation and Tourism Flows in the Selected Areas", is a report structured by pilot area, that brings together this information into a solid baseline of the current situation.

From this activity, the Toolkit extracts **a framework and a template for the initial characterisation of a destination**, including the key aspects to consider when approaching the study of tourism flows from a practical and territorial perspective.

2.2. Activity 1.2 Revision and enrichment of the HERIT-DATA list of indicators

Activity 1.2 focused on revising and adapting an existing system of **tourism sustainability indicators** to better respond to the needs of the TOURISMO pilot areas. Based on the indicator framework developed under the HERIT-DATA project, which was taken as a reference and further refined to align with the specific objectives of tourism flow management within the project.

This process was carried out through a collaborative and iterative approach led by Fundación Santa María la Real, involving all project partners. The existing indicators were reviewed and assessed in relation to their relevance, feasibility and applicability across the different pilot areas. This included analysing their capacity to capture key aspects of tourism dynamics, such as visitor pressure, environmental impact, socio-economic effects and governance-related aspects. In addition, exchanges with pilot managers helped to identify specific needs, data availability constraints and priorities for each location.

The indicators were organised into three different categories based on their relevance and usability across the pilots, distinguishing between **key indicators** (applicable to all pilot areas), **secondary indicators** (context-

specific), and **complementary indicators** (optional or less directly relevant). This classification allows for a common framework while maintaining flexibility to adapt to different territorial contexts.

The activity also defined the main **data requirements associated with each indicator**, as well as preliminary **threshold values** and **recommendations for data collection and validation**. This ensures that the indicators are not only conceptually relevant, but also feasible to implement in practice and useful for monitoring and decision-making processes.

The main output, Deliverable D.1.2.1 "Tourism Sustainability Indicators Report", provides an enriched and structured **list of indicators** tailored to the TOURISMO context. It includes the definition of indicators, their components, the data to be collected, and guidance for their application.

From this activity, the Toolkit extracts a **structured indicator framework**, including categorisation criteria, data requirements and guidance for selection and adaptation, which can be used by other destinations to define their own monitoring systems for tourism flow management.

2.3. Activity 1.3 Fine-tuning of complementary datasets

Activity 1.3 focused on identifying and organising the sources and gathering datasets from existing complementary databases that are used for the analysis during the pilot testing (ie. weather data, tourist arrivals, etc.), with emphasis on available open data sources at European, national and local levels.

This work was carried out through a collaborative process involving all project partners. A **shared table** was used as a common working tool, where each partner contributed information on available datasets in their respective pilot area. The template allowed partners to systematically register key information such as the type of data, source, format, frequency of update, level of access, and its potential integration into the TOURISMO platform. This resulted in a structured overview of the data landscape in each pilot area. It provided a clearer picture of what complementary data are available, how they can be used, and what gaps remain for future development.

In many cases, challenges were identified, including fragmented data sources, differences in formats, and restricted access to certain types of data, especially those linked to real-time monitoring or private providers.

From this activity, the Toolkit extracts **a template to catalogue and organise complementary datasets**, including the main fields and criteria needed to assess their relevance, accessibility and potential use for tourism flow management.

2.4. Activity 1.4 Fine-tuning of the HERIT-DATA platform

Activity 1.4 focused on adapting the **Snap4City platform**, previously used in HERIT-DATA, to meet the specific needs of the TOURISMO pilot areas. This included adjusting the system to new locations, creating new dashboards to visualise the information required in each pilot area, and ensuring compatibility with the datasets identified in previous activities.

The process was iterative, ensuring continuous alignment between the platform, the evolving indicator system

developed in WP1, and the specific objectives of each pilot. This allowed new data and metrics to be progressively incorporated during the first stages of the project, responding to real needs identified by the partners.

Although no formal deliverable was produced, this activity contributes to the Toolkit by providing **a practical reference on how to adapt a data platform to different destinations**, including data integration, indicator linkage and scenario simulation to support decision-making.

The transfer process assessed how technological components and operational approaches can address local tourism challenges, governance structures and data ecosystems, with particular focus on tourism flow monitoring and data-driven destination management.

The activity exploited technologies such as digital twin modelling including contextual descriptions, visitor counting systems, thermal cameras, Wi-Fi/Bluetooth tracking, drones, environmental sensors, mobility and transport data, statistical data, users' participation/engagement data, and admin data, towards integrated data platforms, dashboards and AI-based analysis tools, evaluating their operational feasibility, interoperability and contribution to tourism flow monitoring and management in each territory.

2.5. Activity 1.5 Specification of pilot actions

Activity 1.5 focused on the **design, specification and operational planning of the pilot actions** to be implemented across the TOURISMO pilot areas. Its objective was to translate the methodological, analytical and technological components developed in the previous WP1 activities into concrete, context-specific interventions, while ensuring coherence and comparability across the project. The main outputs of this activity are **Deliverables D1.5.1 and D1.5.2**.

To support this process, a **common demonstration methodology** was developed as a shared framework for planning, implementing, monitoring and evaluating the pilot actions. It defined the main elements to be considered by all partners, including pilot-specific objectives and expected outcomes, the selection of KPIs and relevant datasets, data collection and processing strategies, and the identification of the tools, technologies and equipment required for each implementation scenario.

Activity 1.5 also supported the preparation of detailed **site-specific implementation plans**, covering roles and responsibilities, stakeholder engagement mechanisms, timelines, operational workflows and validation procedures. Particular attention was given to the integration of heterogeneous tourism-related data sources, the testing of data-driven decision-support approaches under real operational conditions, and the assessment of pilot performance through qualitative and quantitative indicators, validation procedures and feedback from end-users and stakeholders.

From this activity, the Toolkit extracts a **step-by-step methodology for designing and executing pilot actions** in a structured, replicable and scalable way, including guidance on data collection, indicator and technology selection, pilot governance, stakeholder engagement, and the testing and validation of solutions in real contexts.

3. The Toolkit

This section presents the main outputs developed throughout WP1, translating them into a set of practical tools that can be used by other destinations.

The Toolkit is structured around the key components developed during the TOURISMO project, including the analysis of tourism flows, the definition of indicators, the identification of datasets, the use of data visualisation platforms, and the planning of pilot actions. These elements are not presented as standalone results, but as part of a coherent approach that can be applied step by step.

For each component, the section explains what it consists of, how it was applied within the TOURISMO project, and how it can be used in practice. It also includes practical guidance, recommendations and lessons learned based on the experience of the pilot areas, highlighting both enabling factors and common challenges.

The aim is to provide a usable reference for stakeholders interested in applying similar approaches in their own context. The Toolkit is therefore designed to be flexible and adaptable, allowing each destination to select and apply the elements that best fit its needs, available data and local conditions.

3.1. Analysis of the touristic habits and tourism flows

3.1.1. Purpose of the tool

The analysis of touristic habits and tourism flows is a tool designed to support the **initial characterisation of a destination** from the perspective of how tourism takes place within it. It focuses on understanding who the visitors are, how they behave, when they visit, and how they move across the territory.

The main objective of this tool is to provide **a structured overview of tourism dynamics** in a given area, combining available data with a spatial interpretation of flows. This allows the identification of key patterns such as peak periods, areas of high concentration, main visitor routes, and potential pressure points.

The expected output is a clear and organised description of the current tourism situation in the destination, including **visitor profiles, temporal trends and spatial distribution of flows**. This baseline understanding is essential to support further steps, such as the definition of indicators, the identification of relevant datasets, and the design of targeted actions for tourism flow management.

3.1.2. Preconditions and required inputs

To gather the information necessary for this analysis, a process over several weeks is typically required, during which pilot areas rely on both available quantitative data (tourism annual reports and national/regional statistics) and input from relevant stakeholders, in order to build a complete picture of how tourism takes place in the destination.

To ensure consistency across different contexts, a **common template** is used to collect and organise this information. This allows all pilot areas to report comparable data and facilitates a structured overview of tourism dynamics, even when data availability varies between locations.

Quantitative data: Official data regarding visitor numbers, seasonality patterns, most visited tourist attractions and, where available, information on visitor origin and type of tourism is used to define and describe the main visitor profiles and identify key temporal trends.

Qualitative data: Additional information is needed to identify and map the most relevant elements of the destination from a spatial perspective, including areas with high visitor concentration, key routes, and potential pressure points. In many cases, this information is not fully available through existing datasets and requires local knowledge, which is complemented through exchanges with stakeholders such as local authorities, tourism boards, cultural institutions and other relevant actors, helping to validate the data, fill information gaps, and provide a more complete understanding of visitor behaviour and current management practices.

3.1.3. Methodological approach

The following steps outline how to carry out the analysis in a clear and replicable way:

Step 1: Define the scope of the analysis
Define the geographical area to be analysed (e.g. city, region or specific site) and the time frame (e.g. annual, seasonal or peak periods).

Step 2: Collect and organise quantitative data
Gather available quantitative data from official sources, such as tourism reports and statistical databases. This includes visitor numbers, seasonality patterns, main attractions and, where possible, information on visitor origin and type of tourism. The data should be organised using a common template to ensure consistency.

Step 3: Identify and analyse visitor profiles and temporal patterns
Use the collected data to define the main visitor profiles and identify key trends over time. This includes understanding when visitors arrive, how demand varies throughout the year, and which types of tourism are most relevant in the destination.

Step 4: Map tourism flows and key locations
Identify and map the main elements of the destination from a spatial perspective, including key attractions, areas with high visitor concentration, main routes and potential pressure points. This step combines available data with local knowledge to build a spatial understanding of tourism flows.

Step 5: Identify and map key stakeholders
Identify the main stakeholders involved in tourism in the area, such as public authorities, tourism boards, cultural institutions and other relevant actors. These stakeholders should be mapped according to their role and level of involvement in tourism management. A common template is provided in Annex 1 to support this process.

Step 6: Summarise key findings
Bring together the main results of the analysis in a clear and structured way, using the **common template** developed within the project (see *Annex 1*). This step can be complemented by **one-to-one exchanges with pilot stakeholders** to review the collected information and discuss the main findings, ensuring a shared and accurate understanding of the results.

Step 7: Validate and complete the analysis with stakeholders

If possible, organise exchanges with relevant stakeholders to validate the information collected, fill data gaps and refine the understanding of tourism dynamics. This helps ensure that the analysis reflects the reality of the destination and includes different perspectives.

3.1.4. Application example from TOURISMO pilots

This analysis was conducted in all pilots using the common template to ensure consistency across the different pilot areas, complemented by interviews with pilot managers to **interpret tourism dynamics from a spatial perspective**.

In the case of **Valencia City**, the analysis focused on the city centre, particularly the historic district of **Ciutat Vella**. One of the main challenges identified in this area is the **high pressure on cultural heritage assets**, which highlights the need to better manage tourism flows in order to preserve the city's historical value while maintaining a high-quality visitor experience.



Figure 2: Valencia, Spain

The analysis combined quantitative data from official sources with qualitative inputs. Quantitative data were mainly obtained from national statistics (INE – Instituto Nacional de Estadística) and from official tourism data provided by public entities such as the Visit Valencia Foundation and Turisme Comunitat Valenciana. This information included indicators such as **annual visitor numbers, origin of visitors, number of registered hotels and hostels, number of tourist apartments, bed capacity, and average length of stay**. Monthly data allowed the **identification of temporal patterns**, showing that, although peak periods exist (such as Las Fallas and summer months), tourism activity remains relatively constant throughout the year.



Figure 3: Ciutat Vella in Valencia, Spain

From a spatial perspective, **mapping exercises** were carried out to identify the main **hotspots and areas under pressure**. While major attractions such as the City of Arts and Sciences and the Oceanogràfic are key drivers of tourism in Valencia, the analysis focused on Ciutat Vella, where a high concentration of heritage sites leads to increased visitor density.

Key locations identified include La Lonja (UNESCO World Heritage Site), the Cathedral, the Central Market, and the Museum of the City of Valencia. These sites attract a large number of visitors and are located within a relatively compact urban area, contributing to the concentration of tourism flows.

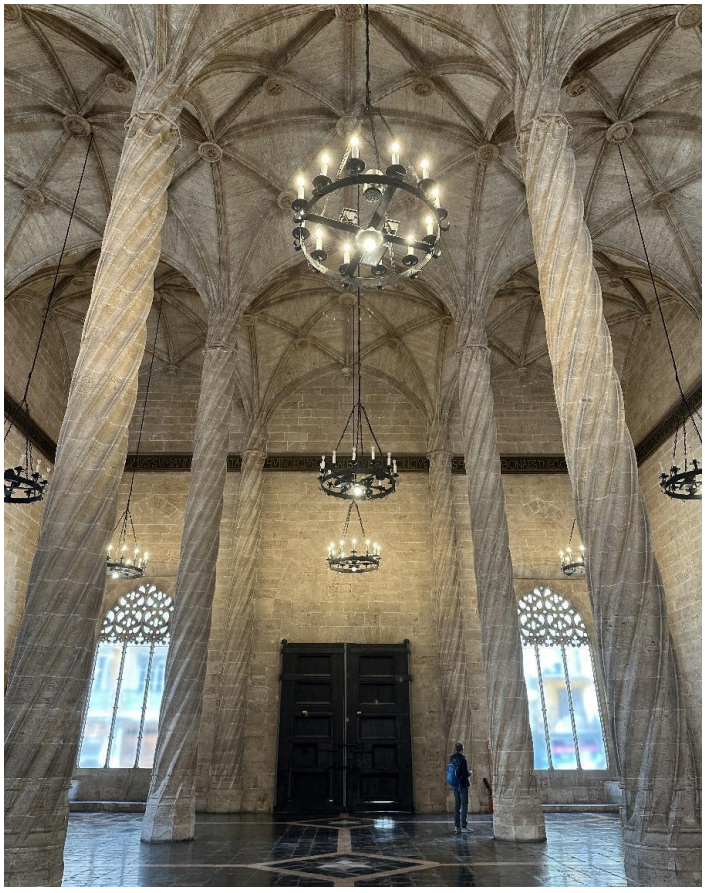


Figure 4: Lonja of Valencia

Additional analysis considered how visitors arrive and move within the city. Main entry points such as Valencia Airport, located approximately 10 km from the city, the port receiving cruise ships, and the main train station were identified and mapped. By overlaying this information with the location of tourist attractions, it was possible to better understand movement patterns and areas of concentration within the city.

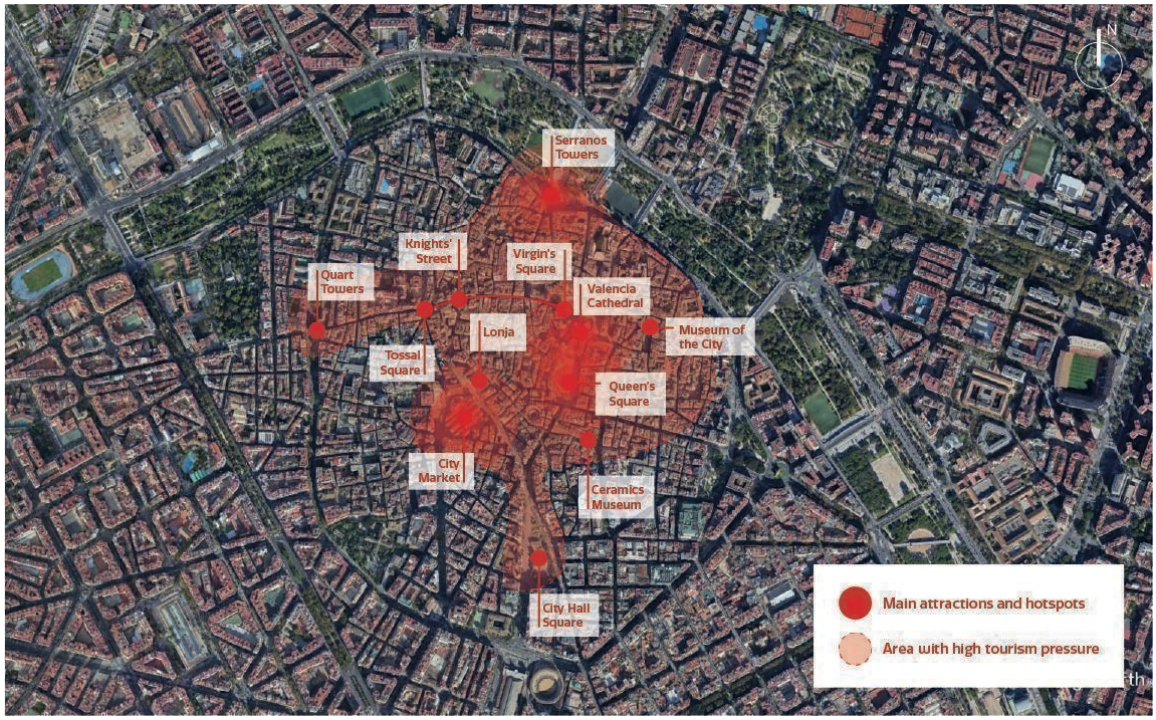


Figure 5: Mapping of main attractions and areas of concentration



Figure 6: Mapping of tourist movement patterns

Finally, a **stakeholder mapping exercise** was carried out to identify the key actors involved in tourism in Valencia.

This included public authorities, cultural institutions and other relevant organisations. Stakeholders were classified according to their role, level of influence, type (public, private, academic or social), and whether they act as data providers.

In addition, stakeholders were classified according to their level of participation in tourism-related processes, distinguishing between non-active, active and pro-active involvement. This helped to understand the degree to which each stakeholder contributes to or influences tourism management, and to identify those who could play a more relevant role in future actions.

Stakeholder	Description of their roles/relationships whitin the pilot	Directly or Indirectly impacted by or influencing the tourism activities in this pilot area	Operational Level	Type	Data Provider	Level of participation*
Valencia City Council	The Valencia City Council oversees various aspects of the city's administration, including tourism development, cultural heritage management, and urban planning. It plays a crucial role in implementing policies and initiatives that affect tourism in the city, particularly in the historical center. As the owners of La Lonja, they are directly involved in its maintenance and promotion.	Directly	Local level	Public	Yes	Pro-Active Participation
Regional Government of Valencia	The Generalitat Valenciana is responsible for the broader regional policies and regulations concerning tourism and heritage preservation. It provides support and resources for local tourism initiatives and collaborates with municipal authorities to enhance the tourism experience in Valencia.	Directly	Regional level	Public	Yes	Non-Active Participation
State Commercial Company for Management of Innovation and Tourism Technologies, S.A.M.P.	SEGITTUR is a state-owned company focused on integrating innovation and technology within the tourism sector. It supports projects aimed at enhancing tourism management through technological solutions and provides valuable data and insights.	Indirectly	National level	Public	No	Pro-Active Participation
Valencia Historical and Artistic Heritage Service Office	This office is responsible for the maintenance and promotion of Valencia's historical and artistic assets. It plays a critical role in ensuring that tourism activities do not negatively impact the city's heritage sites.	Directly	Local level	Public	No	Active Participation
Polytechnic University of Valencia	The Polytechnic University of Valencia contributes through research and data analysis on various aspects of tourism and its impacts. It collaborates on projects to monitor the effects of tourism on cultural heritage.	Indirectly	Regional level	Academia	No	Non-Active Participation
Museum of the City	The City Museum is directly involved in the project, owning one of the pilot sites to be monitored in the historic city of Valencia. Their participation is crucial, as museums—especially those with regional collections—are key to promoting local identity and culture.	Directly	Local level	Public	Yes	Pro-Active Participation

Figure 7: Stakeholder's mapping table example

3.1.5. Recommendations for replication

- **Start with available data:** Even if datasets are incomplete, an initial analysis can be carried out using existing information. This allows a first understanding of tourism dynamics, which can be improved over time as more data become available.
- **Use a common template to structure the analysis:** When analysing multiple areas or destinations, the use of a shared template is key to organising information in a consistent way. It helps ensure that all relevant aspects are covered and allows comparison between different areas.
- **Combine quantitative data with local knowledge:** Official data should be complemented with qualitative inputs to identify spatial patterns, pressure points and visitor behaviour that are not always visible in datasets.
- **Include stakeholder mapping as part of the process:** Identifying and categorising stakeholders helps to understand the governance context and supports the identification of key actors for future actions. Listing them in a structured way also helps to identify who can be consulted to validate the analysis or provide quantitative data and qualitative insights that contribute to a better understanding of the pilot area.
- **Engage stakeholders during the validation phase:** Exchanges with local stakeholders are essential to validate findings, fill data gaps and ensure that the analysis reflects the real situation of the destination.
- **Use spatial analysis to support decision-making:** Mapping key locations, routes and pressure points helps to better understand how tourism is distributed and supports the identification of priority areas for intervention.

3.2. Definition of tourist indicators

3.2.1. Purpose of the tool

The definition of tourist indicators within the TOURISMO project consists of the establishment of a **flexible and adaptable system of sustainability indicators** aimed at supporting evidence-based tourism management in Mediterranean destinations. The tool builds upon the experience and methodological foundations developed in the HERIT-DATA project and further refines them according to the specific characteristics and needs of the TOURISMO pilot areas.

The indicator system combines quantitative and qualitative data to monitor tourism dynamics, visitor pressure, environmental conditions, tourist perceptions and the operational capacity of destinations and heritage areas. It is designed to support the understanding of tourism saturation phenomena and their potential impacts on cultural heritage sites, public spaces and local communities.

As mentioned before, the TOURISMO system organises indicators into three categories:

- **Key indicators**, applicable to all pilot sites and focused on common tourism pressure and sustainability challenges;

- **Secondary indicators**, selected according to the specific context and priorities of each pilot;
- **Complementary indicators**, considered optional or context-dependent due to data availability or implementation complexity.

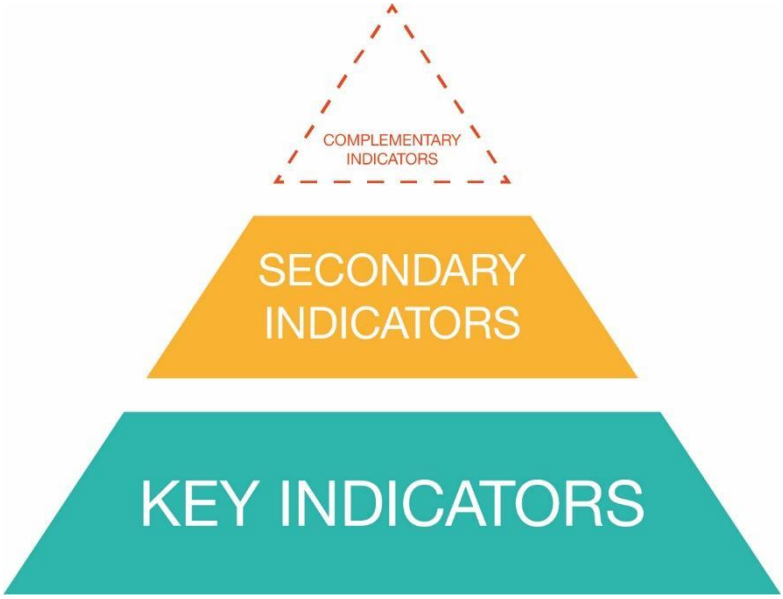


Figure 8: Structure of the TOURISMO Sustainability Indicator System

The tool is conceived as a **dynamic framework** rather than a fixed list of indicators. As monitoring activities evolve and new data become available, destinations may revise thresholds, incorporate additional indicators or refine existing ones.

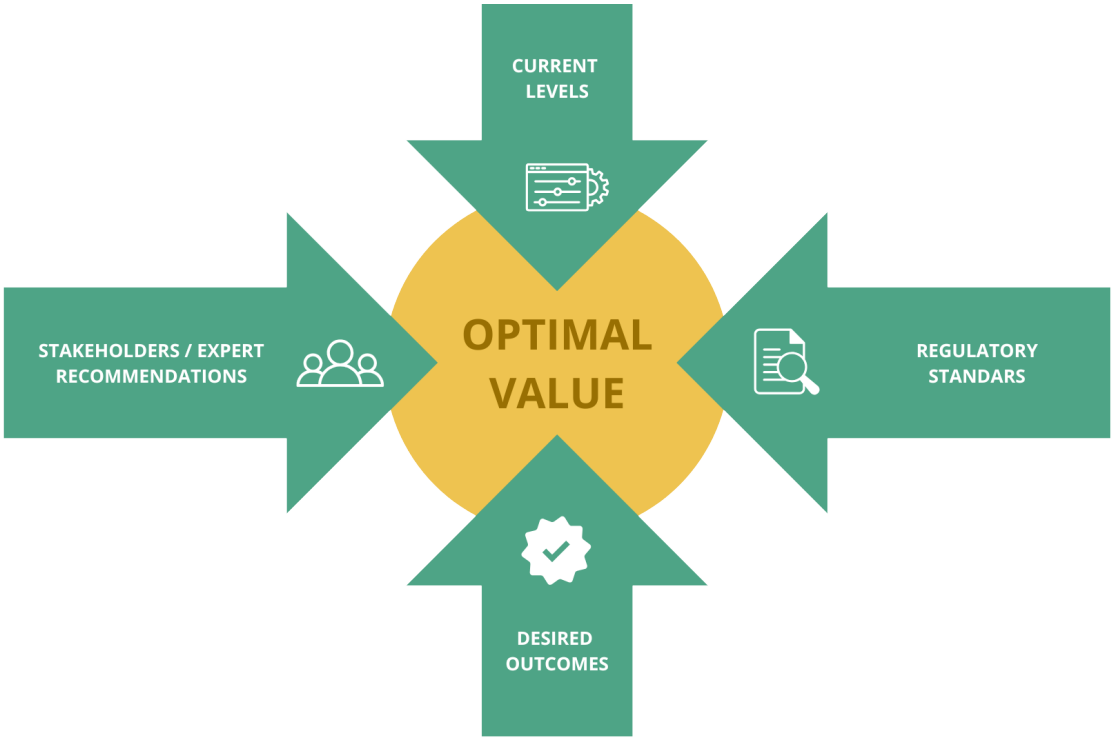


Figure 9: Elements considered in the definition of optimal threshold values for tourism sustainability indicators.

The main objective of this tool is to help destinations identify, structure and monitor relevant tourism sustainability indicators that support more informed, preventive and adaptive decision-making processes.

The expected contributions of the tool include:

- Establishing a **common methodological framework for tourism sustainability monitoring** across different Mediterranean pilot areas;
- Supporting the **identification of tourism pressure, overcrowding patterns and environmental impacts** in heritage and natural tourism sites;
- Improving the capacity of destinations to **anticipate risks and define preventive management measures**;
- Facilitating **data-driven governance and communication between public authorities, tourism managers and other local actors**;
- Supporting the **integration of tourism data into digital platforms** and smart destination ecosystems;
- Enhancing **comparability and knowledge transfer** between pilot areas and future replicators.

3.2.2. Preconditions and required inputs

The implementation of the indicator system requires **access to a minimum set of baseline data** capable of characterising tourism dynamics, visitor behaviour and the monitored environment. The type and quantity of data may vary depending on the pilot context and the indicators selected, but several categories of information are generally required.

Depending on the indicators selected, data sources may include sensor systems, tourism statistics, ticketing systems, reservations data, GIS information, surveys, social media analysis, transport data and local administrative records.

The methodology also requires an **initial contextual assessment** (see the previous segment or Annex 1) to understand the specific tourism pressures, operational realities and management priorities of each destination. This is particularly important because tourism saturation behaves differently depending on the identity, scale and tourism model of each site.

3.2.3. Methodological approach

The methodology follows an iterative and flexible process adapted to the specific needs of each TOURISMO pilot area. The process combines technical analysis, stakeholder consultation and progressive refinement through monitoring activities.

Step 1: Identify tourism challenges and monitoring objectives

Destinations should identify the main tourism-related challenges affecting the area and define the operational objectives of the monitoring system.

Step 2: Review existing sustainability frameworks and indicators

The first step consists of reviewing existing tourism sustainability frameworks and previous indicator systems in order to identify relevant approaches, methodologies and indicator categories. Within TOURISMO, this process built upon the HERIT-DATA project and included the analysis of several reference frameworks such as ETIS (European Tourism Indicator System), SIROCCO and the UTH Thessaly Indicator System.

Step 3: Select and classify indicators

Indicators are selected and categorised according to their relevance and applicability to the pilot site (for example: key, secondary, complementary). This classification allows destinations to maintain a common monitoring framework while adapting implementation to local conditions, available resources and data feasibility (Figure 8 and 10).

Step 4: Identify data sources and monitoring methods

Once indicators are selected, the next step is to identify the required datasets, technologies and monitoring methods necessary to calculate and analyse the indicators. This may involve different sources like: Sensors, visitor counting systems; Open data, surveys and questionnaires; GIS and mobility datasets.

Step 5: Define thresholds and operational ranges

Thresholds are established in order to interpret indicator values and support operational decision-making. The methodology proposed in TOURISMO defines three threshold levels: optimal, acceptable and critical. Thresholds should be adapted to the characteristics of each site and validated through expert consultation, stakeholder feedback and comparison with existing standards or regulations (Figure 9).

Step 6: Validate and revise indicators through monitoring

Indicators and thresholds are progressively validated and refined through real monitoring activities. As new data become available (or unavailable), destinations may adjust threshold values, change their monitoring methodologies and add or remove indicators to the list. This iterative approach ensures that the monitoring system remains operational, realistic and aligned with evolving tourism dynamics.

3.2.4. Application example from TOURISMO pilots

As already described in the previous sections, indicators were organised into three categories: key, secondary and complementary indicators. This structure allowed the project to maintain a shared monitoring logic while preserving enough flexibility to adapt the indicator system to different territorial, environmental and governance contexts.

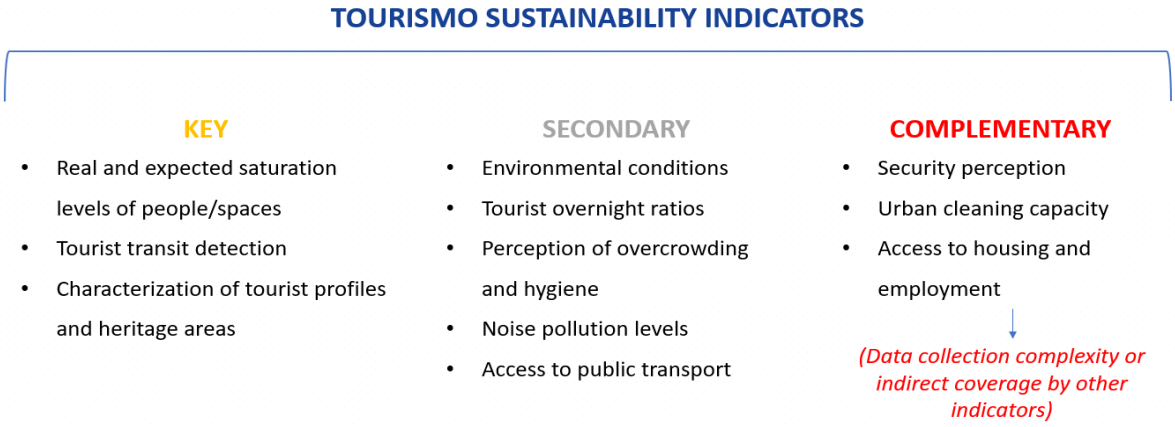


Figure 10. Classification of TOURISMO sustainability indicators

In practice, pilots combined different categories of indicators according to their needs, technical feasibility and stakeholder priorities. The complete list of indicators and their classification can be consulted in *Annex 2.*

As mentioned before, the Valencia City pilot focused on monitoring tourism pressure and environmental conditions in two heritage buildings located in the historic centre of Valencia (La Lonja and the Museum of the City), with the aim of understanding how tourism activity and occupancy peaks affect the conservation conditions of these buildings.

For this pilot area, the first step consisted of selecting the **most relevant indicators** according to the specific challenges and objectives identified. The selected key indicators included:

- (E1) I.2 Optimal levels of overcrowding of sites of cultural value;
- (E2) I.4 Optimal levels of overcrowding of people transit;
- (E3) I.5 Tourist perception about adequacy of overcrowded site experience;
- (E4) I.12 Capacity to ensure permitted ranges of contamination and environmental conditions in heritage areas.

In addition, some secondary indicators were also incorporated due to their relevance for heritage conservation

and visitor experience, including:

- (E1) I.1 Preservation level in optimal conditions (environmental and architectural) of sites of cultural value;
- (E3) I.8 Personal perception about hygiene, sanitation and cleaning conditions site experience.

Once the indicators had been selected, the pilot team analysed which **datasets and technologies** were necessary to monitor them. This included:

- people-counting systems installed at the entrances of the monitored buildings;
- environmental sensors measuring parameters such as temperature, noise, relative humidity and CO_2;
- historical tourism statistics;
- stakeholder consultations;
- qualitative feedback collected through questionnaires, surveys and meetings.

A practical example of threshold definition was developed for indicator (E1) I.2 “Optimal levels of overcrowding of sites of cultural value”, following several methodological stages.

First, an initial baseline assessment was carried out using historical visitor records and stakeholder consultations. Official visitor data from 2023 showed:

- La Lonja: 624,934 annual visitors;
- Museum of the City: 26,942 annual visitors.

At the same time, discussions were held with local stakeholders and building managers to understand operational realities and acceptable occupancy conditions. In the case of La Lonja, stakeholders indicated that overcrowding was not constant but that occasional visitor peaks affected circulation and could potentially impact conservation conditions. In contrast, the Museum of the City was identified as a low-occupancy site with capacity to receive larger visitor flows.

Following this assessment, preliminary threshold values were proposed by combining:

- current occupancy patterns;
- management objectives;
- building capacity;
- conservation considerations;
- operational experience of local managers.

For La Lonja, the pilot estimated that an optimal range would be approximately 2,500–3,000 visitors per day. Acceptable ranges were established **between 1,000–2,500 and 3,000–4,000 daily** visitors, while values below 1,000 or above 4,000 visitors per day were considered critical.

For the Museum of the City, the objective was different, since the pilot sought to encourage greater visitor redistribution towards this less visited heritage site. In this case, optimal values were estimated at **200–300 visitors per day**, considering both current attendance levels and available operational resources.

The pilot also reviewed **external references and regulatory frameworks** during the threshold definition process.

These included UNESCO Operational Guidelines for World Heritage management, local heritage protection plans, environmental comfort references, and contextual comparisons with other nearby tourist attractions.

Further in the project, these preliminary thresholds were subsequently compared and validated against the data obtained through the monitoring systems installed in the buildings. In particular, occupancy peaks were analysed together with environmental parameters such as temperature, relative humidity, CO_2 concentration and noise levels, in order to assess whether indoor conditions remained within the comfort and conservation ranges previously established.

3.2.5. Recommendations for replication

Destinations interested in replicating this methodology should begin with a realistic assessment of their available data, technical capacity and local priorities. It is not necessary to implement the full set of indicators from the beginning. A smaller but operational set of **well-defined key indicators** is often more effective than a large and difficult-to-maintain monitoring system.

It is also recommended to:

- Start with key indicators directly linked to the main tourism challenges of the destination;
- Use existing open data sources whenever possible before investing in new technologies;
- Prioritise interoperability between datasets and platforms;
- Ensure that indicators are understandable and useful for decision-makers;
- Combine quantitative and qualitative information;
- Review thresholds periodically as new monitoring results become available.

Destinations should also avoid treating thresholds as fixed values. Tourism dynamics are highly context-dependent and may evolve over time due to changes in visitor behaviour, seasonality, infrastructure or local policies.

Suggested good practices and considerations

The TOURISMO experience identified several good practices that may support successful replication:

- Involve stakeholders from the early stages of indicator selection and validation;
- Ensure that monitoring activities respond to real operational needs;
- Maintain flexibility in the indicator system;
- Prioritise non-invasive and scalable monitoring technologies;
- Promote data-sharing mechanisms between institutions.

It is also important to recognise that not all destinations have the same technical capacity or access to data. The methodology should therefore be adapted proportionally to the scale, resources and objectives of each territory.

3.3. Compilation of complementary datasets

3.3.1. Purpose of the tool

An essential prerequisite for effectively managing tourism flows and mitigating the negative impacts of overtourism is the ability to monitor and analyse these flows in a systematic and reliable manner. Understanding what is happening in a specific site — when, where, and under which conditions — is the foundation upon which informed management decisions and targeted solutions can be developed.

In recent years, many destinations have invested, or are considering investing, in technological equipment capable of capturing primary data related to visitor flows. Such equipment may include person counters, intelligent cameras, LiDAR systems, mobile signal detectors, or similar monitoring tools that provide continuous or near-real-time information on visitor presence and movement within a site. These systems are crucial for generating quantitative evidence on tourism intensity and spatial–temporal patterns.

However, primary flow monitoring data alone is often insufficient to fully explain tourism dynamics or to support robust decision-making processes. Visitor flows are influenced by a wide range of external factors — such as weather conditions, seasonality, transport availability, events, accommodation occupancy, or broader mobility patterns — that cannot be captured by monitoring equipment alone. For this reason, it is necessary to complement primary data with additional datasets originating from existing sources.

At present, a large amount of potentially valuable information is available through open and freely accessible data sources at European, national and local levels. Public administrations, meteorological agencies, statistical offices, smart city departments, transport authorities and other entities increasingly publish data through open data portals, application programming interfaces (APIs), and similar digital mechanisms as part of their digitalisation and transparency strategies. Despite their availability, these datasets often remain underused, as they are developed independently, managed in sectoral silos, and not always well known to tourism managers or destination stakeholders.

Against this background, conducting a structured search and compilation of complementary datasets becomes a mandatory step in the development of a comprehensive analytical framework for tourism flow management. Identifying relevant data sources, assessing their quality and accessibility, and understanding their potential added value are critical to extending the knowledge base beyond what is provided by on-site monitoring technologies alone. When combined and correlated, primary and complementary data allow for more nuanced analyses, improved interpretation of results, and stronger evidence to support strategic and operational decisions.

This chapter of the TOURISMO Toolkit provides guidance for approaching this crucial step. It outlines a systematic process for identifying, collecting and organising complementary datasets, with a particular emphasis on open data sources. It also proposes criteria for data classification and highlights key characteristics to be considered, such as spatial and temporal resolution, data ownership, update frequency, interoperability and relevance for tourism flow analysis. In doing so, the chapter supports destinations in building a more integrated, data-driven understanding of tourism dynamics, adaptable to different Mediterranean contexts and scalable to future needs.

3.3.2. Preconditions and required inputs

The effective application of the TOURISMO Toolkit requires the fulfilment of a set of minimum preconditions related to data availability and stakeholder involvement. These elements are essential to ensure that the proposed analytical and management approaches can be implemented in a reliable and scalable manner.

Minimum Data Requirements

At a minimum, destinations should have access to core datasets that directly support the objectives defined for the pilot site. These typically include primary monitoring data (e.g. visitor counts, flows, or occupancy levels) complemented by contextual datasets such as weather conditions, transport information or tourism statistics, depending on the use case.

To ensure operational feasibility:

- Data should be digitally available and transferable, preferably through online access, APIs, databases or similar mechanisms, allowing automatic or semi-automatic ingestion into the smart city or destination management platform.
- Data sources must be trustworthy and reliable, preferably provided by recognised public authorities, infrastructure operators or established data providers, with clear documentation and known update frequencies.
- For datasets that are critical to achieving the defined objectives, alternative or backup sources should be identified wherever possible. This redundancy increases the robustness of the system and reduces risks associated with data unavailability, technical failures or changes in access conditions.

Attention should also be paid to basic data quality aspects such as temporal continuity, spatial coverage and consistency over time, as these factors strongly influence the usability of the data for analytics and decision support.

Stakeholders to Be Consulted or Involved

Stakeholder involvement represents an additional key precondition. Several actors may own, manage or influence access to relevant data sources, including infrastructure owners, port authorities, transport operators, municipalities, tourism boards and smart city departments.

To facilitate collaboration:

- Key stakeholders should be informed about the project objectives and expected benefits at an early stage.
- Workshops or coordination meetings are recommended as effective tools to align expectations, clarify data needs and build trust.
- Early engagement often simplifies access to complementary datasets and reduces barriers related to data sharing, governance or institutional silos.

By ensuring the availability of minimum data inputs and proactively involving relevant stakeholders, destinations can create a favourable environment for the successful deployment of the TOURISMO Toolkit and for data-driven tourism flow management initiatives.

3.3.3. Methodological approach

The compilation of complementary datasets follows a structured, purpose-driven methodological approach, designed to ensure that the selected data effectively supports tourism flow monitoring, analysis, and management at pilot site level. Rather than collecting data indiscriminately, the approach emphasises relevance, usability and coherence with the overall objectives of the destination.

Step 1: Definition of Objectives at Pilot Site Level

The first methodological step consists of clearly defining the objectives related to tourism flow management for each monitored site. Objectives should be specific, measurable, achievable, relevant and time-bound (SMART) and closely linked to the concrete challenges observed at the destination (e.g. overcrowding during peak hours, congestion at access points, seasonal imbalance, pressure on sensitive areas).

Examples of site-specific objectives may include:

- Reducing visitor congestion at specific times or locations;
- Improving the distribution of visitors across space and time;
- Enhancing visitor experience while protecting local communities and natural or cultural assets;
- Supporting proactive operational measures or long-term planning decisions.

Clearly defined objectives provide a necessary reference framework for determining what type of information is required and which data sources are relevant.

Step 2: Design of Solutions and Identification of Information Needs

Once the objectives are established, the next step is to design a set of solutions or management measures aimed at addressing the identified challenges. These solutions may be operational (e.g. dynamic access management, visitor redirection), strategic (e.g. spatial planning, policy measures), or communicative (e.g. visitor information systems).

At this stage, solutions should be described with sufficient detail to allow a straightforward identification of information needs. This includes understanding:

- Which indicators are required to assess the situation,
- Which variables influence tourism flows,
- What temporal and spatial granularity is necessary.

Some of the required information can be obtained through **primary data** generated by on-site monitoring equipment (such as people counters, cameras or sensors). However, other information cannot be captured directly and must be sourced from complementary datasets (e.g. weather conditions, public transport usage, accommodation occupancy, event calendars).

A key methodological principle is to avoid overloading the system with redundant or low-value data. The focus is not on collecting as much data as possible, but rather on **selecting data that is meaningful, actionable and directly linked to the defined objectives**.

Step 3: Identification and Access to Complementary Data Sources

Based on the identified information needs, a structured search for complementary datasets is carried out. Data sources may include:

- Open data portals at European, national or local levels;
- Internal or proprietary datasets within public administrations or destination organisations;
- Data hosted in sector-specific infrastructures or platforms (e.g. transport, environment, smart city systems);
- Data owned by third parties, both public and private.

Depending on the source, accessing the data may require different levels of effort, ranging from simple downloads to setting up **formal agreements**, such as data-sharing protocols, memoranda of understanding or non-disclosure agreements (NDAs). For this reason, the **time and organisational effort required to obtain the data** must be considered as part of the methodological planning.

This step also involves an initial assessment of data availability, continuity, reliability and legal conditions, which may influence the feasibility of its use during pilot testing.

Step 4: Dataset Inventory and Classification

To support consistent analysis, integration and reusability, all identified datasets are compiled into a structured inventory. Within the TOURISMO project, this inventory was designed not only to document available and desired datasets, but also to facilitate subsequent steps such as data processing, analytics, system integration and visualisation.

Each dataset or data source is described using a set of common characteristics, including:

- **Data Source ID**: Unique identifier assigned to each data source.
- **Data Source Name**: Name of the dataset or data source.
- **Description**: Summary of the information provided.
- **Objective**: Purpose for which the dataset is used in the pilot.
- **Data Type**: Category of data (e.g. weather, tourist arrivals, mobility).
- **Source URL**: Access point to the data.
- **Open Data (Yes/No)**: Indication of data openness.
- **Data Provider**: Organisation responsible for the data.
- **Geographical Coverage**: Spatial extent covered by the data.
- **Temporal Coverage**: Time period covered.
- **Update Frequency**: How often the data is updated.
- **Data Format**: Technical format (e.g. CSV, JSON).
- **Usage Rights**: Licensing and usage conditions.
- **Possibility for Real-Time Usage**: Availability of real-time or near-real-time access via APIs or databases.
- **Integration Status**: Status of integration into the TOURISMO digital infrastructure (e.g. Snap4City).

This common structure ensures comparability across pilot sites, improves transparency, and reduces barriers for future reuse or transfer to other Mediterranean destinations.

Step 5: Preparation for Analysis and Integration

As a final methodological consideration, the compilation of datasets is carried out with a forward-looking perspective. The characteristics collected are specifically chosen to ease subsequent activities within the TOURISMO Toolkit, including data analytics, processing, interoperability, system integration and visualisation. By addressing these aspects early in the process, destinations can reduce technical bottlenecks and improve the overall effectiveness of data-driven tourism flow management.

3.3.4. Application example from TOURISMO pilots

As an example of the above methodology, in this section the case for the Valencia Port pilot site is exposed. In the following table, the application of the methodology for that pilot is summarised..

Methodological Step	Application to Valencia Port Pilot
1. Definition of Objectives	Predict the number of cruise passengers likely to disembark and their destinations; analyse transport modes used to reach tourist areas; identify tourist attractions most frequently visited by cruise passengers.
2. Design of Solutions and Information Needs	Use Machine Learning models trained with historical and real-time data. Required information includes PAX sensor counts, cruise schedules, vessel characteristics, weather conditions, transport usage and queue data at attractions. Data selection focuses on relevance and usability.
3. Identification and Access to Data Sources	Search for complementary data from open sources (e.g. port call schedules), internal port systems (meteorology), and sensor systems. Access may require APIs or institutional agreements, which are considered in planning.
4. Dataset Inventory and Classification	Complementary datasets such as Port Call Schedules and Meteorological Data are documented using a structured inventory including objectives, data type, provider, openness, coverage, update frequency and integration status.
5. Preparation for Analysis and Integration	Datasets are assessed for suitability for predictive analytics, real-time use and integration into the TOURISMO digital infrastructure, supporting decision-making and passenger information services.

In the following image, a snapshot of the inventory for the Valencia Port pilot site is shown.

Data Source ID	Pilot Site ID (Jems)	Data Source Name	Description	Objective	Data Type	Source URL	Open Data (Yes/No)	Da
VLP-01	I2.3 - Valencia Port pilot	Port Call Schedule	Contains a history of cruise port calls with temporal events (e.g. ETA, ATA) and vessel's characteristics.	Analyse its parameters such as arrival and departure times, port call and vessels characteristics for the pilot's predictions to be made. Through the API get the schedule and vessel's characteristics of future cruise visits.	Cruise arrivals and departures	https://www.valenciaportpcs.net/portcalls/Search	Yes	Po Va
VLP-02	I2.3 - Valencia Port pilot	Meteorology	Contains a history of meteorological parameters being measured by the meteorological stations located inside the port.	Analyse and correlate meteorological conditions with thenumber of cruisers disembarking in past cruise visits	Rain gauge, wind, humidity, solar radiation, temperature	Not Available (through an URL)	No (But it could be)	Po Va

Figure 11. Valencia Port complementary datasets table

3.3.5. Recommendations for replication

- **Define clear, site-specific objectives:** Begin with clearly articulated and measurable objectives linked to concrete tourism flow management challenges. Objectives should guide all subsequent decisions on technologies, data sources and analytical methods.
- **Design solutions before collecting data:** Identify the management or analytical solutions to be implemented before searching for data. This ensures that data selection is purpose-driven and directly supports decision-making, rather than resulting in unused or redundant datasets.
- **Balance primary and complementary data:** Combine data from on-site monitoring equipment with complementary datasets (e.g. weather, transport, events, statistics) to achieve a comprehensive understanding of tourism dynamics. Recognise that sensors alone rarely provide sufficient explanatory context.
- **Prioritise relevance, quality and usability:** Focus on datasets that are reliable, regularly updated, and appropriate in terms of spatial and temporal resolution. Avoid over-collection of data and prioritise information that can be effectively analysed and operationalised.
- **Leverage open data, anticipate access constraints:** Systematically explore open data sources at European, national and local levels. When non-open data are required, plan in advance for access conditions, legal constraints and potential delays linked to data-sharing agreements.
- **Use a structured dataset inventory:** Document all datasets using a standard set of characteristics (objective, data type, coverage, format, usage rights, update frequency). This facilitates comparison, integration, analytics and reuse across pilot sites and destinations.
- **Plan for scalability and transferability:** Adopt solutions and data models that rely on standard formats, interoperable systems and widely available data sources, enhancing the potential for replication in other Mediterranean destinations.

3.4. Selection of tool to visualise tourism data

3.4.1. Purpose of the tool

The visualisation of tourism data is a key component of data-driven tourism flow management. The purpose of this tool is to transform heterogeneous datasets and analytical outputs into understandable, actionable and interactive information that can support operational monitoring, strategic planning and decision-making processes.

Within the TOURISMO context, tourism-related information originates from multiple sources, including thermal cameras, Wi-Fi/Bluetooth tracking, drones, environmental sensors, mobility and transport data, statistical data, users' participation/engagement data, and administrative data. Without an appropriate data analysis and visualisation environment, the large amount of collected data may become difficult to interpret, limiting its practical usefulness for destination managers and public authorities.

The objective of this tool is therefore to support the selection and deployment of a digital platform capable of:

- Integrating heterogeneous and real-time datasets;
- Visualising tourism indicators and flows in an intuitive manner;
- Supporting monitoring, prediction and decision-making activities;
- Facilitating communication among technical and non-technical stakeholders;
- Enabling scalability and replicability across different pilot areas.

In the TOURISMO project, the visualisation layer was implemented through the adoption and adaptation of the **Snap4City platform**, originally developed within previous European initiatives including Interreg HERIT-DATA. The platform provides a flexible environment for integrating IoT data, contextual information, analytics and flexible visualisation tools/dashboards into a unified smart city ecosystem.

The expected outputs of this tool include:

- Operational dashboards for monitoring tourism flows and related indicators;
- Interactive maps and geospatial visualisations of tourism dynamics;
- Real-time alerts and event monitoring functionalities;
- Decision-support interfaces for destination managers and authorities;
- Historical and predictive analytics visualisation tools;
- Customisable interfaces adapted to the needs of different stakeholders.

Beyond simple data representation, the visualisation platform acts as an enabling layer connecting data collection, analytics and operational management, helping destinations move from fragmented datasets to integrated and actionable knowledge.

3.4.2. Preconditions and required inputs

The implementation of a tourism data visualisation platform requires several technical, organisational and operational preconditions to ensure effectiveness and sustainability.

Minimum data requirements

At a minimum, the selected platform should be capable of receiving and processing:

- Tourism flow monitoring data (e.g. people counters, Wi-Fi/Bluetooth tracking, cameras, etc.);
- Statistical tourism data;
- Geospatial information;
- Complementary contextual datasets such as weather, mobility, transport and events data;
- Historical and, where possible, real-time datasets.

To maximise interoperability and scalability, datasets should preferably:

- Be digitally accessible through APIs, databases or standard data formats (e.g. JSON, CSV, MQTT, NGSI);
- Include metadata and temporal information;
- Follow standardised structures where possible;
- Be compatible with real-time or near-real-time data ingestion.

Data quality is also essential. Incomplete, inconsistent or poorly synchronised datasets may reduce the reliability of visualisations and associated decision-support processes.

Technical and infrastructure requirements

The selected visualisation environment should provide:

- Cloud or server infrastructure capable of handling multiple datasets;
- Support for the development and implementation of Data Analytics, Machine Learning/AI algorithms
- Support for dashboard creation and geospatial visualisation with flexible visualisation capabilities;
- Integration capabilities with IoT devices and external APIs;
- User authentication and role management, GDPR compliance, permission management and security;
- Scalability to incorporate future datasets and analytical services.

Particular attention should be paid to interoperability and openness, ensuring that the platform can integrate data from multiple providers without excessive custom development.

Stakeholders to be consulted or involved

The selection and configuration of the visualisation tool should involve:

- Public authorities and municipalities;

- Destination Management Organisations (DMOs);
- Smart city departments and ICT teams;
- Tourism managers and operational staff;
- Data providers and infrastructure owners;
- Universities or research centres supporting analytics activities.

Stakeholder involvement is important to ensure that dashboards and interfaces reflect real operational needs rather than purely technical perspectives. Early engagement also facilitates alignment regarding data governance, access rights and expected functionalities.

3.4.3. Methodological approach

The selection and deployment of a data visualisation platform based on Snap4City technology should follow a structured and iterative methodology.

Step 1: Define operational and analytical objectives

The first step consists of identifying the operational and strategic objectives that the platform should support. Examples may include:

- Real-time monitoring of visitor congestion;
- Predictive analysis of tourism flows;
- Monitoring environmental impacts;
- Supporting mobility management;
- Enhancing communication with tourists or operators.

Objectives should guide the type of visualisations, indicators and functionalities required.

Step 2: Identify users and decision-making needs

Different stakeholders require different levels of information and interface complexity. It is therefore important to identify:

- Who will use the platform;
- What decisions they need to support;
- Which indicators are most relevant;
- What temporal and spatial granularity is required.

This user-centred approach helps avoid overly complex dashboards with excessive or irrelevant information.

Step 3: Platform instantiation and data source registration

A dedicated Snap4City instance is deployed (on cloud or on-premises) for the pilot area, according to criteria

such as:

- Interoperability and integration capabilities;
- Real-time data management;
- Dashboard customisation;
- Geospatial visualisation functionalities;
- Scalability and modularity;
- AI and analytics integration;
- User management and security;
- Open-source availability or licensing conditions;
- Replicability in other destinations.

Within TOURISMO, the use of Snap4City was considered particularly suitable due to its ability to integrate heterogeneous urban and tourism-related datasets into a unified digital twin environment.

Step 4: Integrate datasets and analytics services

The next step involves connecting the identified datasets to the platform and configuring:

- Data ingestion pipelines;
- APIs and connectors;
- Real-time streams;
- Predictive analytics services;
- Data harmonisation and semantic models.

Within Snap4City, this process includes the creation of data brokers, IoT applications, semantic interoperability layers and digital twin components.

Step 5: Design dashboards and visualisation logic

Once the platform is deployed, dashboards and interfaces should be designed according to operational priorities. Good practices include:

- Prioritising simplicity and readability;
- Using maps and spatial visualisations for tourism flows;
- Including threshold-based alerts and KPIs;
- Combining real-time and historical views;
- Allowing filtering by time, location or data category.

Dashboards should support both detailed analysis and quick operational interpretation.

Step 6: Validate usability with stakeholders

Pilot users and stakeholders should test the dashboards and interfaces in operational conditions. Validation should assess:

- Ease of interpretation;
- Relevance of indicators;
- Responsiveness of the system;
- Reliability of visualisations;
- Practical usefulness for decision-making.

Feedback obtained during this phase should be used to refine dashboards and functionalities iteratively.

Step 7: Prepare long-term operational deployment

Finally, governance and sustainability aspects should be addressed, including:

- Platform maintenance responsibilities;
- Data governance procedures;
- User training;
- Scalability plans;
- Cybersecurity and privacy considerations;
- Long-term hosting and operational costs.

This ensures that the platform remains operational and useful beyond the pilot phase.

3.4.4. Application example from TOURISMO pilots

In the case of Valencia, the visualisation layer was implemented through the Snap4City platform, with the objective of integrating and displaying tourism flow and environmental monitoring data collected both in the historic centre of the city and in the Port of Valencia.

The first step consisted of defining the operational objectives of the platform. The main objective was to provide public authorities, including Valencia City Council, the Heritage Service and the Port Authority, as well as site managers, with real-time and historical information on visitor occupancy and environmental conditions. This information supports a better understanding of tourism pressure and enables more informed decision-making regarding visitor flow management in both the city centre and the port area, while also supporting the conservation of two monitored heritage buildings located in the historic centre. Additional objectives included improving access to tourism-related information and facilitating data-driven discussions among a wider range of stakeholders, including tourism agencies, tourism operators and other interested organisations.

Once the objectives had been defined and the main user groups and their information needs identified, a dedicated Snap4City environment was configured and connected to the different data sources used within the pilot. These included people-counting systems installed at strategic locations in the port, throughout the historic centre and at the entrances of the monitored heritage buildings. The platform also integrated environmental sensors measuring temperature, relative humidity, CO_2 concentration and noise levels inside the selected buildings, together with complementary datasets from public sources, including weather information, parking occupancy data and other contextual tourism-related information.

Based on the selected indicators and monitoring objectives, a series of dashboards were developed to visualise occupancy levels, visitor trends and environmental conditions. The dashboards combined graphical representations, time-series analysis and geospatial visualisations, allowing users to analyse tourism pressure patterns and compare them with conservation-related parameters. Particular emphasis was placed on simplicity, readability and the use of threshold-based visualisations to facilitate operational interpretation, ensuring that the information could be easily understood by both technical and non-technical users.

One of the most valuable features of the platform is its interactive map-based interface. Users can visualise the geographical location of the different data sources, including sensors, people-counting devices and other monitoring points. By selecting an element on the map, a summary of the associated data can be displayed,

facilitating quick interpretation and exploration. In addition, users can activate or hide different data layers according to their needs, allowing the dashboard to be adapted to specific analyses and improving the readability of complex datasets.

The dashboards were progressively reviewed and refined through continuous exchanges with pilot stakeholders and end users, including project meetings, Info Days, workshops involving different stakeholder groups, and regular coordination meetings with site managers and public authorities. This validation process helped improve the relevance of the displayed indicators, refine visualisation formats and ensure that the platform responded to real operational and management needs.

As the pilot evolved and new datasets became available, a series of dedicated thematic dashboards were also developed and made accessible from the main interface. These dashboards focused on specific aspects of the pilot, including La Lonja, the Museum of the City, cruise activity, city centre visitor monitoring, sentiment analysis and other tourism-related datasets. This modular structure allowed users to move from a general overview of the destination to more detailed analyses of individual sites, indicators or management challenges.



Figure 12. Valencia main dashboard on Snap4city

3.4.5. Recommendations for replication

Destinations considering adopting Snap4City for tourism data visualisation should take into account a number of practical considerations summarised below.

- To reduce the risk of data quality issues and allow the team to build familiarity with the platform incrementally, it is advisable to start with a limited set of well-defined indicators and a small number of reliable data sources, rather than attempting a comprehensive integration from the outset.
- Involving end users (destination managers, municipality officers) from the earliest stages of solution and

tool design significantly improves the relevance and uptake of the tool.

- If sensor data are not available or too costly to deploy, Snap4City can still deliver meaningful visualisations using open statistical datasets and publicly available APIs, making it accessible even to resource-constrained destinations.
- Consider sharing public dashboards to promote transparency and engage citizens and tourists in sustainable destination management.
- Prioritise interoperability and openness in Snap4City platforms for integrating heterogeneous datasets through standard protocols and APIs. This reduces future integration costs and improves scalability.
- Keep dashboards simple and actionable. Avoid excessive complexity. Dashboards should focus on a limited number of meaningful KPIs and visualisations directly linked to decision-making needs.
- Combine real-time and historical analysis. Operational monitoring should be complemented with historical trends and predictive analytics to support both immediate actions and long-term planning.
- Ensure scalability from the beginning. Select architectures and technologies that can progressively integrate additional datasets, services and pilot areas without requiring major redesign.
- Involve end users throughout the process. Continuous stakeholder feedback improves usability, relevance and adoption of the platform.
- Consider governance and sustainability aspects early. Long-term maintenance, hosting, cybersecurity, data governance and operational responsibilities should be addressed from the initial stages of deployment.
- Use digital twins and geospatial visualisation. Spatial representation of tourism dynamics significantly improves the understanding of flows, congestion patterns and interactions between tourism and urban systems.

Promote replicability and transferability. Adopt standardised approaches, modular architectures and reusable dashboard models to facilitate transfer to other destinations and tourism contexts.

3.5. Methodology for pilot actions

3.5.1. Purpose of the tool

Developed within the TOURISMO project, the **Common Demonstration Methodology for Pilot Actions** provides a structured framework to design, deploy, and evaluate targeted strategies for tourism flow monitoring and management. Building upon the experience and technological foundations of the HERIT-DATA project, it combines data-driven approaches with robust governance and stakeholder engagement processes.

The framework establishes a unified operational approach across all pilot areas to ensure coherence and comparability, thereby facilitating seamless coordination and knowledge exchange among project partners. Simultaneously, its flexible design allows each destination to adapt the model to its specific territorial

characteristics, governance structures, and tourism challenges.

Particular attention is given to aligning local needs with data availability, technical feasibility, and operational requirements. Consequently, the methodology guides partners through the entire development lifecycle—from initial scope definition and solution mapping to platform integration, behavioural influence techniques, and final evaluation.

To achieve this operational support, the methodology relies on four core structural pillars:

- **Strategic Design and Stakeholder Engagement:** It outlines a clear sequence for objective setting and scope definition, adapting the Quadruple Helix Model to the TOURISMO context to map and engage local stakeholders, ensuring long-term sustainability and policy alignment.
- **Data Lifecycle and Platform Integration:** It establishes a structured data lifecycle encompassing data discovery, modelling, and analytics design, which directly feed into the technical platform integration phase, ensuring secure data processing logic and user interface development.
- **Equipment Selection and Technology Procurement:** It provides clear guidance on identifying, procuring, and deploying the specific physical equipment and technologies required to monitor visitor numbers and flows across the diverse pilot areas.
- **Visitor Behaviour and Flow Management:** To mitigate overtourism, it places significant emphasis on proactive management through coordinated communication strategies, tailored incentives, and behavioural influence techniques—such as nudging and sentiment analysis—implemented in close collaboration with local entities to subtly guide tourist movement.

Main Objective and Expected Output

To drive tangible results, the framework focuses its operational capacity on three core areas:

- **Empowering project partners** to execute interventions in a structured, coordinated, and replicable manner.
- **Harmonising deployment standards** for data-driven tourism management solutions, ensuring technical, organisational, and governance aspects are addressed from the outset.
- **Harnessing behavioural influence techniques** to optimise visitor decisions, reduce crowding in critical areas, and promote lesser-known local attractions through nudging, real-time incentives, and targeted communications.

The expected output is a practical methodological reference providing a clear, step-by-step process for the specification, deployment, and evaluation of local actions. By identifying implementation requirements, enabling conditions, and potential operational barriers, this tool helps stakeholders anticipate challenges prior to deployment. Ultimately, it serves as a transferable model to assist other Mediterranean destinations facing severe tourism pressure and overtourism challenges.

3.5.2. Preconditions and required inputs

Rather than prescribing a rigid set of universal datasets, the **Common Demonstration Methodology for Pilot Actions** adapts minimum data requirements to the specific objectives, territorial characteristics, and operational scope of each destination. However, the framework presupposes guaranteed access to core data sources capable of supporting robust tourism flow monitoring, analysis, and decision-making.

At a minimum, pilot areas must leverage data tailored to their specific management challenges, drawing from diverse sources and technologies such as field sensors, statistical databases, smart city infrastructures, and existing destination management platforms. These targeted data types include:

- Tourism statistics, visitor flows, and historical or real-time monitoring data.
- Mobility, transport, accommodation, and occupancy metrics.
- Environmental, weather, and event-related information.
- Geospatial asset data and complementary public open data.

The methodology requires a rigorous assessment of these datasets during the initial pilot preparation phases. This evaluation focuses on data accessibility, update frequency, spatial granularity, and overall quality. Concurrently, partners must ensure technical interoperability with the selected IT platform, verifying that heterogeneous data sources can be successfully combined to support advanced analytics, visualization, and decision-support functionalities while respecting legal and ethical constraints.

Stakeholders to be consulted or involved, where relevant

The framework operationalises a multi-stakeholder approach based on the Quadruple Helix Model, recognising that effective tourism flow management requires active coordination among public authorities, the private sector, academia, and civil society. This cross-sectoral involvement is a prerequisite for the successful planning, delivery, and long-term sustainability of the interventions.

Depending on the pilot destination's ecosystem, relevant actors to be engaged include:

- Local, regional, and national public authorities, alongside DMOs.
- Tourism, transport, and port operators, as well as cultural and heritage institutions.
- Universities, research centres, technology providers, and smart city departments.
- Local communities, civil society associations, and visitors.

These stakeholders contribute dynamically across the pilot lifecycle by identifying local operational needs, providing critical datasets, validating flow analyses, and deploying technological solutions. Within the TOURISMO project, this engagement was structured through workshops, Infodays, technical meetings, and participatory sessions. Engaging these actors at an early stage proved essential to overcoming barriers related to data access, institutional coordination, and operational deployment, ensuring transparent governance across the tourism ecosystem.

3.5.3. Methodological approach

The operational implementation across the 8 TOURISMO pilots followed a structured six-step methodological sequence designed to ensure consistency, comparability and adaptability across the different pilot areas.

Step 1: Designing a Common Framework for Implementation

Outlining a clear set of steps to ensure that solutions are implemented systematically and consistently through a comprehensive roadmap, and applying the SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) criteria for effective goal-setting.

Step 2: Data Collection Planning

Developing detailed timelines and protocols for systematic data collection to capture accurate and relevant data for analysis.

Step 3: Platform Integration

Establishing protocols for connecting with digital platforms, which serve as essential tools for data gathering, communication, and stakeholder engagement.

Step 4: Selection of Equipment and Technologies

Identifying and planning the procurement of the appropriate equipment, tools, and technologies required for effective pilot implementation and data collection.

Step 5: Engagement Strategies

Developing tailored approaches to interact with key stakeholders in the tourism sector, with a focus on influencing user behaviour and fostering engagement among diverse groups. These strategies aim to actively involve tourists and local communities, encouraging meaningful interactions that drive measurable behavioural changes. The ultimate goal is to enhance the overall visitor experience while promoting sustainable practices within the sector.

Step 6: Identification of Indicators and Related Thresholds

Establishing key performance indicators (KPIs) and specific thresholds to monitor pilot success. These indicators serve as benchmarks for evaluating the effectiveness of pilot actions, providing quantifiable metrics for precise assessments. The definition of these thresholds ensures that both progress and challenges are captured in real time, guiding necessary adjustments and enhancing the quality of decision-making.

3.5.4. Application example from TOURISMO pilots

An application of the Common Demonstration Methodology was carried out in Florence, where the pilot focused on monitoring and managing tourism flows within the historic city centre, an area characterised by high visitor concentration and significant pressure on cultural heritage sites and public spaces. The pilot aimed to improve the understanding of tourism dynamics and support more informed destination management through data-driven approaches, real-time monitoring solutions and sentiment analysis activities.

Following the methodology, the pilot first defined its operational objectives, focusing on the analysis of visitor concentration patterns, the identification of peak pressure periods and areas, and the improvement of tourism flow monitoring capabilities within the city centre. The methodology was then adapted to the specific characteristics of the Florence context, taking into account the historic urban environment, the distribution of tourism hotspots and the governance framework of the destination.

Based on these objectives, the pilot identified the main information needs, relevant primary and secondary indicators, and the datasets required to support the analysis and monitoring activities. The implementation combined different types of data sources, including tourism statistics, mobility-related information and data collected through monitoring technologies integrated within the TOURISMO digital platform environment. In addition, sentiment analysis activities were carried out to better understand visitors' perceptions, experiences and behaviours, as well as reactions related to tourism pressure and the use of urban spaces.

Particular attention was given to the integration of heterogeneous datasets and to the visualisation of information through dashboards and analytical tools supporting tourism flow analysis, monitoring and decision-making processes. The pilot also included communication and stakeholder engagement activities aimed at increasing awareness of sustainable tourism management challenges and encouraging collaboration between the different actors involved in the destination.

Stakeholder engagement represented a key component of the implementation process. Local authorities, tourism-related actors, cultural institutions, research organisations and other relevant stakeholders were involved throughout the different phases of the pilot in order to support the identification of local needs, facilitate coordination activities and contribute to the validation of the pilot approach and results.

The Florence pilot demonstrated the applicability of the methodology in a complex urban and heritage context, highlighting the importance of combining technological solutions, integrated datasets, indicators, sentiment analysis and stakeholder collaboration to support tourism flow monitoring and more sustainable destination management practices.

3.5.5. Recommendations for replication

As practical guidance for future users, it is important to first define three types of requirements for the application of the solution:

- **Financial:** A budget is required for the procurement of equipment, including sensors, IoT devices, and related infrastructure, as well as for software development and indicator monitoring.
- **Technical:** Expertise in large language models (LLMs), data analytics, and platform development and configuration is needed.
- **Operational:** A clear implementation timeline (e.g., Gantt charts), staff for stakeholder training, and dedicated teams for platform operation and data management are necessary.

The methodology itself is readily transferable, as it provides structured guidance on the actions to be implemented across the different phases of the pilot cycle. Moreover, the territorial scale does not significantly affect the applicability of the methodology, enhancing replicability across different destination contexts. Key

enabling conditions include:

- Availability of diverse and interoperable data sources that are open and usable.
- Formal authorisation from property owners or site managers to install sensors and monitoring equipment for the collection of relevant data.
- Availability of funding for the purchase, installation, and possible maintenance or insurance of sensors and technological equipment.
- Compliance with the GDPR, the AI Act, and other relevant regulatory frameworks governing data collection and processing.
- A common monitoring framework to ensure comparability of results across different contexts.
- Integration with a digital platform capable of supporting IoT connectivity, data ingestion, and analysis, such as Snap4City.
- Active territorial cooperation among relevant stakeholders of the Quadruple Helix to ensure the sustainability of implementation.
- Customisation of the solution to align with local regulations, governance structures and tourism strategies.
- Customisation of indicators to adapt them to the specific pilot context and to measure what is meaningful and strategically relevant for the destination.

Suggested good practices and considerations

Lessons learned and key considerations emerging from the development of the methodology can be summarised as follows:

- **Continuous stakeholder engagement:** Regular feedback activities (e.g., meetings, website updates and social media communication) and informative events (workshops, Infodays) are crucial to ensure that technical tools align with actual local needs and to support effective implementation throughout the pilot phase.
- **Flexibility:** The indicator system must remain flexible; some indicators may become more or less relevant as the pilot evolves and should be reclassified within the monitoring framework rather than being rigidly fixed.
- **Communication and behavioural approaches:** Influencing tourist behaviour requires a combination of digital approaches, such as behavioural nudging techniques and digital communication tools, together with physical information and awareness-raising activities (e.g., QR codes, workshops and local engagement initiatives) to ensure broader outreach and behavioural impact.
- **Integration and interoperability:** Particular attention should be given to the interoperability between datasets, monitoring technologies and digital platforms, as effective integration is essential to support data analysis, visualisation and evidence-based decision-making processes.

4. Conclusions

The experience developed throughout Work Package 1 in the TOURISMO project demonstrated that **the management of tourism flows requires a combination of data, technology, local knowledge and stakeholder engagement**. While the methodology proved applicable across a wide variety of Mediterranean contexts, its implementation also revealed several operational and methodological challenges that provide valuable insights for future replication.

The activities carried out contributed to establishing a **common framework for analysing tourism dynamics, selecting indicators, identifying relevant datasets, visualising information and planning pilot interventions**. At the same time, the diversity of pilot areas confirmed that tourism monitoring and management solutions must remain sufficiently **flexible to adapt to different territorial realities, governance structures and data ecosystems**.

4.1. Challenges addressed

One of the main challenges encountered during the implementation of the tools described in this Toolkit was the need to properly characterise each pilot area before defining monitoring objectives, indicators and actions. This required extensive consultation with local stakeholders, as quantitative data alone were often insufficient to understand tourism dynamics, visitor behaviour and local management priorities.

The definition of thresholds represented another significant challenge. In many cases, limited historical data or the absence of previous studies made it difficult to establish what should be considered normal, acceptable or critical conditions. As a result, threshold values often had to be defined through a combination of expert judgement, stakeholder consultation and progressive validation using real monitoring data.

Data availability varied considerably among pilot areas. While some destinations had access to extensive statistical, mobility or sensor datasets, others relied on more limited sources of information. Consequently, not all indicators, including some classified as key indicators, could be applied uniformly across all pilots. This highlighted the need to balance methodological consistency with practical feasibility.

Additional challenges emerged from the fragmentation of data sources across different institutions and platforms. Differences in data formats, update frequencies, interoperability standards and ownership conditions often complicated data integration processes. In some cases, access to real-time or near-real-time data was restricted by technical limitations, legal requirements or organisational constraints.

The implementation of the visualisation platform also required substantial adaptation to local contexts. Dashboards, visualisations and functionalities needed to respond to different management objectives, stakeholder expectations and levels of technical capacity. This reinforced the importance of maintaining a **flexible and user-oriented approach** throughout the development process. However, the experience also confirmed the high versatility of the platform, which successfully accommodated the needs of very different pilot areas while maintaining a common architecture, methodology and visualisation environment.

Finally, the project highlighted the constant need to **balance comparability across pilot areas with adaptation to local territorial conditions**. While a common methodological framework is essential to facilitate knowledge transfer and replication, successful implementation ultimately depends on recognising and accommodating local specificities.

4.2. Lessons learnt

One of the main lessons learned is that a rigid methodology would not have been capable of accommodating the diversity of tourism destinations represented within TOURISMO. Instead, a flexible structure allowed partners to **adapt indicators, datasets, technologies and visualisation tools according to their specific needs and constraints**.

The project also confirmed that it **is preferable to start working with available data rather than waiting for ideal datasets** that may never become accessible. **Incremental implementation** proved more effective than attempting to build complete monitoring systems from the outset. Simple templates and structured methodologies helped partners organise information consistently and progressively improve data quality over time.

The experience with the visualisation platform demonstrated that dashboards are most effective when they remain **simple, intuitive and focused on operational needs**. Excessively complex interfaces can reduce usability and limit the practical value of collected data. A step-by-step development process, supported by continuous feedback from pilot managers and end users, proved particularly effective for refining functionalities and improving adoption.

Stakeholder engagement emerged as a critical success factor throughout all stages of the process. Consulting different stakeholder groups provided complementary perspectives and helped identify issues that would not have been visible through data analysis alone. Likewise, **combining quantitative information with qualitative insights** enabled a more comprehensive understanding of tourism dynamics and destination challenges.

The project also highlighted the importance of interoperability. Effective tourism monitoring increasingly depends on the ability to i**ntegrate heterogeneous datasets originating from multiple sources and institutions**. Technical solutions alone are not sufficient if data governance mechanisms and collaboration agreements are not in place.

Another important lesson concerns the selection of indicators. Indicators should not only reflect theoretical sustainability objectives but also **respond to what can realistically be measured** within each destination. This requires continuous adaptation as new datasets become available or monitoring capacities evolve.

Finally, TOURISMO demonstrated that replicability depends on much more than technology. The successful transfer of methodologies and tools requires **adequate governance structures, stakeholder cooperation, local knowledge and sufficient data availability**. Technology can facilitate decision-making, but its effectiveness ultimately depends on the institutional and organisational environment in which it is deployed.

Annexes

Annex 1 - Common template for pilot characterization

PILOT CHARACTERIZATION

Please complete the following document to provide information on touristic habits and tourism flows in the XXXX pilot.

Description of the pilot area:

· Provide a description of the pilot including its geographic location, main characteristics, and tourism relevance. (150-200 words)

· What are the peak tourist seasons? Have they changed in any way in the last 10 years? (Beyond the summer season, which sees high demand throughout the MED area, please be more specific and consider national holidays and weekends.)

Tourist profiles and flows:

· Outline the demographic characteristics of tourists who visit the pilot area. (If possible, characterize the main by categories and briefly describe each.)

· Is there any method currently being used to study/monitor tourism flows in the pilot area? Please describe.

Stakeholders:

· Identify and describe the different stakeholders involved in the pilot at the national, regional, and local levels.

Pilot implementation:

· Identify steps towards pilot implementation" ("please provide a (high-level) step-wise description of the actions you plan to take at this stage towards the implementation of the pilot.

· First draft of the Timeplan for aforementioned pilot implementation steps.

Extra:

Please share links to publications and/or news that may be useful to provide a deeper understanding of the topics in this document or the pilot itself.

PILOTS CHARACTERIZATION SUMMARY TABLE							
PILOT AREA	COUNTRY	KEY ATTRACTIONS	TOURIST PROFILES	PEAK SEASON	VISITOR DEMOGRAPHICS	VISITORS NUMBERS (Recent year)	CHALLENGES

-	-	-	-	-	-	-	-

STAKEHOLDERS MAP						
STAKEHOLDER	**ROLE**	**Directly or Indirectly impacted by or influencing the tourism activities in this pilot area**	**OPERATIONAL LEVEL**	**TYPE**	**DATA PROVIDER**	**LEVEL OF PARTICIPATION**
-	-	Directly / Indirectly	-	-	Yes / No	Non-Active / Active / Pro-Active

Annex 2 - Complete list of TOURISMO indicators

Key Indicators

INDICATORS	INDICATORS COMPONENTS
(E1) I.2 Optimal levels of overcrowding of sites of cultural value	(E1) I.2.1 Real saturation levels of people / spaces
	(E1) I.2.2 Expected saturation levels of people / spaces
(E2) I.4 Optimal levels of overcrowding of people transit	(E2) I.4.1 Detection real transit of nº people / area / time
	(E2) I.4.2 Analytics anticipated reserves management: prediction of critical values agglomerations
(E3) I.5 Tourists perception about adequacy of Overcrowded site experience	(E3) I.5.1 Real time percepción overcrowded: Social net
	(E3) I.5.2 Index perception post-experience overcrowded (sample)
(E4) I.12 Capacity to ensure permitted ranges of contamination - basic environmental conditions in heritage areas	(E4) I.12.1 Air pollution ranges in heritage environment stations
	(E4) I.12.2 Range of noise pollution in heritage sites
(E0) 0.20 Characterization areas / sites of tourist value and tourism profiles	(E0) 0.20.1 Delimitation and basic characteristics of sites subject to saturation: sites / spaces / heritage areas
	(E0) 0.20.2 Characterization and types of routes - Tourist shops
	(E0) 0.20.3 Characterization of tourist profile visiting heritage areas/sites
	(E0) 0.20.4 Characterization of tourist profile visiting heritage areas/sites
	(E0) 0.20.5 Historical data tourism heritage areas
	(E0) 0.20.6 Economic data tourism

(E0) 0.22 Capacity charge heritage area	(E0) 0.22.1 Capacity of saturation sites
	(E0) 0.22.2 Accommodation by Type
	(E0) 0.22.2 Public transport by type
	(E0) 0.22.2 Tourist services by type in heritage areas
	(E0) 0.22.2 Restoration by type in heritage areas
	(E0) 0.22.2 Parking spaces in heritage areas

Secondary Indicators

INDICATORS	INDICATORS COMPONENTS
(E1) I.1 Preservation Level in optimal conditions (environmental and architectural) of sites of cultural value	(E1) I.1.1 Environmental levels Sites
	(E1) I.1.2 Cost Investment - Maintenance sites
(E1) I.3 Optimal levels of Tourists overnights	(E1) I.3.1 Overnights/(number of beds in un-official accommodation*30)
	(E1) I.3.2 Cost Investment - Maintenance sites
	(E1) I.3.3 Tourists overnights in official accommodations / number of residents (monthly) (georeferred)
	(E1) I.3.4 Tourists overnights in un-official accommodations / number of residents (monthly) (georeferred)
	(E1) I.3.5 Tourists overnights in all types of accommodations / number of residents (monthly) (georeferred)
	(E1) I.3.6 Ratio between the number of tourists overnights and the number of residents within a significant neighbourhood (to be defined according to the characteristics of the place or building, for example the UNESCO center)
(E3) I.8 Personal perception about hygiene, sanitation and cleaning conditions site experience	(E3) I.8.1 Real time perception about hygiene, sanitation and cleaning conditions: Social net
	(E3) I.8.2 Index perception post-experience about hygiene, sanitation and cleaning conditions (sample)
(E3) I.9 Personal perception about cultural heritage preservation site experience	(E3) I.9.1 Index perception post-experience cultural heritage preservation (sample)

(E4) I.11 Capacity to maintain optimal citizen security	(E4) I.11.1 Crime rate (tourism and general) in target area (EUROSTAT indicators)
(E4) I.13 Fluid access to public transport in heritage areas	(E4) I.13.1 Waiting times in main transport public
(E4) I.14 Fluid access to parking spaces around heritage areas	(E4) I.14.1 % of free parking spaces in parking areas (daily).
(E5) I.18 Higher prices in target areas	(E5) I.18.1 Local price index
(E5) I.19 Lack of identity of the traditional activities	(E5) I.19.1 Employees' number of traditional activities (historical shops, handicraft shops, etc.) / total number of employees
(E0) 0.21 Access capacity charge (heritage area from port)	(E0) 0.21.1 Maximum number of passengers disembarkation day / hour
	(E0) 0.21.2 Historical disembarkation of passengers
	(E0) 0.21.3 Disembarkation forecast nº of passengers / itineraries x day / hour

Complementary Indicators

(E3) I.7 Personal perception about adequacy of Security site experience: Security perception can be implicitly covered by broader indicators measuring overall tourist satisfaction. Obtaining accurate and reliable data on security perception through social media and surveys, as has been done in previous projects, can be problematic due to current privacy regulations and the continuous enhancements to these regulations in many countries. Additionally, no security issues were mentioned in interviews, except for Golden Bay, which focused more on vandalism and the destruction of nature, particularly regarding wildfires, rather than typical security concerns like theft.

(E4) I.10 Optimal capacity of the urban cleaning service and decorum: Collecting consistent and precise data on the number of litter bins, waste collection volumes, and the frequency of hygiene services across different heritage sites can be logistically challenging and resource-intensive. The complexity of standardizing this data across various locations makes it impractical for inclusion in the TOURISMO project.

(E5) I.15 Optimal levels of access to housing in tourist areas by local population: Collecting data on residential and tourist housing ratios, as well as housing values, and standardizing this data across various locations, makes it impractical for inclusion in the TOURISMO project. Moreover, while housing access is important for sustainable tourism, it does not directly align with the core objectives of managing tourist flows.

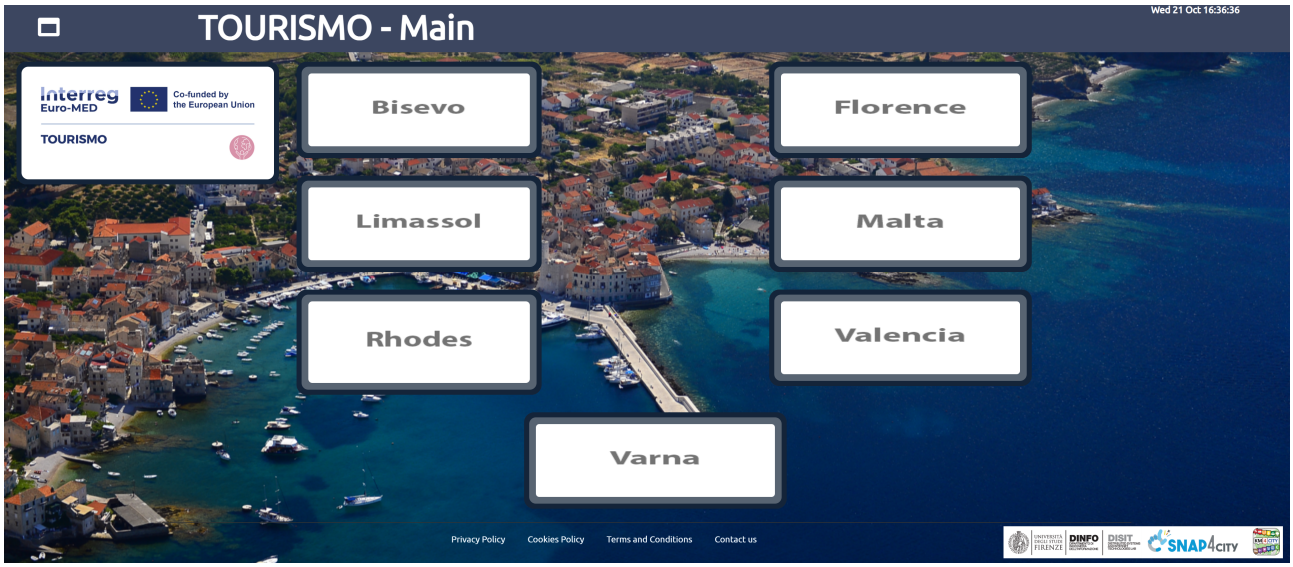
(E5) I.16 Optimal levels of access to Employment quality in tourist areas by local population: Employment quality is a multi-faceted issue that intersects with broader socio-economic policies and conditions beyond the scope of the TOURISMO project. Effective measurement and improvement of employment quality require integrated approaches involving labor market policies, education systems, and economic development strategies, which extend far beyond the direct influence of a tourism management project.

(E5) I.17 Optimal levels of access to local stores and products in tourist areas by residential population: The logistical challenges of collecting detailed data on the commercial offer in tourist areas are significant. This involves not only cataloging the number and type of retail stores but also continuously updating this information to reflect changes in the market. Such data collection efforts are resource-intensive and may not provide the direct, actionable insights necessary for the TOURISMO project's primary goals.

Annex 3 – Overview of Snap4City TOURISMO platform

The TOURISMO framework is accessible through the Snap4City platform. Users can access the project environment by entering *"TOURISMO"* in the platform's search tab or directly through the Snap4City - TOURISMO web page.

The user can access the main TOURISMO dashboard (Figure 1), which serves as the central entry point to the project's analytical environment. From this dashboard, users can select the destination and navigate to the dashboards and analytical tools associated with the different pilot sites.



https://www.snap4city.org/dashboardSmartCity/view/newTheme.php?iddasboard=NDM2Ng==

Figure 1: Tourismo Main Dashboard.

The TOURISMO analytical framework provides a comprehensive environment for **monitoring**, **analysing** and **forecasting** tourism-related phenomena through a set of advanced dashboards integrated within the Snap4City platform. The framework combines real-time observations, historical datasets, environmental information, mobility indicators, and user-generated feedback to support evidence-based decision making.

The analytical tools have been designed to support both operational management and strategic planning activities. By integrating heterogeneous data sources into a unified environment, stakeholders can gain a holistic understanding of tourism dynamics, identify critical situations, and evaluate the effectiveness of mitigation and management strategies.

The **dashboards** are organized into three main components. The first component consists of an interactive control panel that allows users to select specific data sources, indicators, temporal ranges, and analytical functionalities. This flexible configuration enables customized analyses tailored to different operational needs. The second component is represented by a geospatial visualization interface where sensors, monitored assets, and points of interest are displayed on interactive maps. Through dedicated pop-up windows, users can access detailed information about each monitored element and navigate to more advanced analytical views. The third

component includes dynamic visualization tools for exploring both real-time and historical data. Time-series graphs, statistical summaries, and comparative analyses allow users to investigate temporal trends and evaluate changes occurring across different time horizons.

In Figure 2, the **general design** of TOURISMO dashboard is shown as an example.



https://www.snap4city.org/dashboardSmartCity/view/newTheme.php?iddasboard=NDcyMg==

Figure 2: Main components of the Snap4City analytics dashboard: (i) an interactive control panel for selecting data sources, indicators, temporal ranges, and analytical functions; (ii) a geospatial interface for visualizing sensors, monitored assets, and points of interest on interactive maps; and (iii) dynamic analytics tools for exploring real-time and historical data through time-series visualizations, statistical summaries, and comparative analyses.

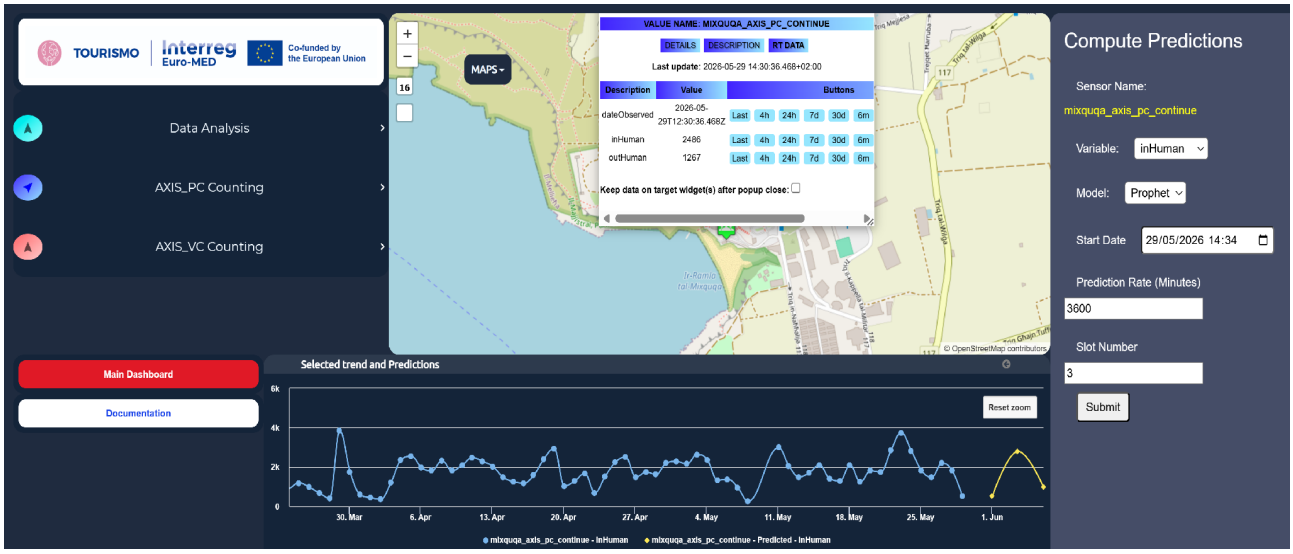
Tourist flow analysis constitutes one of the core functionalities of the TOURISMO framework. Visitor presence and movements are monitored through the integration of heterogeneous sensing technologies, including Sniffers Wi-Fi/Bluetooth counters, video analytics systems, radar sensors, and thermal cameras.

The framework supports both real-time monitoring and retrospective analyses, providing information on visitor volumes, movement patterns, peak periods, and temporal variations. Historical data analysis enables the identification of recurring patterns and seasonal trends, while real-time monitoring supports rapid responses to emerging situations.

Behavioural indicators are also computed to better understand visitor interactions with monitored environments. Examples include holding time estimation, occupancy dynamics, flow direction analysis, and movement distribution across monitored areas. To improve the interpretation of raw observations, the framework computes a set of advanced Key Performance Indicators (KPIs), including: total visitor volumes, peak visitor levels, occupancy rates, density indicators; area capacity utilization; human space availability; queue length estimation; infrastructure usage indicators, etc. Practical implementations of these indicators have been

developed across multiple pilot areas. Examples include, beach occupancy monitoring in Malta, queue management and room occupancy analysis in Valencia, capacity assessment in the Medieval City of Rhodes, and Origin-Destination flow analysis in Florence.

Moreover, forecasting functionalities support proactive tourism management by predicting visitor flows and other tourism-related indicators. Users can configure forecasting tasks by selecting devices, prediction horizons, temporal aggregation levels, and forecasting models. Historical observations and predicted values are visualized together to facilitate comparison and interpretation. Available across all pilot areas, the forecasting environment supports the automated generation and visualization of predictive analyses through a dedicated Snap4City tool, whose dashboard design is shown in Figure 3.



https://www.snap4city.org/dashboardSmartCity/view/newTheme.php?iddasboard=NDg2NA==

Figure 3: The automatic approach for forecasting performances provided by all the metrics coming from the installed sensors in all pilots.

To complement quantitative tourism monitoring, the TOURISMO framework integrates visitor feedback collection and qualitative analysis. A dedicated QR Code Generation Dashboard enables destination managers to create and geolocate QR codes linked to digital questionnaires (Figure 4). Visitors can submit feedback directly, with responses automatically associated with the relevant locations and made available for analysis through Snap4City dashboards. Using NLP and LLM techniques through SnapAdvisor, the system summarizes visitor perceptions, identifies recurring themes, and highlights strengths and weaknesses, supporting the assessment of visitor satisfaction and service quality.

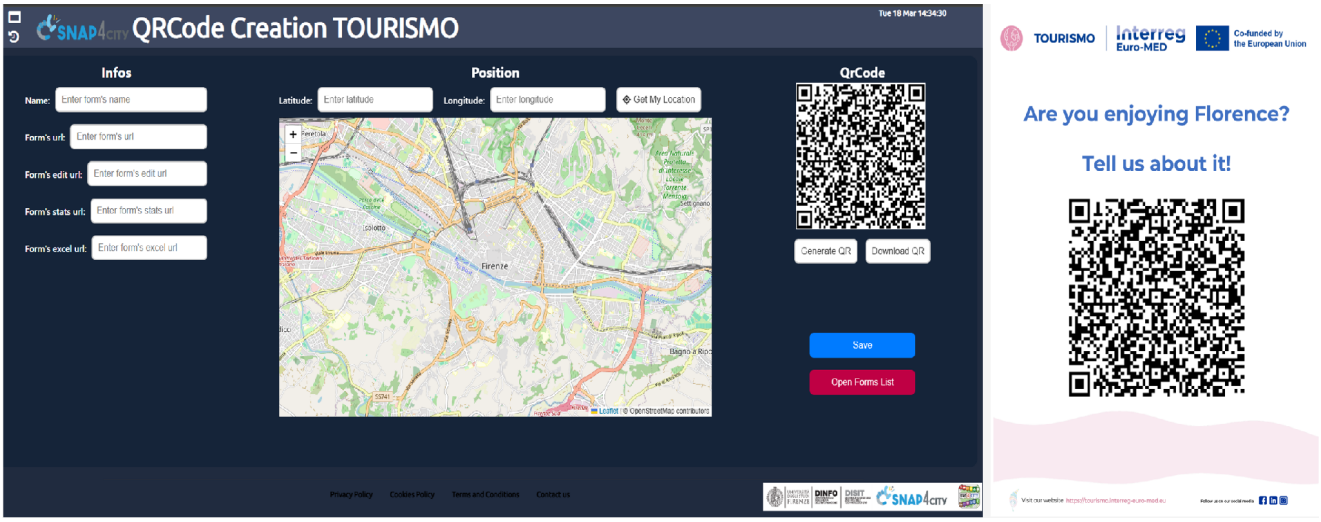


Figure 4: QR code creation tool provided for sentiment analysis evaluation (for authorised users only).

Contacts for Destination Onboarding

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Additional related materials:

- Snap4Tourism: https://www.snap4city.org/1170
- Welcome to Varna (TOURISMO) https://www.snap4city.org/1031
- Welcome to Valencia (TOURISMO) https://www.snap4city.org/1036
- Welcome to Florence (TOURISMO) https://www.snap4city.org/1035
- Welcome to Malta (TOURISMO) https://www.snap4city.org/1034
- Welcome to Bisevo (TOURISMO) https://www.snap4city.org/1030
- Welcome to Limassol (TOURISMO) https://www.snap4city.org/1032
- Welcome to Rhodes (TOURISMO) https://www.snap4city.org/1034
- Florence: https://www.snap4city.org/747
- Pont Du Gard: https://www.snap4city.org/740

- Valencia: https://www.snap4city.org/742
- Dubrovnik: https://www.snap4city.org/741
- Mostar: https://www.snap4city.org/744
- SOLUTION: Agentic AI for Natural-Language Access to Snap4City Data and Services
- Inventory of transferable digital applications and solutions for the tourism ecosystem
- **Scenario: Herit-Data video and aims**
- **SOLUTION: Smart Tourism Management with Snap4City**
- SOLUTION: Agentic AI for Natural-Language Access to Snap4City Data and Services
- RETAIL: SADI-MIAC: Integrated Decision Support System with Digital Twin Models and Artificial Intelligence for Business
- **SADI-MIAC Dashboard Manual, ENG**

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