



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union

TOURISMO Final Conference

Data-driven solutions for smart crowd flow management.
Visitor counting with sensors and AI at tourism hotspots.

9th of June 2026
Valletta, Malta

Libeccio. Destination Management Support System integrating sustainability indicators and Big Data

Christos Alexakos, ISI/ATHENA

Interreg
Euro-MED



Co-funded by
the European Union

LIBECCIO



About LIBECCIO

The Challenge

Tourism is a key driver of Mediterranean economies. The COVID-19 pandemic exposed deep vulnerabilities — fragile governance structures, limited resilience, and a lack of timely, data-driven decision making for policy makers.

LIBECCIO's Response

LIBECCIO addresses these challenges through **digital transformation** — enhancing tourism governance, destination management and sustainability. It supports policy makers with **integrated, data-driven tools for more informed and resilient decision making** across the Euro-Mediterranean region.

Approach

Intersectoral & transdisciplinary methodology involving the **Q Helix tourism community through the Euro Med Tourism Innovation Platform (ETIP)**, using Living Lab methodology to co-test and transfer sustainable solutions across partner countries.

**Interreg
Euro-MED**



Co-funded by
the European Union

LIBECCIO



TOURISMO

**Interreg
Euro-MED**



Co-funded by
the European Union



LIBECCIO

**Interreg
Euro-MED**



Co-funded by
the European Union

Who Benefits?

01 Policy Makers

Local & Regional Authorities, Public Bodies

Evidence-based governance and planning tool. Monitor environmental, social and economic indicators, compare destinations, evaluate policy measures and support long-term tourism strategies.

02 Private Sector

SMEs, Tourism Associations

Market intelligence and competitiveness tool. Practical insights supporting business planning, visitor-flow management, destination promotion and product development.

03 Research & Consulting

Academics, Consultants, Researchers

Analytical knowledge environment with structured datasets, dashboards, indicators and metadata for feasibility studies, benchmarking, policy analysis and impact assessment.



TOURISMO

**Interreg
Euro-MED**



Co-funded by
the European Union



LIBECCIO

**Interreg
Euro-MED**



Co-funded by
the European Union

From Data to Knowledge

Wisdom: Knowledge guided by insight and ethics. Answers *why* and chooses the best action.

Knowledge: Information applied with rules and experience. Answers *how*.

Information: Data with structure and context. Answers *who, what, where, when*.

Data: Raw, unprocessed figures or signals. Alone, they lack context or meaning.

Information Systems ease this transition exploiting useful knowledge for decision making



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union



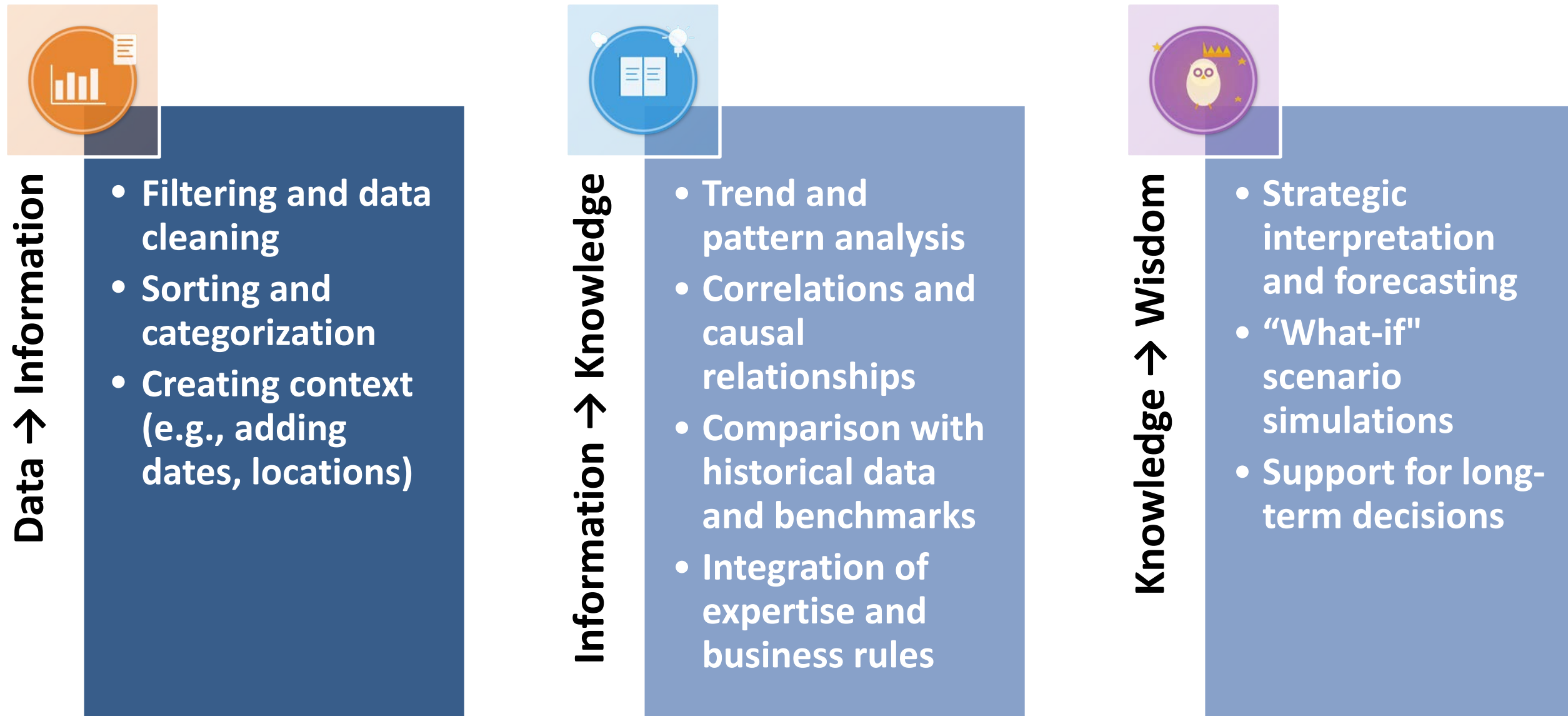
LIBECCIO

Interreg
Euro-MED



Co-funded by
the European Union

How Information Systems turn data into wisdom



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union



LIBECCIO

Interreg
Euro-MED



Co-funded by
the European Union

LIBECCIO - DMSS

The LIBECCIO DSS is an innovative online platform that leverages sustainability indicators and big data analytics. Its goal is to support decision-making and shape effective, data-driven policies.



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union



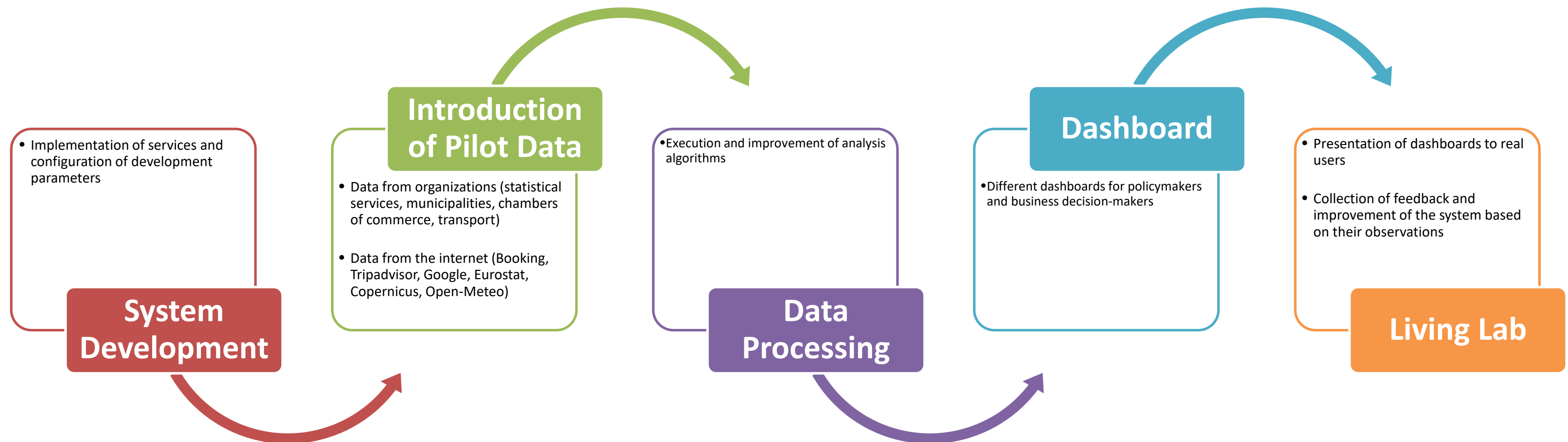
LIBECCIO

Interreg
Euro-MED



Co-funded by
the European Union

Implementation Steps



TOURISMO

**Interreg
Euro-MED**



Co-funded by
the European Union



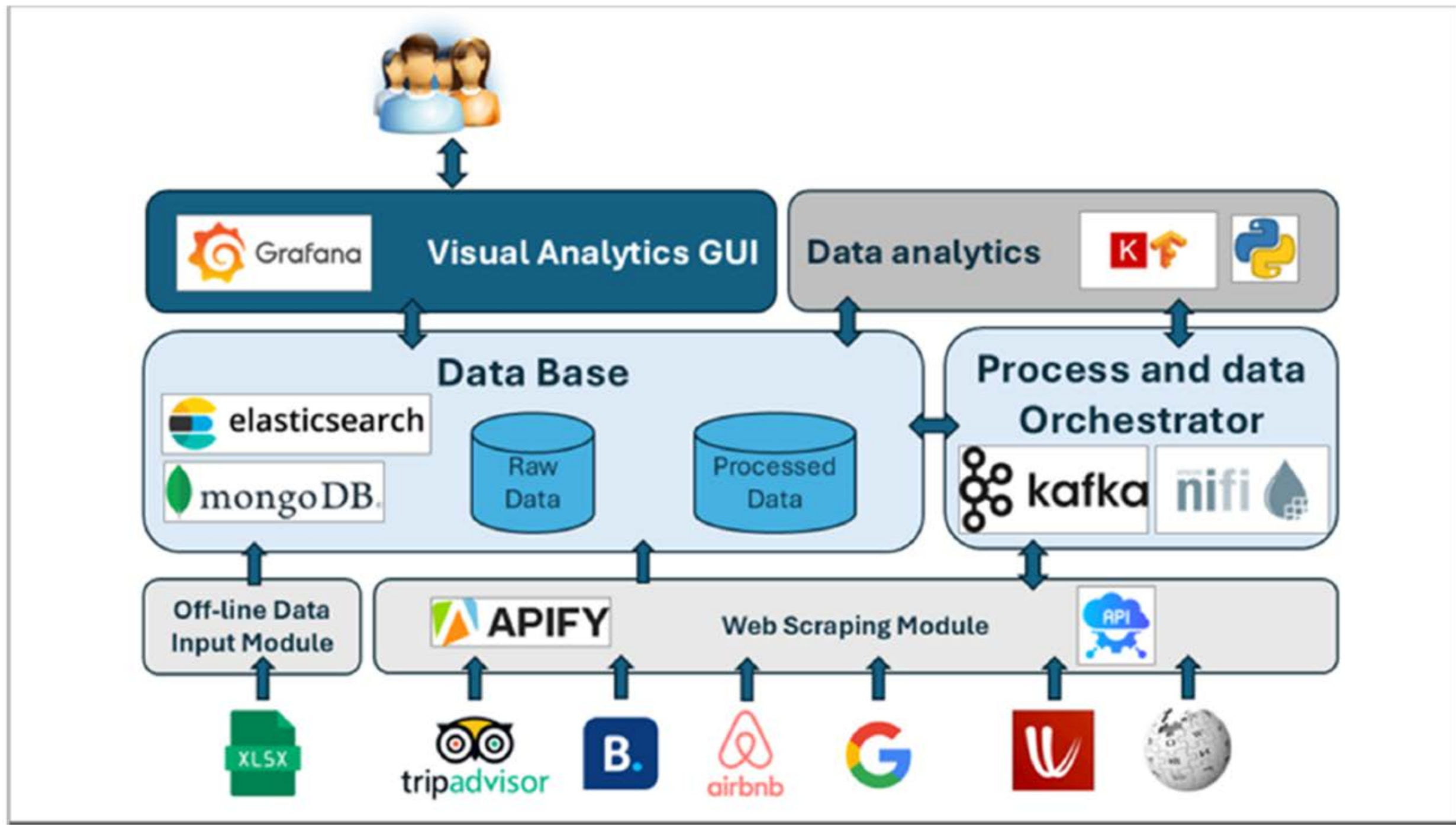
LIBECCIO

**Interreg
Euro-MED**



Co-funded by
the European Union

Technologies behind the DMSS



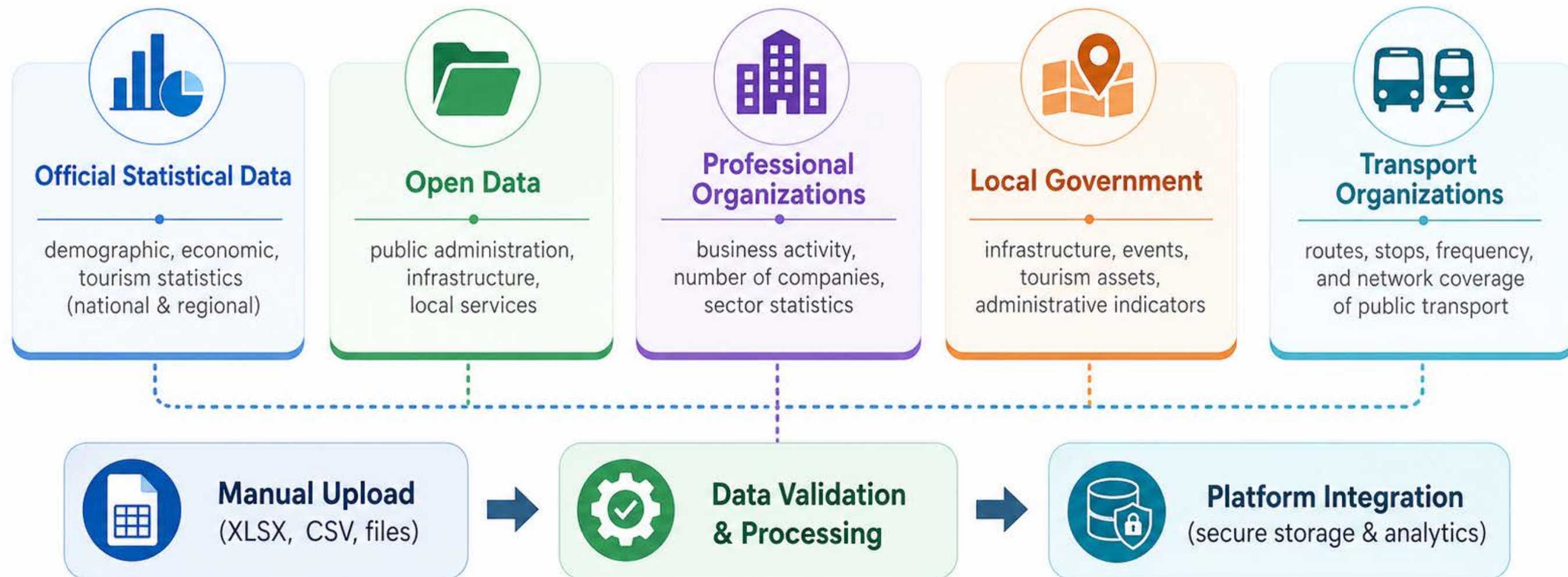
Data collection from the web



Data added by the users

USER-ADDED DATA

Official, structured data uploaded manually from trusted institutions.



 Enhancing automated data sources with deeper regional and administrative insights.



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union



LIBECCIO

Interreg
Euro-MED



Co-funded by
the European Union

Examples of services for policy makers



Social Sustainability

Accessibility assessment & identification of service gaps per municipality



Economic Impact

Comparison of spending, visitors, and overnight stays between domestic and international tourism



Airports & Connectivity

Monitoring of passenger flows and air connectivity



Active Transport

Cycling/hiking routes, attractions, sustainable planning



Tourism Weather Risk

24–48 hour risk forecasting for event coordination & safety



Criminal Activity

Overview of incidents and annual trends 2010–2019



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union



LIBECCIO

Interreg
Euro-MED



Co-funded by
the European Union

Examples of services for tourist destination organizations

Accommodation Price Analysis



Market prices, lead time, supply dynamics, and validation metrics

Reputation & Pricing



Linking ratings with pricing for competitive assessment per municipality

Spatial Distribution of Accommodations



Density of hotels & apartments, coastal & inland patterns

Types of Businesses on Maps



Spatial distribution of tourism businesses across all municipalities



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union



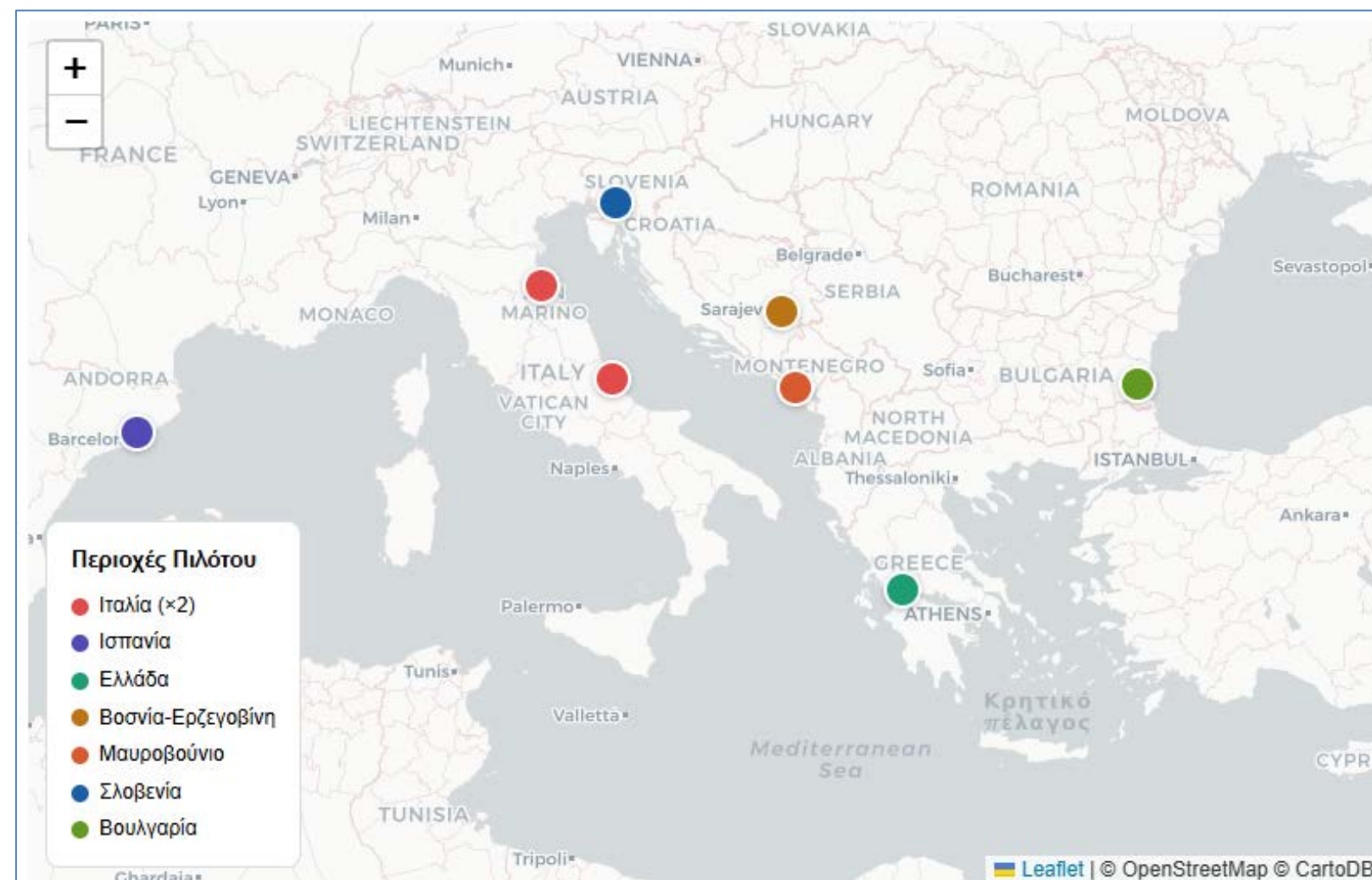
LIBECCIO

Interreg
Euro-MED



Co-funded by
the European Union

Pilot Testing



- **Italy**
 - **Regione Emilia-Romagna** — 11 coastal municipalities (Rimini, Ravenna, Cesenatico etc)
 - **Regione Abruzzo** — 7 coastal municipalities in Teramo (Giulianova, Roseto degli Abruzzi ect)
- **Spain**
 - **Terrassa** — city in Catalonia, at a distance of 20 Km from Barcelona, 228.785 inhabitants
- **Greece**
 - **Western Greece** — municipalities in Etoloacarnania (Paleros, Astakos) and Achaia (Longos, Selianitika, Egio)
- **Bosnia Herzegovina**
 - **Istočno Sarajevo**— 1.450 km², 61.516 inhabitants
- **Montenegro**
 - **Kotor** — coastal city UNESCO, 21.916 inhabitants
- **Slovenia**
 - **Green Karst** — 6 municipalities (Postojna, Cerknica, Pivka etc), 53.092 inhabitants, 1.456 km²
- **Bulgaria**
 - **Burgas** — Region in SE Bulgaria, Black Sea, 13 municipalities, 7.748 km²



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union



LIBECCIO

Interreg
Euro-MED

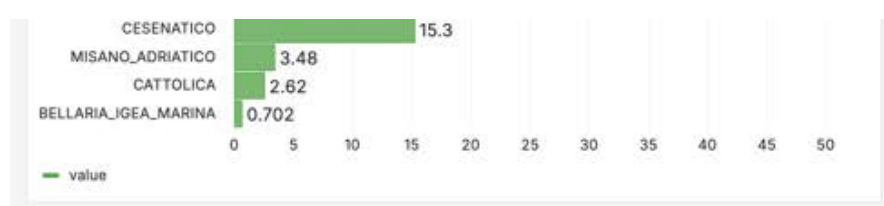
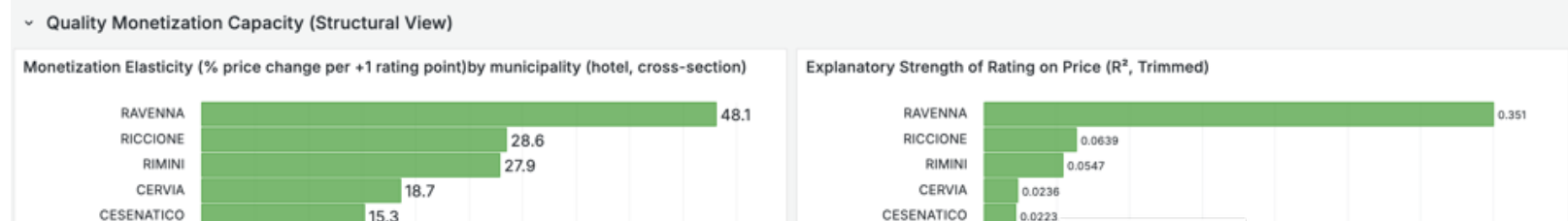
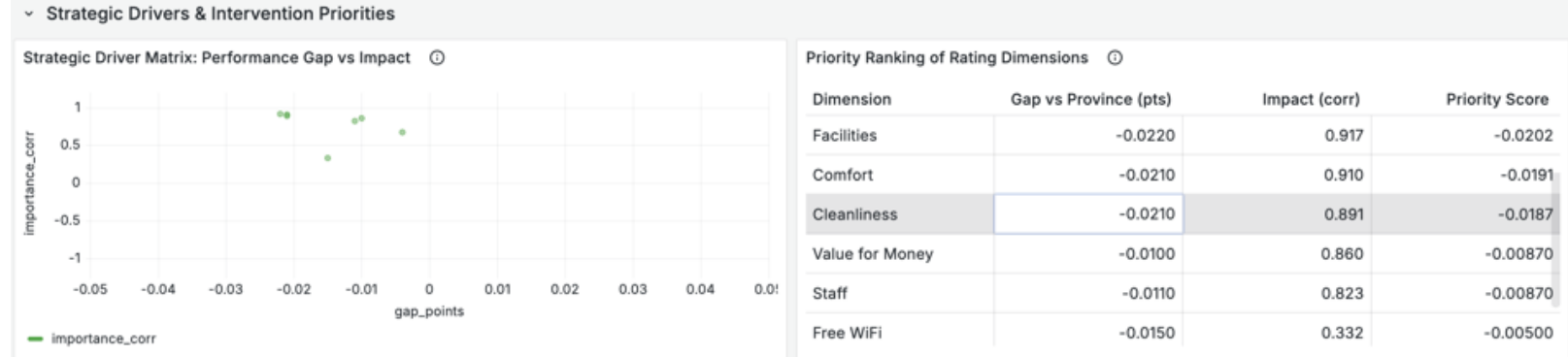
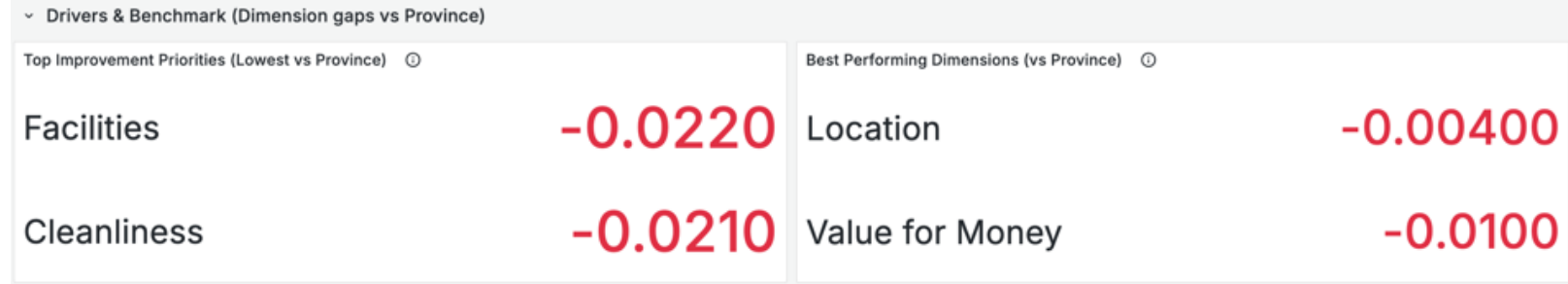
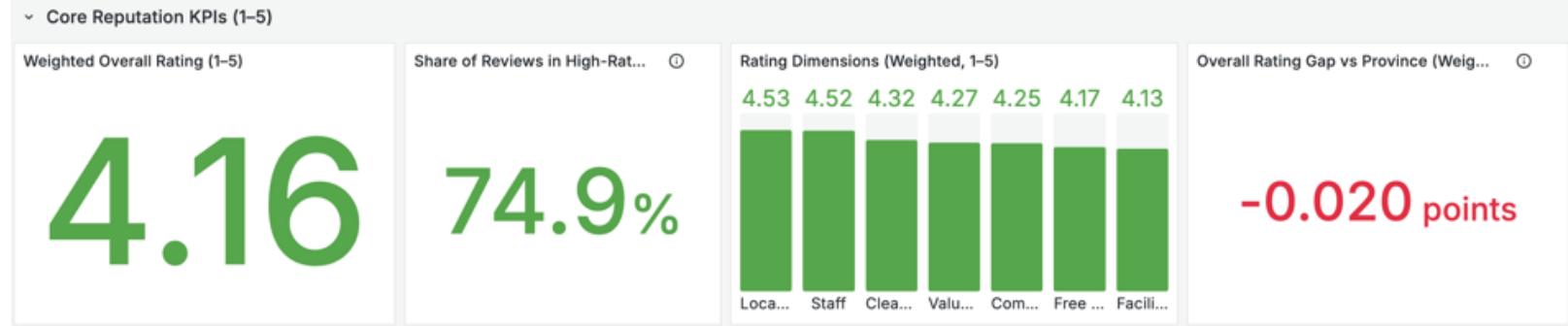
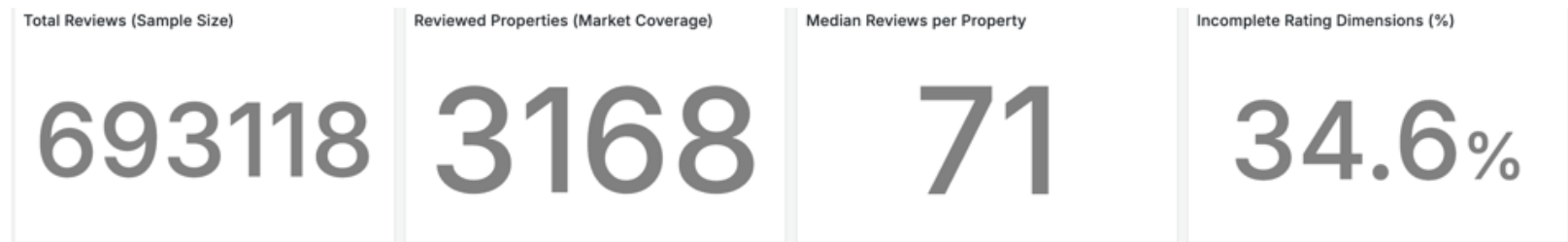


Co-funded by
the European Union

Pricing and Trends



Visitor Sentiment Analysis



What this shows
Percentage change in price associated with a +1 rating point (log-linear model).

Interpretation

- 30% → A 1-point rating improvement corresponds to ~30% higher price.
- Higher values indicate stronger ability to convert reputation into pricing power.
- This reflects structural market differentiation, not seasonal variation.

What this shows
R² from regression: ln(price) ~ overall_rating.

Interpretation

- 0.00-0.02 → Rating weakly explains price (price-driven market).
- 0.02-0.05 → Moderate structural effect.
- >0.05 → Strong structural alignment between quality and pricing.

R² measures consistency, not magnitude.

How to read the chart

X-axis → Monetization elasticity (% price premium per +1 rating point)
Y-axis → Structural strength (R²)
Bubble size → Matched trimmed sample (n_trim)

What it shows

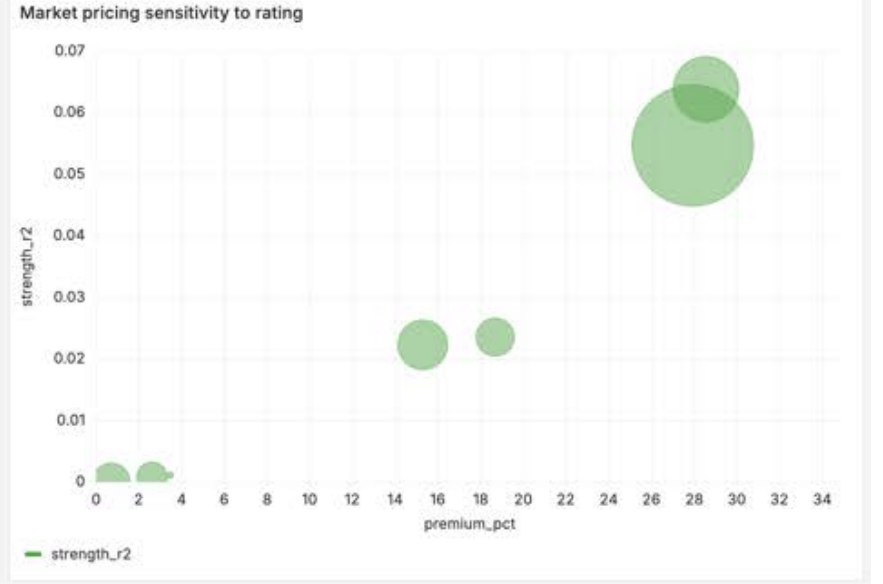
- Each bubble represents one municipality
- Further right = stronger price premium associated with better ratings
- Higher up = ratings explain prices more consistently across the local market
- Bigger bubbles = more robust local sample

Interpretation thresholds

- Strong alignment → premium ≥ 20, R² ≥ 0.04, t-stat ≥ 2.0
- Emerging alignment → premium ≥ 15, R² ≥ 0.03, t-stat ≥ 1.8
- Weak / price-driven → below these thresholds

Method scope

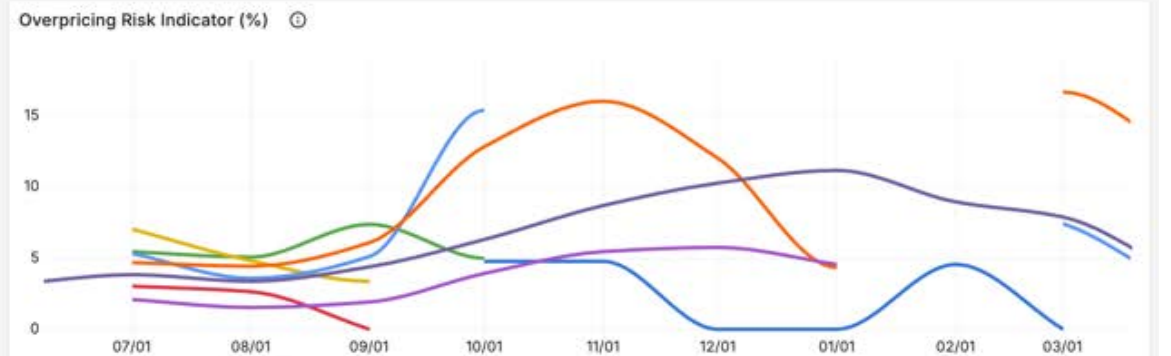
- Segment shown: Hotels, all-period model (month IS NULL)
- Price basis: median listed price, 2 persons, 7-day horizon, check-in from 2025-06-01 onward
- Property filter: at least 50 reviews, non-null overall rating, positive valid price
- Outlier treatment: top 2% of prices trimmed before final estimation



Price-Reputation Misalignment (Intervention Targets)

What this shows
Number of hotels priced in the top 20% of their local market (per month) while having an overall rating ≤ 4.0.

Interpretation
Higher values indicate potential price-reputation misalignment. Persistent spikes may signal competitive risk or overpricing pressure.



Tourism Flow and Economic Impact

Tourism Flow and Economic Impact – Emilia-Romagna (IT)

This section compares inbound international tourism with outbound travel by regional residents, across expenditure, visitor volumes, and overnight stays. Together, these indicators provide a structural view of tourism inflows, outbound leakage, and overall demand intensity over time.

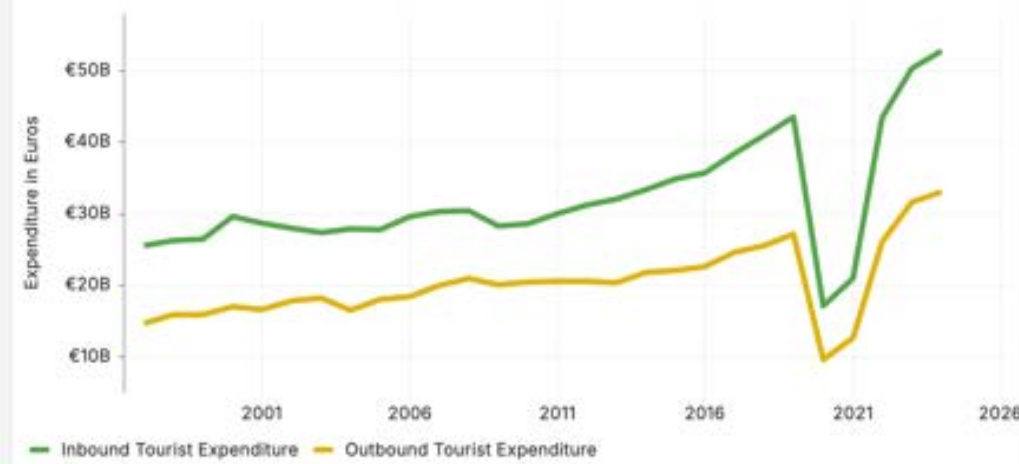
The three panels illustrate revenue trends, flow dynamics, and accommodation pressure, supporting assessment of tourism's contribution and balance within the regional economy.

Source: Banca d'Italia – International Tourism Survey. Annual statistics on inbound and outbound tourism expenditure and flows.

Inbound vs Outbound Tourism Expenditure

This chart compares expenditure by international visitors (inbound, green) with spending by regional residents travelling abroad (outbound, yellow). Values are expressed in euros and illustrate the balance between tourism revenue inflows and outbound spending over time.

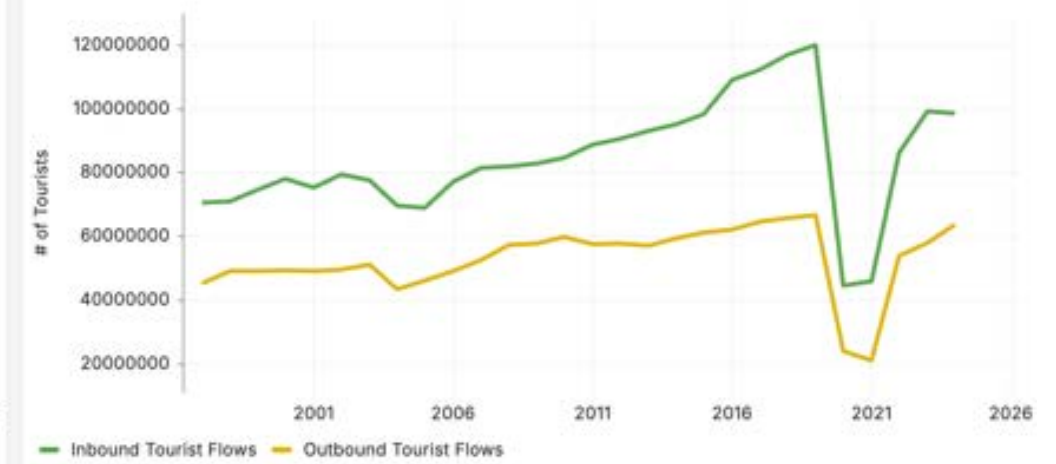
Inbound vs Outbound Tourism – Expenditure



Inbound vs Outbound Tourism – Number of Visitors

This chart compares the annual number of international visitors (inbound, green) with regional residents travelling abroad (outbound, yellow). It illustrates the evolution of tourism flows and supports interpretation of revenue dynamics when analysed alongside expenditure trends.

Inbound vs Outbound Tourism – Visitor Flows



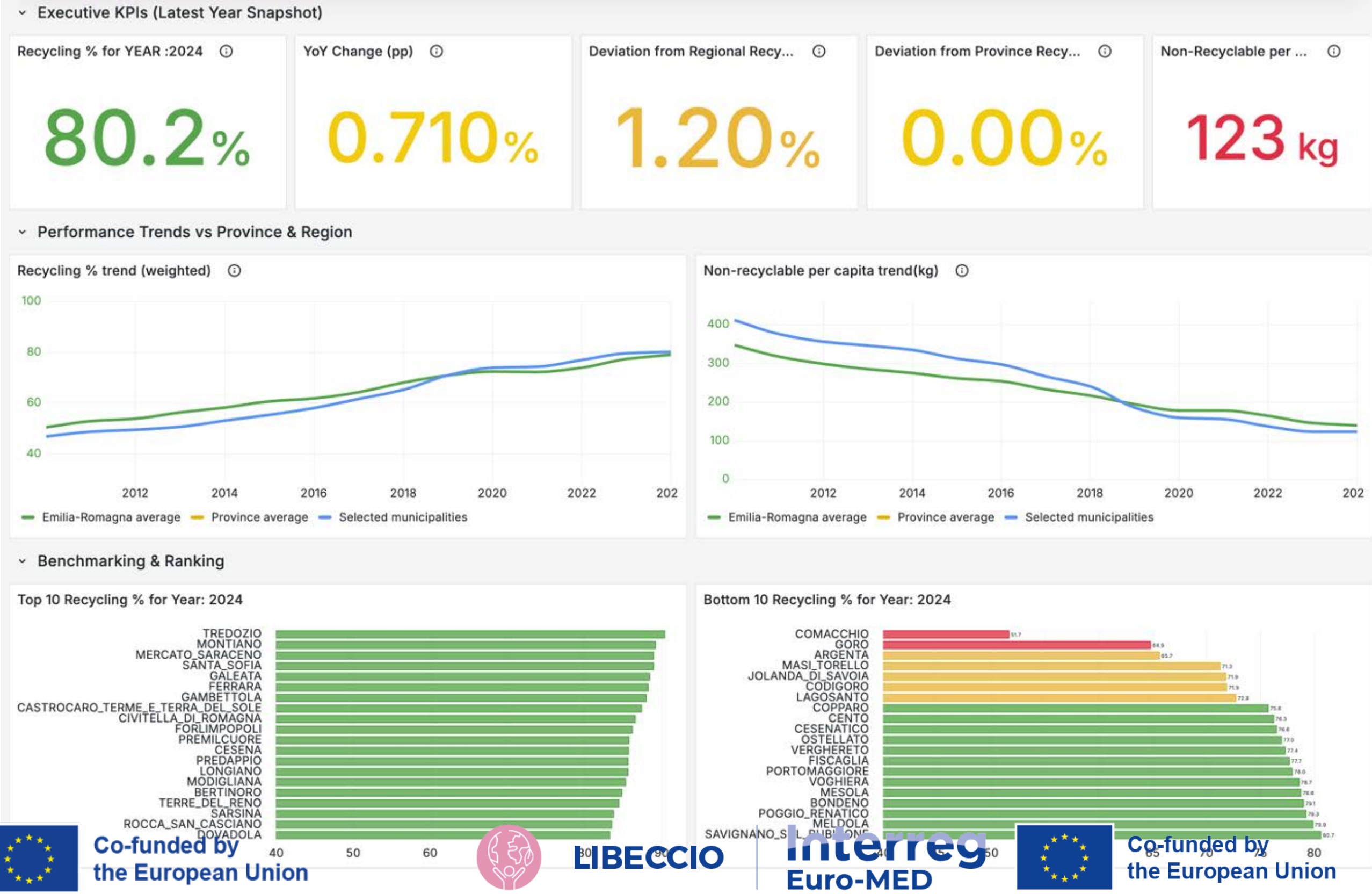
Inbound vs Outbound Tourism – Overnight Stays

Annual overnight stays by inbound international visitors (green) and outbound regional residents (yellow). This indicator captures overall tourism intensity, combining visitor volume and average length of stay.

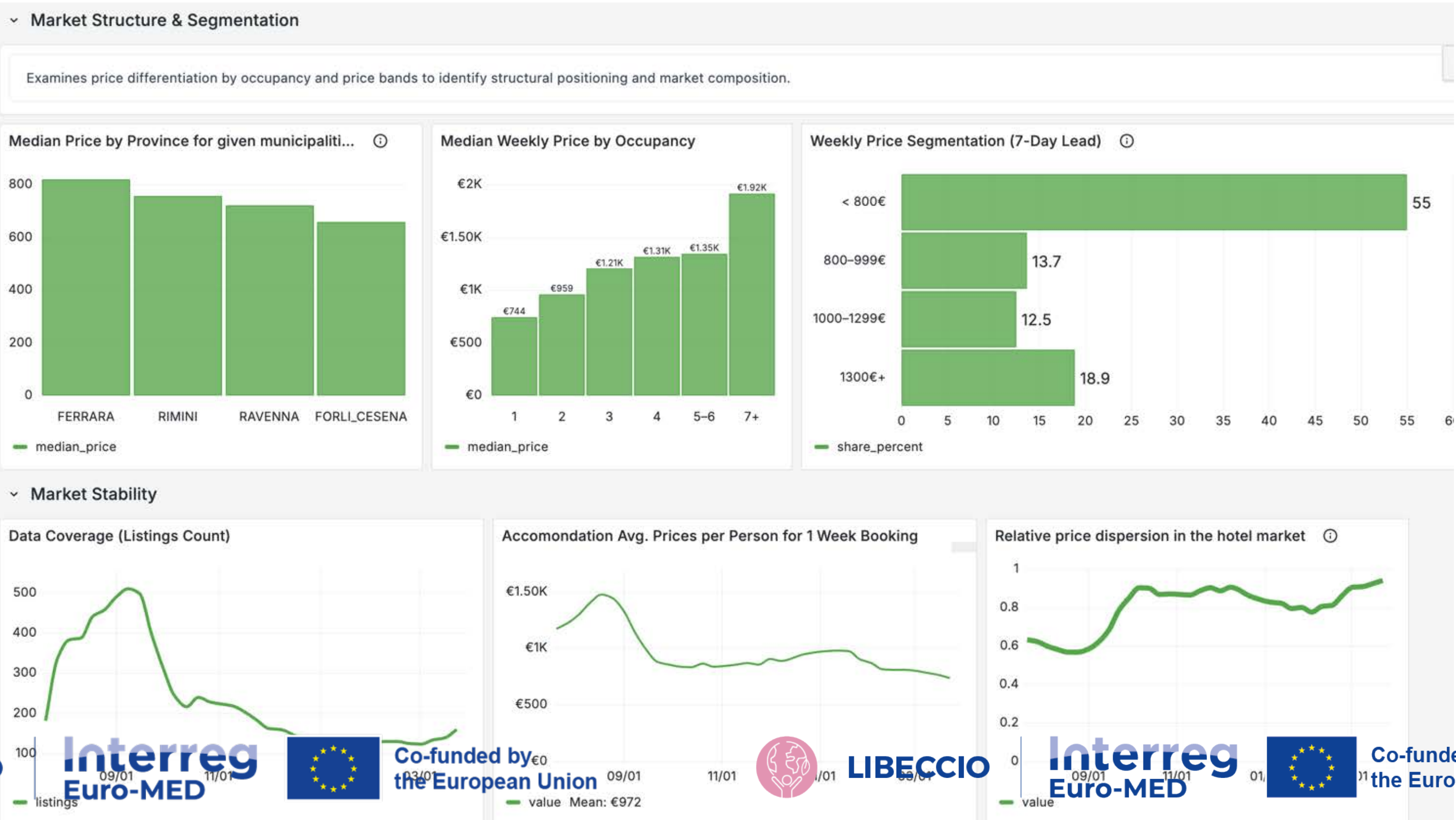
Inbound vs Outbound Tourism – Overnight Stays



Sustainability KPIs



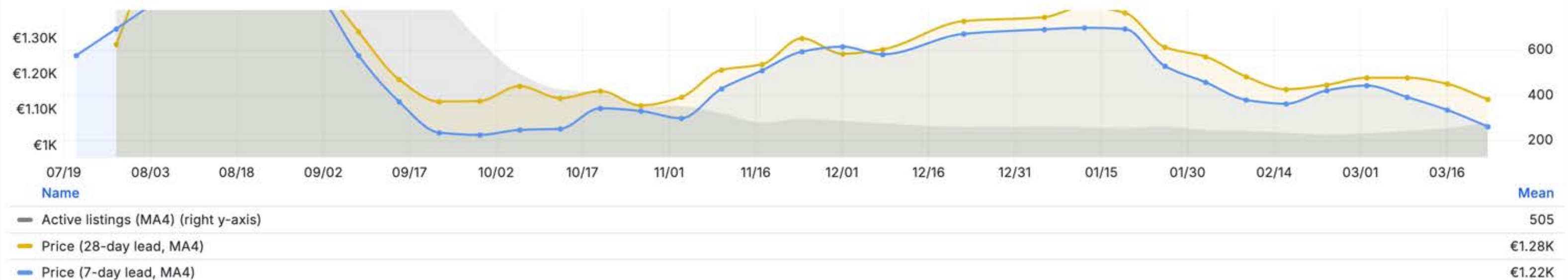
Market Structure & Segmentation



Supply & Pricing Dynamics

Measures expectation revision and volatility between early (28-day) and near-arrival (7-day) pricing signals.

Accommodation Avg. Prices for Weekly Stays Booked in Advance for 1 Persons ⓘ



▼ Data reliability indicators

Volatility Normalizati... ⓘ

0.17

Outlier Frequency (Extreme-... ⓘ

3.03%

Market Supply Elasticity ⓘ

0.714

Price Distribution Consistency

0.223

Seasonal Signal Strength (Tr... ⓘ

0.746



TOURISMO



Co-funded by the European Union



LIBECCIO



Co-funded by the European Union

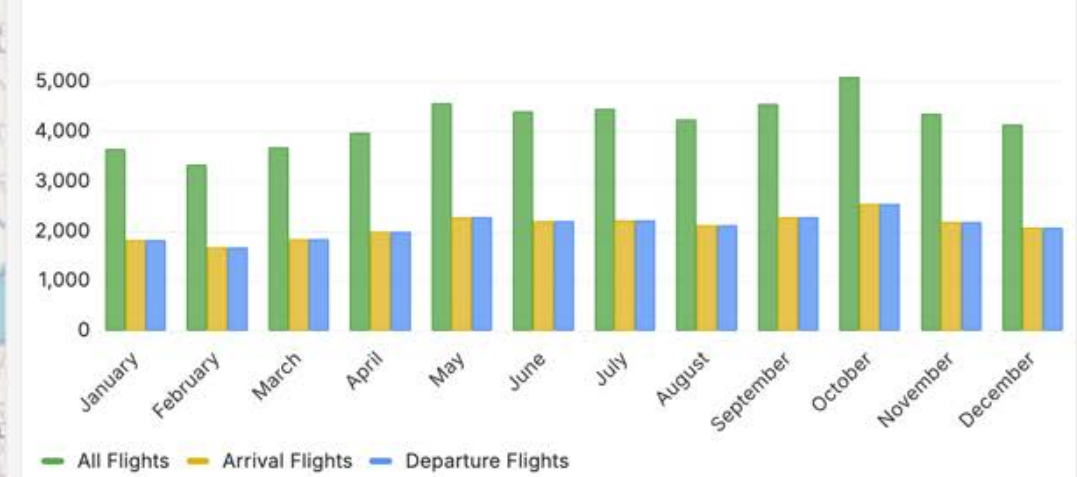
Connectivity

Spatial Route Connectivity for year : 2002

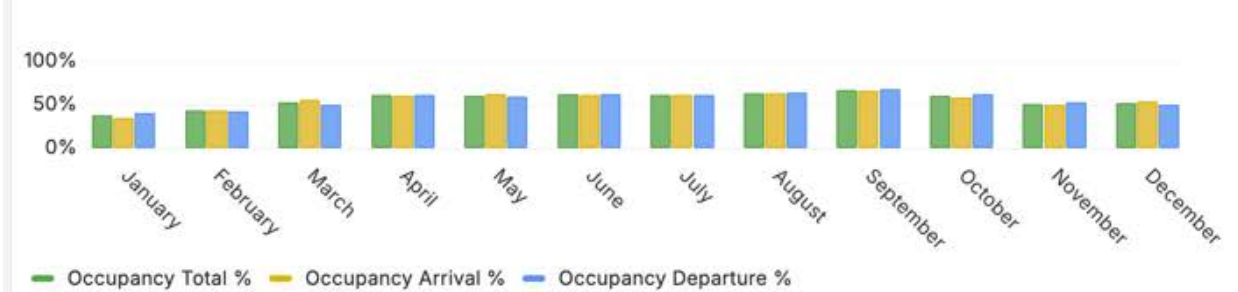


Data source: Eurostat – European Union official statistics. Airport traffic and passenger movement data derived from the Eurostat air transport database.

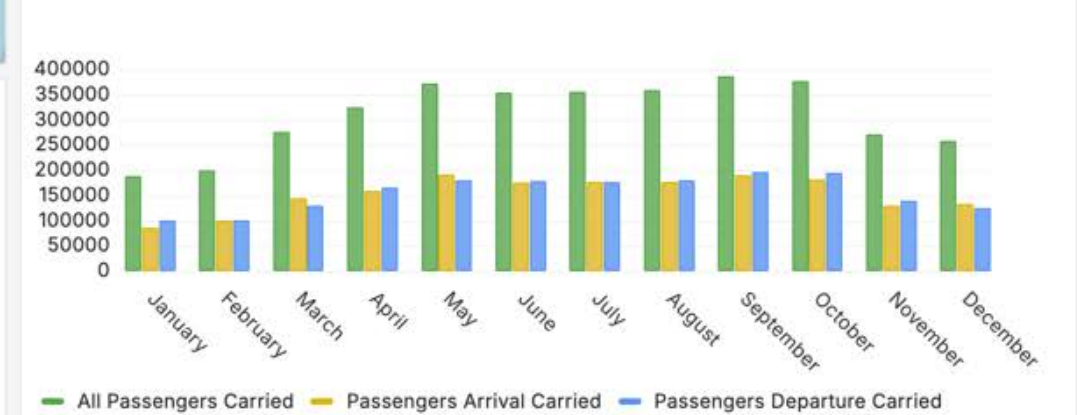
Naples International Airport (IT_LIRN) Monthly Flight Operations



Naples International Airport (IT_LIRN) Seat Utilization Rate



Naples International Airport (IT_LIRN) Passenger Traffic Trend



DMSS analytics

Airport Strategic Snapshot — Naples International Airport (IT_LIRN) (2002)



Social sustainability

Coverage / penetration

Social Sustainability – Accommodation Coverage

This section evaluates the distribution of socially relevant accommodation amenities across Emilia-Romagna municipalities. It focuses on accessibility, inclusion, and family-oriented facilities.

INDICATORS

- Penetration Rate: % of listings offering a given amenity.
- Accessibility Share: Listings declaring at least one accessibility-related feature.
- Regional Comparison: Difference between selected municipality and regional average (percentage points).

Data based on scraped listing amenities (e.g. Booking). Amenities are self-declared and do not guarantee certified accessibility standards.

Accessibility Coverage

Share of accommodations declaring at least one accessibility-related amenity (wheelchair access, adapted facilities, or barrier-free features).

- % Accessible (those areas) → Overall benchmark
- % Accessible (selected area) → Local performance
- Δ → Gap vs benchmark (positive = stronger, negative = weaker)

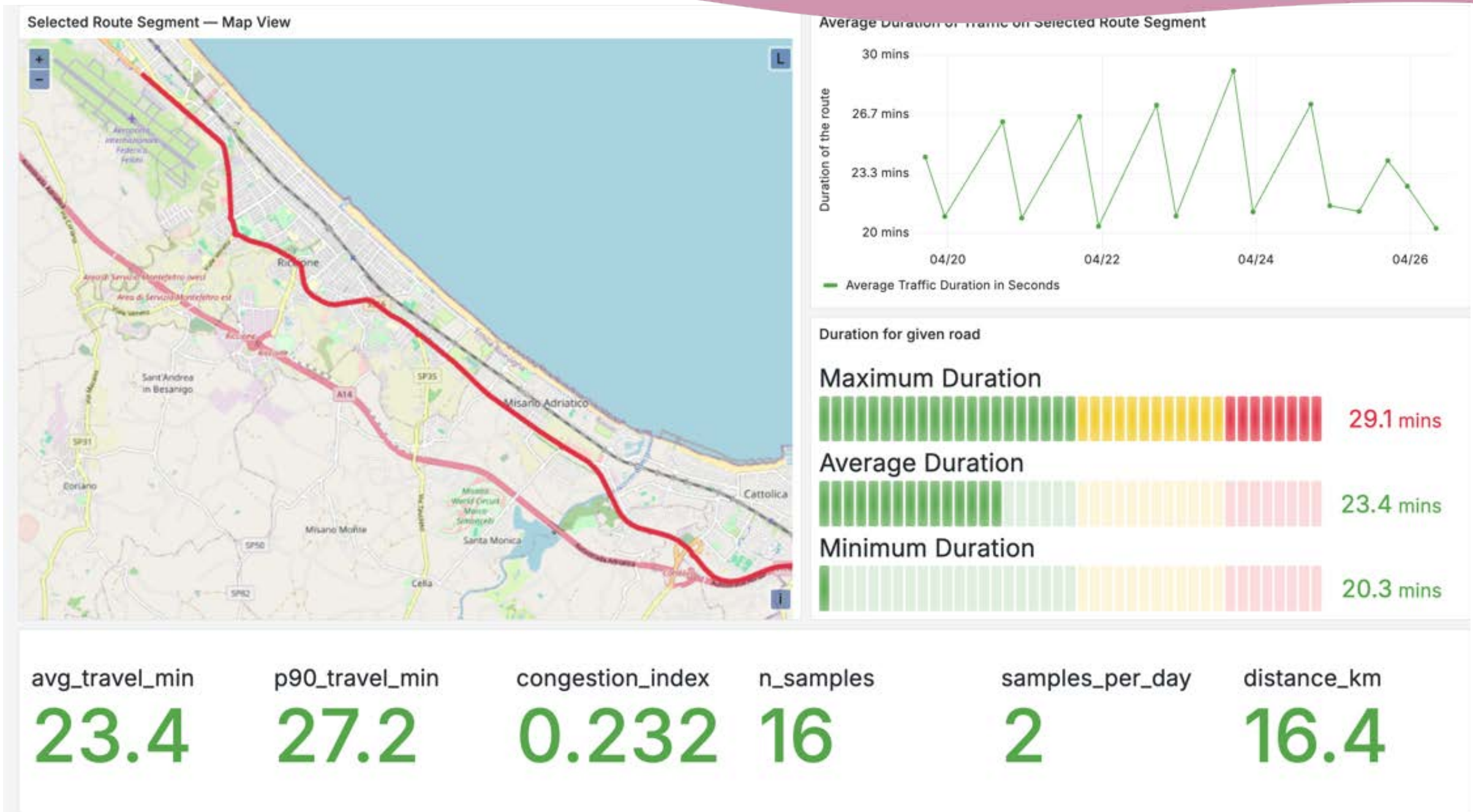
Accessible Accommodations in CESENATICO Compared to the Emilia-Romagna Total



% Accessible (those ... % Accessible (select... Δ Accessible (select...

Amenity Type	% Have This Utility (those areas)		% Have This Utility (selected area)	
family_child_infrastructure	89.2		90.4	
safety_and_security	82.2		75.5	
coastal_scenic_value	73.7		76.9	
international_readiness	72.2		66.4	
breakfast_quality_signal	66.3		66.4	
structural_accessibility	58.3		53.4	
service_intensity_professional_operat	49.0		50.5	
sports_active_recreation	41.8		39.4	
aquatic_infrastructure	34.5		24.5	
wellness_thermal_infrastructure	30.8		34.6	
accessibility_policy_commitment	24.6		27.4	
entertainment_social_experience	22.6		28.9	

Mobility & Transport



Monitoring Accessibility Through Route Segments — Emilia-Romagna Coastal Corridor

This section visualizes accessibility and travel dynamics along the main coastal corridor of Emilia-Romagna, focusing on key road and transport segments such as SS16 and adjacent connecting routes. The visual components combine temporal and spatial perspectives: the left panel displays the *average travel duration (in seconds)* for the selected segment, while the right panel shows the exact geographic route of that same segment along the Adriatic coastline.

The time-series graph highlights how travel conditions evolve over the selected time range. Increased average durations may indicate periods of congestion, road works, or tourism-driven traffic peaks, while decreased durations reflect smoother flow conditions. Because the chart adapts to the dashboard's active time filter, users can seamlessly explore *short-term patterns* (hourly or daily) as well as *longer-term seasonal trends*.

The map visualization traces the exact polyline of the chosen segment, derived from its recorded geospatial coordinates. Plotted over the *OpenStreetMap* basemap, the segment is contextualized within its surrounding municipalities, mobility network, and coastal infrastructure.

Co-funded by the European Union

LIBECCIO

Interreg Euro-MED

Co-funded by the European Union

DMSS Capitalisation Pathways

PATH A · Open Source Self-Deployment

For organisations with in-house IT resources

WHAT IS PROVIDED

- Full DMSS source code released under an open licence
- Installation & configuration documentation
- Data model specifications and API documentation
- Sample datasets and dashboard templates
- Community forum / issue tracker for peer support

OR

PATH B · Managed Service Provision

For organisations requiring full deployment & operational support

THREE DEPLOYMENT SCENARIOS

S1

Core Configuration

Standard setup using 15 existing core dashboards. Data mapping, population, testing & training. Lowest cost, shortest lead time.

S2

Extended Dashboards

Modular add-on activating 10 additional predefined datasets/dashboards on an existing S1 installation.

S3

Custom Build

Full customisation with new datasets, indicators and dashboards — requirements analysis, data modelling, development & validation.



TOURISMO

Interreg
Euro-MED



Co-funded by
the European Union

Making
the **Mediterranean**
Green Transition
happen

