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HERIT ADAPT

Deliverable name: Transferability Plan (D3.2.1)
Project Acronym: HERIT ADAPT
Work package No: 3
Work package Title: Enhancing Tourism Sustainability via HERIT ADAPT Sustainable Tourism Model

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Date: 08/05/2026
Status: Final

Abstract

The current Transferability Plan establishes a structured framework for replicating the Sustainable Tourism Model (STM) and the portfolio of solutions developed within the HERIT ADAPT project across diverse territorial contexts. The Plan emphasizes a systematic, governance-integrated approach to transferring validated Use Cases while maintaining alignment with the project's methodological principles. Its main objective is to provide a controlled, measurable, and operational pathway for the adoption of the STM, ensuring the preservation of its systemic coherence and adaptive management capacity. Furthermore, the Plan identifies key strategies to support broader transferability of the model, while addressing potential barriers, gaps, and the need for contextual adjustments. An accompanying action plan outlines guidelines for the effective dissemination and implementation of project outcomes, with particular focus on institutional preparedness, technical requirements, and territorial adaptability derived from pilot experiences.

Project Partners

Organization	Abbreviation	Country
Region of Western Greece	RWG	GR
ATHENA, Research and Innovation Centre in Information, Communication and Knowledge Technologies, Industrial Systems Institute	ATHENA	GR
European Public Law Organization	EPLO	GR
Sapienza University of Rome	SDR	IT
Municipality of Genoa	COMGE	IT
Dubrovnik Development Agency DURA	DURA	HR
Limassol Tourism Development and Promotion Co Ltd	LTC	CY
Old Royal Capital Cetinje	PCT/ORCC	ME
University of Granada	UGR	ES
Regional Tourism Agency Occitanie	CRTL	FR
Ministry of Tourism of the Republic of Bulgaria	MTRB	BR

Document History

Date	Person	Action	Status
29/04/2026	Athanasios Kalogeras, George Mylonas, External Expert (Living Prospects)	First version of the strategy	Draft
05/05/2026	Athanasios Kalogeras	Integration of partners' comments	Draft
08/05/2026	Athanasios Kalogeras	Final version	Final

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Glossary

Territorial Working Groups	TWGs
Sustainable Tourism Model	STM
Use Case(s)	UC(s)

1. Transferability Plan Overview

1.1 Purpose and Objectives of the Transferability Plan

The HERIT ADAPT Transferability Plan provides a structured framework for the replication of the Sustainable Tourism Model (STM) and the portfolio of solutions developed within the HERIT ADAPT project. The Plan focuses on the systematic and governance-embedded transfer of the implemented Use Cases to new territorial contexts, ensuring consistency with the project's methodological foundation. Its primary objective is to establish a controlled, measurable, and operational pathway through which the STM can be transferred while preserving its systemic logic and adaptive management capacity.

1.2 Scope and Focus of the Transferability Plan

The Plan identifies the relevant strategies associated with the wider transferability of the Sustainable Tourism Model, as well as the need for their adjustment and enhancement to overcome potential barriers and gaps. It also includes an action plan setting out the guidelines for the wider transferability of the project outcomes. The scope is limited to the transferability of the operational model and its respective Use Cases (UCs), as implemented and validated through pilot experience, with emphasis on institutional readiness, technical conditions, and territorial adaptability.

1.3 The Sustainable Tourism Model as the Conceptual Backbone of the Transferability Plan

The Sustainable Tourism Model (STM) constitutes the conceptual and operational foundation of this Transferability Plan. The model integrates data collection mechanisms, technological applications structured under four Use Cases (UC1–UC4), governance structures, including Territorial Working Groups (TWGs), and adaptive decision-making processes into a coherent tourism management system. The transfer therefore concerns the replication of an integrated governance-enabled mechanism, rather than the deployment of isolated technological tools, ensuring that analytical outputs are systematically translated into policy-relevant insights and operational decision-making processes supporting sustainable tourism and resilience strategies.

The HERIT ADAPT Sustainable Tourism Model operationalizes this framework by combining structured data collection, stakeholder engagement through TWGs, and analytical processes that support informed decision-making. Through the integration of technological tools, governance structures, and monitoring mechanisms, the model enables the identification of tourism management priorities and the implementation of resilience-oriented strategies across diverse territorial contexts.

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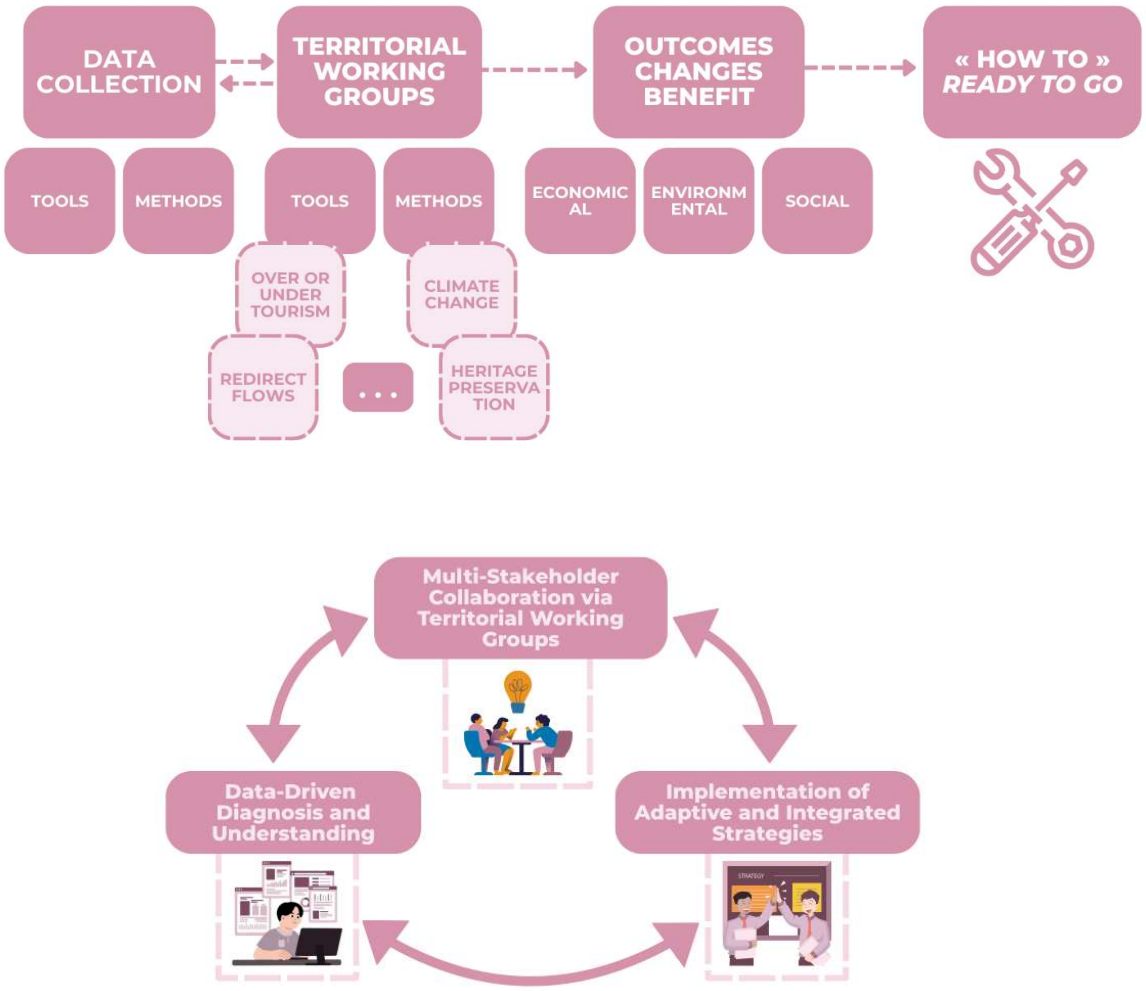

Figure 1 HERIT ADAPT Sustainable Tourism Model

1.4 Alignment with the HERIT ADAPT Framework

The Transferability Plan is fully aligned with the strategic architecture of HERIT ADAPT, as defined in the Application Form and the Feasibility Study. The categorization of solutions under the four Use Cases, the clustering of pilot territories, and the selection of monitoring indicators are as defined within the methodology of the Sustainable Tourism Model. The Plan ensures continuity between pilot implementation and future replication by preserving the project's sustainability, resilience, and evidence-based governance principles.

2. Use Case Framework

The Use Case Framework developed within the HERIT ADAPT project defines the structural organization of the technological and analytical solutions tested through pilot activities, grouping them into four complementary Use Cases. These Use Cases constitute the operational components through which the HERIT ADAPT Sustainable Tourism Model is implemented, enabling the systematic collection and analysis of tourism-related data and supporting informed, evidence-based decision-making for sustainable and resilient tourism management.

2.1 Conceptual Overview of the Use Case Approach

The Use Case approach constitutes the structural architecture of the project's operational solutions, as defined within the methodology of the Sustainable Tourism Model. Each Use Case represents a distinct but interrelated application domain through which data collection, technological processing, and governance integration are combined to address specific territorial challenges identified in the pilot phase. This categorization ensures coherence between pilot implementation, monitoring logic, clustering methodology, and the subsequent Transferability Framework.

The Use Cases do not represent isolated technological tools; rather, they define functional configurations embedded within the broader Sustainable Tourism Model. Their classification provides the reference structure upon which territorial mapping, clustering logic, and transfer methodology are systematically developed.

The Use Case framework incorporates both fully implemented and validated pilot applications, as well as analytically derived potential deployment scenarios, where relevant. This approach ensures that the Transferability Plan reflects both tested operational experience and forward-looking application pathways under comparable territorial conditions, maintaining consistency with the operational logic and phased implementation approach of the model.

This combined perspective further supports the structured transition from pilot implementation to transfer, ensuring that both validated applications and forward-looking deployment scenarios can be operationalized within a consistent and governance-integrated framework.

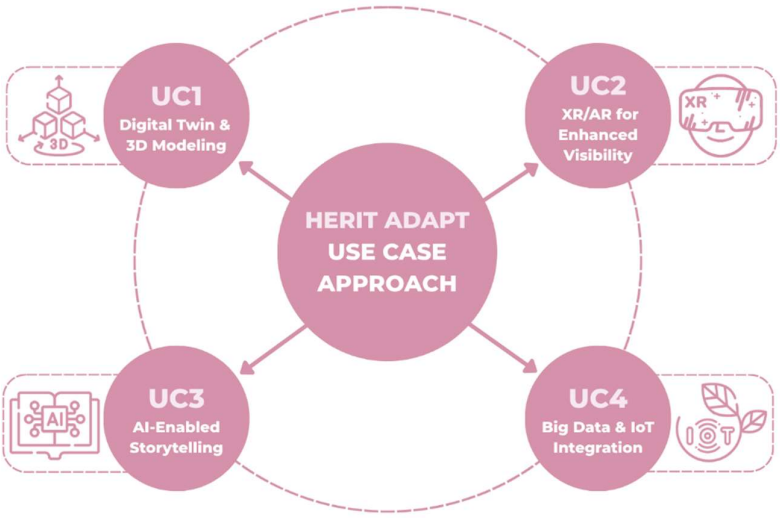

Figure 2 HERIT ADAPT Use Case Approach

2.2 UC1 – Digital Twin & 3D Modeling

UC1 encompasses the development and operational use of digital twin environments and 3D modeling tools to support the digital documentation, analysis, preservation, and interpretation of cultural heritage assets in diverse territorial contexts.

Through high-resolution 3D capture, reconstruction, and visualization, the Use Case generates structured digital outputs that support conservation planning, heritage management, educational use, and enhanced visibility of heritage sites. Within the Sustainable Tourism Model, UC1 functions as a digital documentation and decision-support mechanism contributing to resilience-oriented governance.

Table 1 Key Elements of UC1 (Digital Twin & 3D Modeling)

Key Element	Description
Use Case Objective	Defines the role of UC1 in supporting digital documentation, analysis, preservation, and interpretation of heritage assets within the HERIT ADAPT Sustainable Tourism Model.
Technological Domain	Digital Twin environments and 3D spatial modelling technologies applied to heritage and tourism destinations.
Tools / Technologies	Digital twin platforms, 3D modelling tools, photogrammetry workflows, laser scanning systems, drone-based imaging tools, annotation platforms, data processing and analytical tools where applicable, and visualization environments used for heritage documentation, reconstruction, analysis, and interpretation.
Data Sources	High-resolution image datasets, laser scanning data, drone-based photogrammetry outputs, 3D geometric and texture data, heritage site documentation records, and complementary contextual datasets supporting digital reconstruction, conservation analysis, and heritage interpretation.
Required Skills	Digital heritage documentation, photogrammetry, laser scanning, 3D reconstruction, data visualization, digital content processing, conservation-oriented analysis, and technical expertise in digital twin and modelling tools.
Pilot Application	Reference to pilot areas where digital twin environments and spatial modelling tools were tested within the HERIT ADAPT project.
Operational Function	Digital documentation, reconstruction, analysis, and visualization of heritage assets in order to support conservation planning, heritage management, interpretation, and evidence-based decision-making.
Expected Outputs	High-resolution 3D models, digital twin outputs, analytical reports, digital documentation assets, visualizations, and heritage interpretation materials supporting conservation, management, and communication processes.
Contribution to the Sustainable Tourism Model	Supports resilience-oriented governance by enabling digital documentation, conservation support, heritage analysis, and enhanced interpretation of cultural assets, while contributing to evidence-based management and sustainable valorization of heritage sites.

Key Element	Description
Transferability Considerations	Institutional, technical, and data requirements necessary for the replication of UC1 in other territorial contexts.
Monitoring Indicators	Indicators used to assess the effectiveness of digital documentation, modelling, conservation support, and heritage interpretation tools.

2.3 UC2 – XR/AR for Enhanced Visibility

UC2 integrates extended reality (XR) and augmented reality (AR) technologies to enhance cultural interpretation and diversify visitor experiences in heritage destinations.

By providing immersive digital content and interactive interpretation tools, the Use Case strengthens visitor engagement while promoting under-visited cultural assets. Through the enhanced visibility of alternative points of interest, UC2 has the potential to contribute to a more balanced spatial distribution of tourism flows. Within the Sustainable Tourism Model, UC2 functions as an engagement-driven mechanism supporting sustainable visitor management and adaptive territorial positioning.

Table 2 Key Elements of UC2 (XR/AR for Enhanced Visibility)

Key Element	Description
Use Case Objective	Defines the role of UC2 in enhancing cultural interpretation and visitor engagement through immersive digital technologies within the HERIT ADAPT Sustainable Tourism Model.
Technological Domain	Extended Reality (XR) and Augmented Reality (AR) technologies applied to cultural heritage interpretation and visitor engagement.
Tools / Technologies	XR and AR applications, immersive storytelling platforms, mobile applications, interactive visualization tools, and digital heritage interpretation systems.
Data Sources	Cultural heritage content, multimedia interpretation materials, visitor interaction data, and digital cultural datasets supporting immersive experiences.
Required Skills	XR/AR development, digital content creation, cultural storytelling, user experience design, and multimedia production.
Pilot Application	Reference to pilot areas where XR and AR applications were implemented to enhance visitor engagement and cultural interpretation.
Operational Function	Delivery of immersive and interactive cultural interpretation experiences that strengthen visitor engagement and promote the visibility of heritage assets.
Expected Outputs	Interactive digital experiences, augmented interpretation tools, enhanced visitor engagement mechanisms, and increased visibility of cultural heritage assets.

Key Element	Description
Contribution to the Sustainable Tourism Model	Supports balanced tourism distribution and sustainable visitor management by promoting alternative attractions and enhancing cultural engagement.
Transferability Considerations	Institutional, technical, and content development requirements necessary for the replication of XR/AR applications in different territorial contexts.
Monitoring Indicators	Indicators assessing visitor engagement levels, digital interaction rates, and the effectiveness of immersive interpretation tools.

2.4 UC3 – AI-Enabled Storytelling

UC3 introduces artificial intelligence (AI) applications designed to generate adaptive and personalized storytelling experiences based on dynamic visitor data.

By analysing visitor preferences, behavioural patterns, and contextual information, the Use Case enables targeted communication strategies that guide visitor choices and enhance cultural engagement. Through intelligent content delivery and data-informed interpretation, UC3 contributes to influencing visitor behaviour and promoting alternative but culturally connected heritage assets and territorial routes. Within the Sustainable Tourism Model, UC3 functions as a behavioural guidance mechanism supporting sustainable tourism management and balanced visitor distribution.

Table 3 Key Elements of UC3 (AI-Enabled Storytelling)

Key Element	Description
Use Case Objective	Defines the role of UC3 in supporting personalized visitor communication and behavioural guidance through AI-driven storytelling within the HERIT ADAPT Sustainable Tourism Model.
Technological Domain	Artificial Intelligence applications applied to adaptive storytelling, personalized content delivery, and visitor engagement in cultural heritage contexts.
Tools / Technologies	AI-based content recommendation systems, natural language processing tools, digital storytelling platforms, and adaptive content delivery systems.
Data Sources	Visitor behaviour data, tourism interaction data, cultural heritage content, and contextual information supporting personalized storytelling experiences.
Required Skills	Artificial intelligence development, data analytics, digital storytelling design, cultural content development, and user experience design.
Pilot Application	Reference to pilot areas where AI-driven storytelling tools were implemented to support personalized visitor experiences and cultural engagement.
Operational Function	Delivery of adaptive storytelling experiences that guide visitor behaviour, enhance cultural interpretation, and support informed visitor choices.

Key Element	Description
Expected Outputs	Personalized storytelling content, adaptive digital narratives, AI-driven content recommendations, and enhanced digital interpretation tools supporting visitor guidance.
Contribution to the Sustainable Tourism Model	Supports behavioural guidance and sustainable visitor management by influencing visitor choices and promoting alternative cultural experiences.
Transferability Considerations	Institutional, technical, and data requirements necessary for the replication of AI-based storytelling systems in different territorial contexts.
Monitoring Indicators	Indicators assessing visitor engagement levels, personalization effectiveness, and the influence of AI-driven communication on visitor behaviour patterns.

2.5 UC4 – Big Data & IoT Integration

UC4 focuses on the integration of Internet of Things (IoT) systems and Big Data analytics platforms to enable continuous monitoring of tourism pressure, environmental conditions, and operational performance in heritage destinations.

Through real-time data collection, processing, and visualization dashboards, the Use Case supports evidence-based monitoring and adaptive decision-making processes. By providing continuous analytical insights into tourism dynamics and environmental indicators, UC4 strengthens the capacity of destination managers to respond proactively to emerging pressures. Within the Sustainable Tourism Model, UC4 functions as the monitoring backbone supporting data-driven governance and resilience-oriented tourism management.

Table 4 Key Elements of UC4 (Big Data & IoT Integration)

Key Element	Description
Use Case Objective	Defines the role of UC4 in supporting continuous monitoring and evidence-based decision-making through Big Data analytics and IoT-enabled data collection within the HERIT ADAPT Sustainable Tourism Model.
Technological Domain	Big Data analytics and Internet of Things (IoT) technologies applied to tourism monitoring, environmental observation, and destination management.
Tools / Technologies	IoT sensors, environmental monitoring devices, data integration platforms, Big Data analytics systems, and real-time visualization dashboards.
Data Sources	Sensor data, tourism mobility data, environmental monitoring data, operational datasets, and other real-time data streams relevant to tourism management.
Required Skills	Data analytics, IoT system management, data integration, statistical analysis, and dashboard development for decision-support systems.

Key Element	Description
Pilot Application	Reference to pilot areas where IoT monitoring systems and Big Data analytics tools were implemented to support tourism monitoring and environmental observation.
Operational Function	Continuous monitoring of tourism flows, environmental indicators, and operational performance through integrated data collection and analytics systems.
Expected Outputs	Real-time monitoring dashboards, analytical reports, data-driven insights, and decision-support tools for tourism and heritage management.
Contribution to the Sustainable Tourism Model	Provides the analytical and monitoring backbone of the model by enabling continuous assessment of tourism dynamics and supporting adaptive governance mechanisms.
Transferability Considerations	Institutional, technical, and data infrastructure requirements necessary for the replication of IoT monitoring systems and Big Data analytics platforms in other territorial contexts.
Monitoring Indicators	Indicators assessing tourism pressure levels, environmental conditions, system performance, and the effectiveness of data-driven monitoring tools.

3. Overview of Pilot Territories

3.1 Territorial Context and Typology

The pilot territories participating in HERIT ADAPT represent a diverse spectrum of cultural heritage contexts across the Euro-MED region. These include high-pressure urban heritage cores, coastal archaeological sites, mountainous and remote heritage landscapes, and smaller-scale regional cultural assets. The typological differentiation of these territories is informed by the project evidence base, including the Feasibility Study and the documented characteristics of the pilot sites, and reflects variations in tourism intensity, governance configuration, environmental exposure, and digital maturity levels.

- **Urban heritage environments** with high international visibility include the Rector's Palace (Dubrovnik, Croatia), the Roman Houses of Celio Hill (Rome, Italy), and the Monumental Complex of Alhambra and Generalife (Granada, Spain), which in the pilot framework functions as the gateway node of a wider territorial heritage system linked to the historical defensive landscape and the watchtowers of the Western Mountains.
- **Semi-urban and coastal** archaeological sites include the Temple of Apollo Hylates (Limassol, Cyprus). Remote or environmentally exposed heritage sites include the Temple of Apollo Epicurius (Bassae, Greece), Žabljak Crnojevića Fortress (Montenegro), and the Canigó Grand Site / Villefranche de Conflent (France).
- **Smaller-scale urban or regional cultural institutions** include the Museo Chiossone (Genoa pilot area, Italy) and the Mausoleum–Ossuary in Koprivshtitsa (Bulgaria).

This diversity of pilot territories illustrates the range of territorial conditions in which the HERIT ADAPT solutions were tested. It provides useful context for interpreting the transferability potential of the Sustainable Tourism Model across different heritage environments.

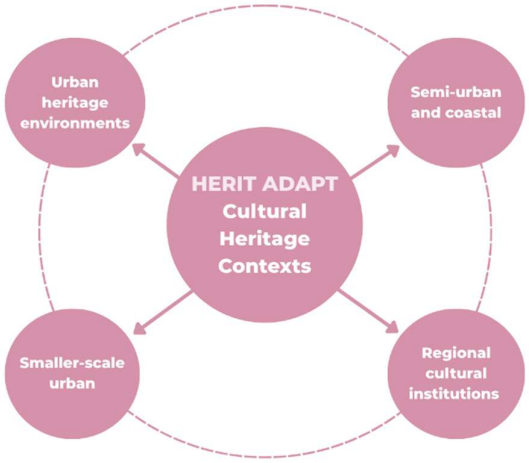

Figure 3 HERIT ADAPT cultural heritage contexts (typologies)

3.2 Analytical Profile per Pilot Territory

For the purposes of this Plan, the pilot geographies referenced throughout Chapter 3 correspond to the nine HERIT ADAPT pilot territories/sites documented in the project evidence base. These pilots represent the full set of implementation locations ("pilot pins") and constitute the territorial reference layer used for the analytical profiling presented in this chapter, the UC-based clustering analysis presented in Section 3.5, and the transfer framework per Use Case developed in Chapter 5. Where a pilot refers to a specific cultural heritage site embedded within a wider urban or regional context, the site designation is retained in order to ensure traceability to the official pilot documentation.

In this Plan, the term **"pilot territory"** refers to the documented HERIT ADAPT pilot implementation location. Depending on the pilot configuration, this may correspond either to a city-level context, to a specific cultural heritage site embedded within a broader municipal or regional setting, or to a core heritage node functionally linked to a wider territorial system. The site-based designation is therefore maintained to ensure full consistency with the official project evidence base and pilot documentation.

For each pilot territory, the Transferability Plan includes a structured analytical profile capturing the territorial parameters that influence transferability potential. These profiles are based on the documented pilot implementation experience and summarize the key territorial characteristics of each site, including governance configuration, tourism pressure conditions, environmental exposure, operational challenges identified during the pilot phase, and the Use Cases implemented.

This structured territorial profiling supports the identification of common operational patterns across the pilot territories and provides the analytical basis for the clustering logic presented in Section 3.5 and the transferability framework developed in Chapter 4.

3.2.1 Temple of Apollo Epicurius (Bassae) – Greece

Situated in a remote mountainous environment and recognized as a UNESCO World Heritage site, this territory is characterized by limited accessibility and environmental exposure. Governance coordination involves regional and heritage authorities. The territorial conditions underlined the relevance of monitoring mechanisms and digital support tools adapted to remote heritage environments.

Table 5 Analytical Profile of the Pilot Territory: Temple of Apollo Epicurius

Key Element	Description
Pilot Territory / Site	Temple of Apollo Epicurius archaeological site (Bassae).
Country / Geographical Context	Greece – remote mountainous heritage site within the Region of Western Greece, in a protected cultural landscape.
Territorial Typology	Remote mountainous archaeological heritage site characterized by limited accessibility and environmental exposure.
Governance Context	Governance coordination involving national heritage authorities and regional administrative entities responsible for heritage protection and site management.
Tourism Pressure Profile	Relatively low but seasonally variable visitor flows due to the site's remote location, with accessibility constraints influencing tourism dynamics.
Environmental / Climate Exposure	Exposure to environmental pressures associated with mountainous terrain and climatic variability affecting heritage conservation conditions.
Key Challenges Identified	Limited accessibility, visibility and management constraints, and the need for advanced digital support tools to enhance documentation, conservation planning, interpretation, and site management in remote heritage environments.
Relevant Use Cases in the Pilot Framework	UC1 – Digital Twin & 3D Modeling
Operational Focus of the Pilot	Application of digital modelling and digital twin tools to support documentation, conservation planning, interpretation, and management of a remote heritage environment.
Strategic Insights for Transferability	Demonstrates the relevance of digital modelling and digital twin solutions for heritage sites located in remote and environmentally exposed territories where traditional conservation and interpretation capacity is limited.

3.2.2 Roman Houses of Celio Hill (Rome) – Italy

Situated in a remote mountainous environment and recognized as a UNESCO World Heritage site, this territory is characterized by limited accessibility and environmental exposure. Governance coordination involves regional and heritage authorities. The territorial conditions underlined the relevance of monitoring mechanisms and digital support tools adapted to remote heritage environments.

Table 6 Analytical Profile of the Pilot Territory: Roman Houses of Celio Hill

Key Element	Description
Pilot Territory / Site	Roman Houses of Celio Hill archaeological complex.
Country / Geographical Context	Italy – urban archaeological heritage site located in Rome within a dense historic urban environment.
Territorial Typology	Urban archaeological heritage site embedded within a large metropolitan heritage network.
Governance Context	Multi-level governance structure involving national heritage authorities, municipal institutions, and cultural heritage management entities responsible for site preservation and visitor management.
Tourism Pressure Profile	Visitor dynamics influenced by Rome's extensive urban tourism network, with fluctuating visitor flows connected to broader heritage tourism patterns across the historic city.
Environmental / Climate Exposure	Moderate environmental exposure typical of dense urban heritage environments, including conservation pressures related to urban conditions and visitor activity.
Key Challenges Identified	Need for strengthened digital interpretation tools, improved visitor engagement mechanisms, and better integration of monitoring systems within existing municipal heritage management frameworks.
Relevant Use Cases in the Pilot Framework	UC2 – XR/AR for Enhanced Visibility
Operational Focus of the Pilot	Strengthening digital interpretation, immersive visitor engagement, and non-invasive access solutions through XR/AR applications that enhance cultural visibility, support accessibility, and contribute to the diversification of visitor experience within a dense urban heritage environment.
Strategic Insights for Transferability	Demonstrates how immersive and non-invasive XR/AR applications can enhance interpretation, accessibility, and visitor engagement in dense urban heritage environments, while supporting sustainable visitor distribution and the visibility of under-visited cultural assets.

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3.2.3 Museo Chiossone (Genoa pilot area) – Italy

Situated within an urban heritage environment, the Museo Chiossone functions as a cultural institution embedded in a dense metropolitan context. The territorial profile is characterized less by overtourism and more by audience diversification and digital engagement challenges. The pilot context highlighted opportunities for strengthening data-informed communication and visitor engagement mechanisms.

Table 7 Analytical Profile of the Pilot Territory: Museo Chiossone

Key Element	Description
Pilot Territory / Site	Museo Chiossone cultural heritage institution located in Genoa.
Country / Geographical Context	Italy – urban cultural heritage institution situated within the metropolitan environment of Genoa.
Territorial Typology	Urban cultural institution embedded within a dense metropolitan heritage and cultural landscape.
Governance Context	Governance framework involving municipal cultural authorities and heritage management institutions responsible for museum administration, cultural programming, and visitor engagement strategies.
Tourism Pressure Profile	Moderate visitor flows with limited overtourism pressure, characterized instead by the need to diversify audiences and enhance cultural engagement.
Environmental / Climate Exposure	Limited environmental exposure typical of indoor urban cultural institutions, with primary operational challenges related to audience engagement rather than environmental pressures.
Key Challenges Identified	Need for improved audience diversification strategies, enhanced digital communication mechanisms, and stronger data-informed visitor engagement tools.
Relevant Use Cases in the Pilot Framework	 UC1 – Digital Twin & 3D Modeling; UC2 – XR/AR for Enhanced Visibility
Operational Focus of the Pilot	Strengthening digital engagement and visibility of cultural assets through enhanced interpretation tools and improved data-informed communication strategies.
Strategic Insights for Transferability	Demonstrates how digital interpretation and engagement tools can support audience diversification and strengthen visitor communication strategies in urban cultural institutions.

3.2.4 Rector's Palace (Dubrovnik) – Croatia

Located within a UNESCO-protected historic core exposed to intense seasonal tourism flows, Dubrovnik represents a high-pressure urban coastal heritage environment. Governance complexity and visitor concentration patterns pointed to the necessity of enhanced monitoring, redistribution strategies, and resilience-oriented management tools.

Table 8 Analytical Profile of the Pilot Territory: Rector's Palace

Key Element	Description
Pilot Territory / Site	Rector's Palace heritage site located within the historic center of Dubrovnik.
Country / Geographical Context	Croatia – coastal urban heritage site situated within the UNESCO-protected historic core of Dubrovnik.
Territorial Typology	High-pressure urban coastal heritage environment characterized by intense seasonal tourism flows.
Governance Context	Complex governance structure involving municipal authorities, national heritage institutions, and cultural heritage management bodies responsible for the protection and management of the historic urban landscape.
Tourism Pressure Profile	Very high visitor volumes associated with Dubrovnik's global tourism visibility, with strong seasonal peaks leading to visitor concentration and congestion within the historic center.
Environmental / Climate Exposure	Exposure to coastal environmental pressures and climate-related risks affecting historic urban heritage sites.
Key Challenges Identified	High tourism pressure, visitor concentration within the historic core, and the need for enhanced monitoring and visitor redistribution strategies.
Relevant Use Cases in the Pilot Framework	UC1 – Digital Twin & 3D Modeling; UC4 – Big Data & IoT Integration
Operational Focus of the Pilot	Strengthening integrated monitoring, real-time data analysis, and decision-support systems through Big Data and IoT tools, complemented by digital documentation and 3D modelling for heritage analysis and conservation planning.
Strategic Insights for Transferability	Demonstrates the importance of integrating real-time environmental monitoring, predictive tools, and digital documentation to support preventive conservation and adaptive governance in highly visited historic urban destinations.

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3.2.5 Temple of Apollo Hylates (Limassol) – Cyprus

Located within a coastal peri-urban setting, this archaeological site combines heritage preservation requirements with exposure to climatic stress factors. The governance structure integrates archaeological authorities and municipal entities. The pilot context emphasized the importance of enhanced visitor management tools and improved data-driven coordination.

Table 9 Analytical Profile of the Pilot Territory: Temple of Apollo Hylates

Key Element	Description
Pilot Territory / Site	Temple of Apollo Hylates archaeological site.
Country / Geographical Context	Cyprus – coastal peri-urban heritage site located near Kourion in Limassol within a Mediterranean coastal environment.
Territorial Typology	Coastal archaeological heritage site embedded in a peri-urban territorial context.
Governance Context	Governance framework involving national archaeological authorities responsible for heritage protection and municipal entities supporting local tourism management and site accessibility.
Tourism Pressure Profile	Moderate visitor flows associated with regional tourism dynamics, with seasonal variation influenced by coastal tourism activity in the surrounding area.
Environmental / Climate Exposure	Exposure to climatic stress factors typical of coastal Mediterranean environments, including heat stress, environmental degradation risks, and climate-related impacts affecting heritage preservation.
Key Challenges Identified	Need for improved heritage documentation, stronger coordination between heritage authorities and local governance actors, and enhanced use of digital and site-related data to support preservation, interpretation, and site management.
Relevant Use Cases in the Pilot Framework	UC1 – Digital Twin & 3D Modeling
Operational Focus of the Pilot	Strengthening digital documentation, preservation support, and heritage interpretation through 3D modelling tools that support conservation planning, site monitoring, and educational use.
Strategic Insights for Transferability	Demonstrates the applicability of 3D modelling and digital twin technologies for supporting documentation, conservation, interpretation, and management in coastal archaeological heritage sites exposed to environmental and tourism pressures.

3.2.6 Žabljak Crnojevića Fortress – Montenegro

This fortress site is located in a remote and environmentally exposed setting characterized by infrastructural constraints and underutilization. Governance operates at regional and municipal levels. The pilot environment indicated the need for improved visibility tools and structured monitoring approaches.

Table 10 Analytical Profile of the Pilot Territory: Žabljak Crnojevića Fortress

Key Element	Description
Pilot Territory / Site	Žabljak Crnojevića Fortress heritage site.
Country / Geographical Context	Montenegro – remote historical fortress site located within a natural landscape environment characterized by limited infrastructure and accessibility.
Territorial Typology	Remote heritage site situated in an environmentally exposed landscape with limited tourism infrastructure.
Governance Context	Governance coordination involving regional and municipal authorities responsible for heritage management, territorial development, and tourism promotion.
Tourism Pressure Profile	Low visitor flows and underutilization of the heritage asset, with tourism potential limited by accessibility constraints and infrastructure gaps.
Environmental / Climate Exposure	Environmental exposure related to the site's location within a natural landscape context, with conservation challenges linked to environmental conditions and limited management infrastructure.
Key Challenges Identified	Limited visibility of the heritage asset, infrastructural constraints affecting accessibility, and the need for improved monitoring and visitor engagement tools.
Relevant Use Cases in the Pilot Framework	UC1 – Digital Twin & 3D Modeling
Operational Focus of the Pilot	Enhancing site visibility and supporting heritage management through digital modelling tools and improved spatial understanding of the heritage landscape.
Strategic Insights for Transferability	Demonstrates how digital modelling technologies can support visibility, planning, and management of underutilized heritage sites located in remote and environmentally sensitive territories.

3.2.7 Monumental Complex of Alhambra and Generalife (Granada) – Spain

As one of Europe's most visited heritage sites, Alhambra operates under sustained visitor pressure and climate exposure conditions. Within the HERIT ADAPT pilot framework, the monument functions as the primary entry point of a territorially extended system, strategically linked to the surrounding network of watchtowers and rural heritage assets of the Western Mountains. Governance integrates regional and heritage authorities within a regulated preservation framework. The territorial context reinforced the importance of visitor-flow redistribution towards connected heritage areas, advanced visitor flow analytics, and adaptive management mechanisms.

Table 11 Analytical Profile of the Pilot Territory: Monumental Complex of Alhambra and Generalife

Key Element	Description
Pilot Territory / Site	Monumental Complex of Alhambra and Generalife heritage site.
Country / Geographical Context	Spain – major cultural heritage complex located in Granada within a historic urban landscape of global cultural significance.
Territorial Typology	Large-scale cultural heritage complex operating within a high-demand international tourism destination, functioning as the core node of a wider territorially connected heritage system.
Governance Context	Governance framework involving regional authorities and heritage management institutions responsible for preservation, visitor management, and site regulation within a protected cultural heritage environment.
Tourism Pressure Profile	Very high visitor volumes throughout the year, with sustained tourism demand and strong seasonal peaks associated with international heritage tourism.
Environmental / Climate Exposure	Exposure to climate-related pressures affecting heritage conservation conditions and visitor management within an open-air heritage complex.
Key Challenges Identified	Managing sustained visitor pressure, improving visitor flow monitoring mechanisms, and enabling effective redistribution of visitors towards culturally connected but under-visited heritage assets, while strengthening data-driven decision-making for heritage site management.
Relevant Use Cases in the Pilot Framework	UC3 – AI-Enabled Storytelling UC2 – XR/AR for Enhanced Visibility (as potential application) UC4 – Big Data & IoT Integration (as potential extension)

Key Element	Description
Operational Focus of the Pilot	Enhancing visitor engagement and interpretation through AI-enabled communication tools that connect the Alhambra with the surrounding watchtower system and rural heritage areas, while also exploring the potential use of immersive digital technologies and IoT-based monitoring to support visitor-flow redistribution across the wider territorial system and improved site experience.
Strategic Insights for Transferability	Demonstrates how advanced digital interpretation and AI-driven communication tools can support visitor engagement and contribute to managing tourism pressure in highly visited heritage destinations, particularly by enabling redistribution towards connected heritage systems beyond the primary attraction.

3.2.8 Canigó Grand Site / Villefranche de Conflent – France

This pilot territory represents a mountainous cultural and natural heritage landscape characterized by seasonal tourism dynamics and environmental sensitivity. Governance coordination operates within a protected landscape framework involving local and regional actors. The territorial context highlighted the need for strengthened monitoring capacity and structured data-informed planning mechanisms.

Table 12 Analytical Profile of the Pilot Territory: Canigó Grand Site / Villefranche de Conflent

Key Element	Description
Pilot Territory / Site	Canigó Grand Site / Villefranche de Conflent
Country / Geographical Context	France – mountainous cultural and natural heritage landscape located within the eastern Pyrenees region.
Territorial Typology	Remote mountainous heritage landscape combining cultural heritage assets with protected natural environments.
Governance Context	Governance coordination involving regional and local authorities responsible for heritage preservation, landscape protection, and tourism management within a protected site framework.
Tourism Pressure Profile	Seasonal tourism dynamics with moderate visitor flows concentrated during peak periods, combined with environmental sensitivity and spatial management constraints.
Environmental / Climate Exposure	High environmental sensitivity due to mountainous terrain, protected landscape status, and exposure to climate-related pressures affecting heritage conservation and visitor accessibility.

Key Element	Description
Key Challenges Identified	Limited monitoring capacity, fragmented data availability, and the need for structured analytical tools supporting evidence-based territorial planning.
Relevant Use Cases in the Pilot Framework	UC4 – Big Data & IoT Integration
Operational Focus of the Pilot	Strengthening monitoring mechanisms and data collection processes to support informed tourism management and environmental observation within a sensitive heritage landscape.
Strategic Insights for Transferability	Demonstrates the relevance of monitoring and data-integration tools for heritage destinations located in environmentally sensitive and spatially complex landscapes, providing lessons for the replication of data-driven monitoring systems in similar territorial contexts.

3.2.9 Mausoleum – Ossuary (Koprivshtitsa) – Bulgaria

This regional heritage site represents a smaller-scale cultural asset within a semi-rural environment. Tourism flows are moderate and seasonally variable, with governance structured at municipal level. The territorial conditions indicated the relevance of improved monitoring tools and enhanced digital interpretation strategies.

Table 13 Analytical Profile of the Pilot Territory: Mausoleum-Ossuary

Key Element	Description
Pilot Territory / Site	Mausoleum–Ossuary heritage site located in Koprivshtitsa.
Country / Geographical Context	Bulgaria – regional heritage site situated in the semi-rural cultural landscape of Koprivshtitsa.
Territorial Typology	Smaller-scale regional cultural heritage asset located within a semi-rural territorial environment.
Governance Context	Governance structure operating primarily at municipal level, involving local authorities responsible for heritage management and cultural tourism development.
Tourism Pressure Profile	Moderate and seasonally variable visitor flows associated with regional cultural tourism and local heritage visitation patterns.

Key Element	Description
Environmental / Climate Exposure	Environmental exposure typical of open-air heritage sites located in semi-rural landscapes, with conservation considerations linked to environmental conditions.
Key Challenges Identified	Limited monitoring capacity, need for improved digital interpretation tools, and the need to strengthen structured visitor engagement mechanisms.
Relevant Use Cases in the Pilot Framework	 UC1 – Digital Twin & 3D Modeling; UC4 – Big Data & IoT Integration
Operational Focus of the Pilot	Strengthening digital documentation and 3D modelling, combined with monitoring and data analysis tools to support improved heritage site management, visibility, and evidence-based decision-making.
Strategic Insights for Transferability	Demonstrates how monitoring tools and digital interpretation solutions can support the management and visibility of smaller-scale heritage sites in semi-rural territorial contexts.

3.3 Identified Needs and Structural Challenges across Pilot Territories

Across the nine pilot territories participating in HERIT ADAPT, several recurring structural parameters and operational challenges were identified, although their intensity varies according to territorial typology and local governance conditions.

The analysis of pilot implementation highlights the main categories of challenges observed across the territories and demonstrates how different territorial contexts influence the operational requirements for sustainable tourism management and the deployment of the HERIT ADAPT Use Cases.

The following categories of challenges were identified across the pilot territories:

- **High-pressure urban heritage environments** face challenges related to visitor congestion, spatial concentration of tourism flows, limited visibility of connected heritage assets, and the need for improved visitor redistribution strategies.

- **Remote and environmentally exposed heritage sites** encounter constraints linked to accessibility limitations and the need for monitoring tools capable of supporting heritage management in geographically complex environments.

- **Smaller-scale cultural institutions and regional heritage assets** often face challenges related to audience diversification, digital engagement, and the integration of structured data into heritage management and communication practices.

Across several pilot territories, additional cross-cutting factors were identified, including climate exposure affecting heritage conservation conditions and governance coordination complexity across institutional levels. These factors influence the operational design and implementation of

the HERIT ADAPT Use Cases and shape the strategic considerations for the transferability framework presented in the following chapters.

3.4 Allocation of Pilot Territories per Use Case

In line with the implementation logic of the HERIT ADAPT Sustainable Tourism Model, pilot territories engaged with one or more Use Cases (Figure 4) based on their specific territorial characteristics, governance structures, and operational needs identified during the pilot phase.

This engagement reflects how the model was operationalized across different territorial contexts, with each Use Case activated in response to distinct challenges and management priorities, thereby illustrating the applied configuration of the model in practice, while providing a structured overview of how technological and governance components were deployed within the pilot framework.

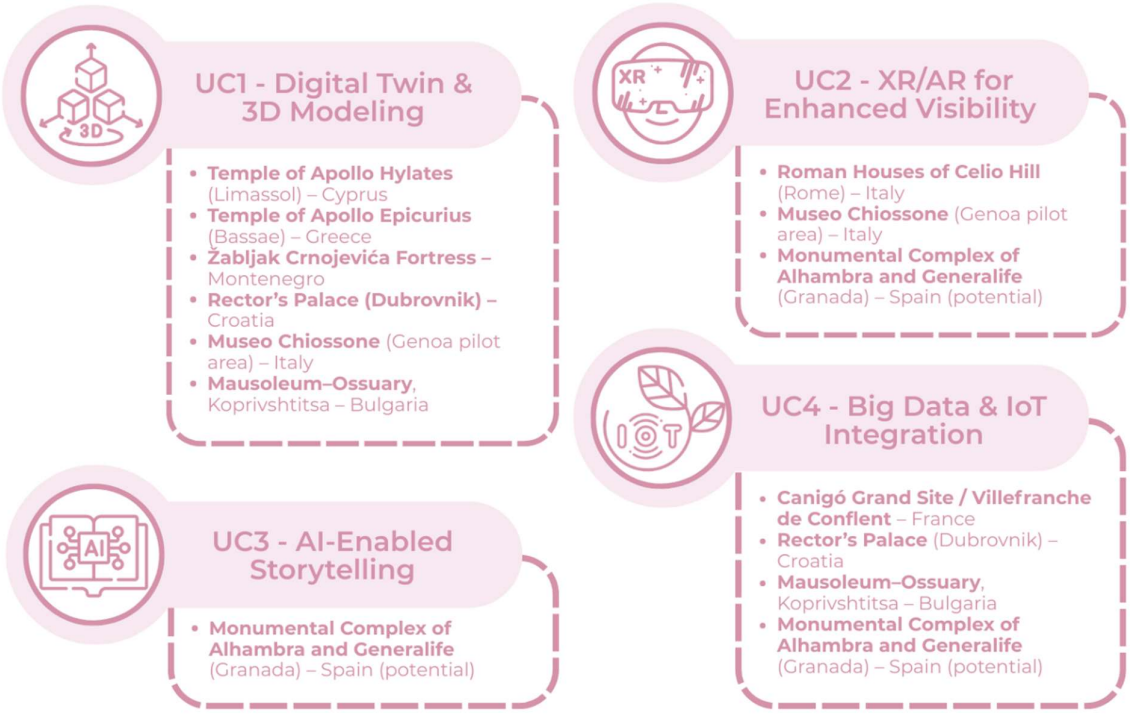

Figure 4 Pilot territories grouped per Use Case

This allocation provides the operational baseline for the Use Case–based clustering presented in Section 3.5 and supports the development of the transferability framework in the following chapter.

Figure 5 HERIT ADAPT Pilot Sites TWGs across the Euro-MED Region

3.5 Use Case–Based Clustering and Distribution Patterns

Building on the configuration presented in Section 3.4, the clustering of pilot territories is structured around the Use Case architecture of the Sustainable Tourism Model. Rather than grouping territories based on geographical proximity or administrative criteria, this approach follows a functional logic, reflecting similarities in applied technologies, data integration mechanisms, monitoring configurations, and decision-support processes. As such, it ensures methodological consistency across heterogeneous territorial contexts while supporting a coherent analytical transition from territorial profiling to transferability design.

Within this framework, the observed patterns across UC1–UC4 reveal differentiated operational priorities, illustrating how specific Use Cases were activated in response to distinct territorial conditions. A higher concentration of pilot territories is observed under UC1 (Digital Twin & 3D Modeling), indicating a widespread need for enhanced digital documentation, heritage analysis, and conservation-support tools across diverse heritage environments.

UC4 (Big Data & IoT Integration) is primarily applied in contexts requiring strengthened monitoring capacity and real-time data-driven management, particularly in environmentally sensitive or high-pressure environments. In contrast, UC2 (XR/AR for Enhanced Visibility) and UC3 (AI-Enabled Storytelling) demonstrate a more targeted application, focusing on visitor engagement, communication strategies, and the enhancement of cultural visibility, especially in urban and high-visibility heritage settings.

Overall, this distribution confirms the modular and complementary nature of the Sustainable Tourism Model, where different Use Cases are selectively activated based on territorial needs while contributing to a unified, governance-enabled system.

The resulting clustering structure, reflecting these operational patterns, is presented in Table 14.

Table 14 UC-based Clustering of Pilot Territories and operational patterns

Use Case Cluster	Pilot Territories	Dominant Operational Function within the STM
 **UC1 – Digital Twin & 3D Modeling**	• Temple of Apollo Epicurius (Bassae) – Greece • Museo Chiossone (Genoa pilot area) – Italy • Rector's Palace (Dubrovnik) – Croatia • Temple of Apollo Hylates (Limassol) – Cyprus • Žabljak Crnojevića Fortress – Montenegro • Mausoleum–Ossuary (Koprivshtitsa) – Bulgaria	✓ Digital documentation ✓ Heritage analysis ✓ Conservation support ✓ Spatial interpretation
 **UC2 – XR/AR for Enhanced Visibility**	• Roman Houses of Celio Hill (Rome) – Italy • Museo Chiossone (Genoa pilot area) – Italy • Monumental Complex of Alhambra and Generalife (Granada) – Spain (potential)	✓ Visitor engagement ✓ Immersive interpretation ✓ Visibility enhancement of cultural assets
 **UC3 – AI-Enabled Storytelling**	• Monumental Complex of Alhambra and Generalife (Granada) – Spain	✓ Personalized communication ✓ Behavioural guidance ✓ Adaptive visitor management
 **UC4 – Big Data & IoT Integration**	• Rector's Palace (Dubrovnik) – Croatia • Monumental Complex of Alhambra and Generalife (Granada) – Spain (potential) • Canigó Grand Site / Villefranche de Conflent – France • Mausoleum–Ossuary, Koprivshtitsa – Bulgaria	✓ Real-time monitoring ✓ Data-driven decision-making ✓ Adaptive governance

4. Transferability Framework per Use Case

This chapter presents the Transferability Framework, translating the Use Case architecture into structured and operational pathways for the replication of the Sustainable Tourism Model in new territorial contexts. The focus is placed on the practical conditions under which each Use Case can be effectively transferred, adapted, and operationalized within local governance and management systems.

The framework is organized around the four Use Cases (UC1–UC4), each representing a distinct implementation pathway through which solutions can be transferred and embedded into different territorial settings. These pathways are grounded in validated pilot implementation experience, ensuring that transfer processes are based on tested operational conditions rather than theoretical assumptions. In this context, the chapter does not reintroduce the conceptual or technological definition of the Use Cases, but focuses on their applicability, transfer conditions, and operational deployment in new environments.

The transfer addressed in this Plan concerns the replication of an implementation-oriented system, through which outputs generated by each Use Case are incorporated into local planning and management processes. While each Use Case is associated with specific technological configurations, their value in the transfer process lies in their ability to support structured intervention logic rather than standalone application.

The framework is therefore conceived as an implementation-oriented structure that organizes the transfer requirements, resource conditions, governance roles, and monitoring logic necessary for the replication of each Use Case. It integrates resource considerations, governance roles, and performance monitoring mechanisms, ensuring that transfer processes remain consistent, measurable, and responsive to territorial specificities.

Each Use Case is presented through a standardized structure, including territorial scope, strategic objectives, transfer methodology, implementation conditions, required resources, key actors, transfer and dissemination activities, monitoring mechanisms, and evaluation processes. This structure ensures comparability across Use Cases while allowing the necessary flexibility for context-specific adaptation.

The approach adopted in this chapter is grounded in the operational experience of pilot implementation, without duplicating its analytical or methodological development. In this respect, the Use Cases are treated as applied configurations whose transferability depends on their integration into local governance structures.

The transfer logic follows a structured and phased progression embedded in the methodology of the Sustainable Tourism Model, where preparation, deployment, validation, and adaptive refinement are systematically linked to performance monitoring and evaluation processes. This ensures methodological continuity between pilot implementation and transfer, reinforcing the operational applicability and robustness of the proposed framework.

Overall, the chapter provides a practical and implementation-oriented framework guiding the transfer of the Sustainable Tourism Model, ensuring that replication is supported by clear conditions, structured processes, and measurable performance criteria.

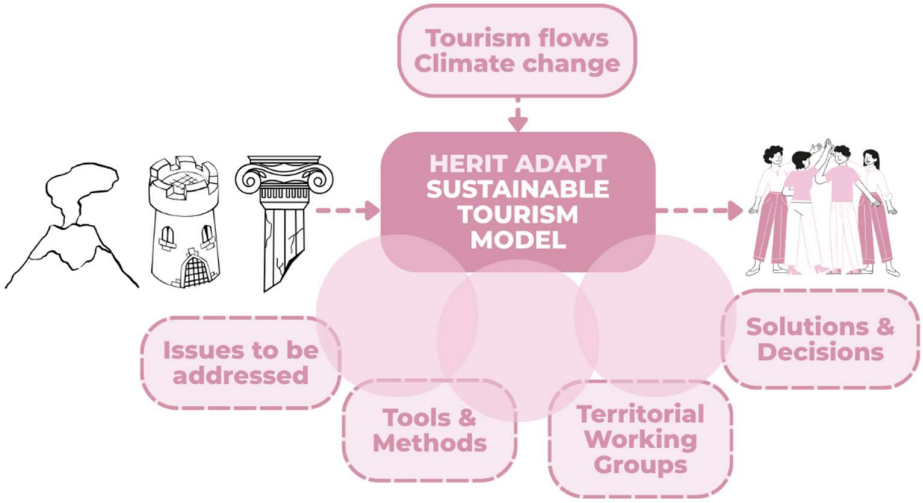

Figure 6 HERIT ADAPT Sustainable Tourism Model dynamics

4.1 UC1 – Digital Twin & 3D Modeling

4.1.1 Participating Pilot Territories and Pilot Implementation Insights

UC1 includes the following pilot territories:

- **Temple of Apollo Epicurius (Bassae) – Greece**
- **Museo Chiossone (Genoa pilot area) – Italy**
- **Rector's Palace (Dubrovnik) – Croatia**
- **Temple of Apollo Hylates (Limassol) – Cyprus**
- **Žabljak Crnojevića Fortress – Montenegro**
- **Mausoleum–Ossuary (Koprivshtitsa) – Bulgaria**

Implementation across the selected pilot territories provides a representative evidence base for assessing the applicability and transfer potential of UC1. In these territories, digital twin environments and 3D modeling tools were applied to document heritage assets, support conservation analysis and planning, enhance interpretation, and in some cases contribute to broader management functions. Applications across pilot sites also demonstrate the relevance of UC1 in diverse territorial contexts, including remote and environmentally exposed sites, as well as dense urban heritage environments subject to high visitor pressure. The operational insights derived from these applications inform the structured transfer pathway proposed for replication.

4.1.2 Strategic Objective of the Use Case

Digital Twin and 3D Modeling support the operationalization of the Sustainable Tourism Model by providing structured digital representations that inform conservation, interpretation, and management decisions. These tools enable structured digital documentation, 3D reconstruction, and digital twin applications that support conservation planning, heritage analysis, interpretation, and evidence-based management of cultural and natural assets.

In this context, they facilitate the monitoring of site vulnerabilities and support controlled access and interpretation of sensitive or restricted heritage areas, enhancing both preservation and visitor experience. The outputs generated under UC1 can be integrated into institutional planning cycles and TWG deliberations to inform adaptive management decisions.

4.1.3 Transfer Methodology

The transfer of UC1 follows a structured and phased implementation pathway, ensuring that digital twin and 3D modelling applications are effectively integrated into local management systems. The process includes territorial readiness assessment, validation of heritage documentation inputs and relevant site datasets, development of digital twin and 3D modelling infrastructure, and embedding analytical and documentation outputs into formal management, conservation, and interpretation procedures.

The pathway is designed to ensure that digital outputs are not limited to technical production, but are effectively used within planning, monitoring, and decision-making processes. Adaptation parameters may vary depending on territorial typology, including coastal, rural, or urban heritage contexts, while maintaining the core governance integration logic.

The transferability of UC1 is therefore based on the replication of a validated implementation process combining technological deployment, stakeholder coordination, and performance monitoring within an appropriate governance setting.

4.1.3.1 Implementation Preconditions

Effective transfer of UC1 requires a minimum level of institutional, technical, and operational readiness to support both the deployment and use of digital documentation outputs. These include availability of relevant heritage documentation inputs and interoperable digital datasets, clarity of data ownership, and designation of a coordinating authority responsible for integrating digital documentation and modelling outputs into management and decision-making processes.

Pilot experience further indicates that site accessibility conditions, baseline understanding of risks and vulnerabilities, and the ability to apply non-invasive documentation methods constitute critical enabling factors. Adequate digital maturity and interdepartmental collaboration constitute minimum readiness requirements.

4.1.3.2 Required Tools and Resources

The implementation of UC1 relies on a combination of digital tools and technical resources supporting the processes of documentation, analysis, monitoring, and operational use of heritage assets within the Sustainable Tourism Model.

Based on the pilot implementation experience, the following tools and resources are associated with UC1:

- Digital twin and 3D modelling technologies supporting the digital representation of heritage assets.
- Photogrammetry and terrestrial laser scanning techniques for high-resolution data acquisition.
- Drone-based imaging systems for aerial documentation and site monitoring.
- LiDAR technologies for precise spatial mapping and structural analysis.
- Digital platforms and tools supporting the visualization, analysis, and interpretation of heritage data.
- Environmental monitoring systems, including IoT sensors, for tracking site conditions and risks.
- Data collection and analysis tools supporting tourism flow monitoring and impact assessment.

For the effective operational deployment and transferability of UC1, the above tools are typically supported by complementary capacities, reflecting operational requirements related to data collection, processing, and governance integration, which may include:

- Data management and storage infrastructures ensuring the organization and accessibility of collected datasets.
- Data processing and analysis environments supporting the interpretation and operational use of digital outputs.
- Interoperability mechanisms enabling the integration of heterogeneous data sources.
- Visualization and interface tools facilitating the use of digital outputs within decision-making processes.
- Technical expertise in digital heritage documentation, modelling, and data analysis.
- Institutional coordination capacities supporting the integration of technical outputs into governance and management processes.

4.1.3.3 Key Success Factors

Successful replication of UC1 depends on the effective integration of data-driven approaches, stakeholder engagement mechanisms, and governance-supported decision-making processes, as reflected in the pilot implementation experience and the project methodological framework.

Table 15 Key Success Factors supporting UC1 Implementation and Transfer

Key Success Factor	Description
Data-driven decision-making	The use of collected environmental, cultural, socio-economic, and tourism flow data to support informed decision-making and management processes.
Continuous monitoring and data collection	The establishment of monitoring systems enabling continuous assessment of site conditions, risks, and tourism impacts.
Stakeholder engagement through structured mechanisms	The active involvement of stakeholders through Territorial Working Groups (TWGs), supporting participatory planning and coordination.

Key Success Factor	Description
Integration of outputs into planning and management processes	The use of data and analytical outputs to inform conservation strategies, tourism management, and policy decisions.
Governance coordination across levels	The need for coordination among local, regional, and national actors to ensure effective implementation and decision-making.
Alignment with sustainability and climate adaptation objectives	The integration of climate resilience and sustainability considerations into tourism and heritage management strategies.

4.1.3.4 Potential Barriers and Mitigation Considerations

The transfer of UC1 may be influenced by technical, operational, and governance-related conditions affecting the generation and use of digital representations and modelling outputs within monitoring and decision-making processes, as reflected in the pilot implementation experience and the project methodological framework.

Table 16 Potential Barriers and Mitigation Considerations

Potential Barrier	Mitigation Consideration
Limited availability or fragmentation of data	Reinforcing systematic data collection and monitoring processes supporting the availability and use of environmental, cultural, and tourism-related data.
Insufficient coordination across governance levels	Strengthening coordination mechanisms among stakeholders through structured governance processes.
Limited stakeholder capacity and technical expertise	Supporting stakeholder involvement through awareness-raising, training, and participatory processes as reflected in the project implementation approach.
Infrastructure and accessibility constraints at site level	Adapting implementation approaches to site-specific conditions, taking into account accessibility and infrastructure limitations identified in the territorial context.
Environmental exposure and vulnerability of heritage assets	Supporting the integration of monitoring and risk assessment approaches within conservation and climate adaptation strategies.
Challenges in managing tourism flows and site pressure	Supporting the use of monitoring data and management approaches to inform visitor flow regulation and reduce pressure on sensitive areas.

4.1.3.5 Key Actors and Stakeholders

The implementation of UC1 involves a multi-level set of actors contributing to both technical deployment and governance integration, as reflected in the pilot implementation experience and the project methodological framework.

The level of impact reflects the degree of involvement of each stakeholder group in governance, decision-making, and operational processes, as derived from the roles identified within this framework and the pilot implementation experience.

Table 17 Key Factor and Stakeholders supporting UC1 Implementation and Transfer

Stakeholder	Role	Level of Impact	Engagement Approach
Municipal and Regional Authorities	Coordination of implementation and integration of outputs into planning and decision-making processes	High	Participation in governance processes and decision-making structures
Cultural Heritage Management Bodies	Oversight of heritage protection, validation of digital outputs, and alignment with conservation requirements	High	Continuous involvement in monitoring, validation, and planning processes
Stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as Territorial Working Groups – TWGs, as applied in the pilot context)	Facilitation of stakeholder coordination and contribution to participatory decision-making processes	High	Structured participation through workshops, consultations, and collaborative processes
Tourism Organizations	Integration of outputs into tourism management strategies and visitor flow management	Medium–High	Contribution to planning processes and use of outputs for tourism-related decision-making
Technology Providers and Technical Experts	Development, deployment, and maintenance of digital tools and data systems	Medium	Technical support and system implementation activities
Site Managers and Local Operators	Application of digital outputs in day-to-day site management and monitoring activities	Medium	Operational involvement and feedback provision
Local Stakeholders and Communities	Contribution to local knowledge, awareness, and acceptance of implemented solutions	Medium	Participation in engagement activities and awareness processes

4.1.3.6 Proposed Action Plan for Transfer and Dissemination

The following action plan outlines indicative transfer and dissemination activities supporting the operational uptake of UC1, as derived from the pilot implementation experience and the project methodological framework.

Table 18 Proposed Transfer and Dissemination Activities supporting UC1 Implementation and Transfer

Proposed Activity	Brief Description	Actors Involved	Indicative Timing
Stakeholder engagement workshops	Organisation of workshops supporting stakeholder coordination, exchange of knowledge, and alignment on implementation objectives	Municipal and regional authorities, cultural heritage bodies, tourism organisations, local stakeholders	Preparatory Phase
Technical training and capacity building	Training activities supporting the use of digital documentation tools and interpretation of generated outputs	Technology providers, technical experts, site managers, public authorities	Implementation Phase
Data collection and modelling demonstrations	Demonstration of digital twin development, 3D modelling processes, and documentation techniques applied in pilot contexts	Technology providers, cultural heritage experts, technical specialists	Implementation Phase
Knowledge exchange activities	Exchange of practices and experiences between stakeholders to support understanding of operational requirements and transfer conditions	Public authorities, tourism organisations, heritage bodies, academic/research actors	Implementation / Operational Phase
Development of operational guidelines	Preparation of guidelines supporting the use, interpretation, and integration of digital outputs into planning and management processes	Public authorities, cultural heritage bodies, technical experts	Operational / Monitoring Phase
Awareness and communication actions	Activities supporting dissemination of results and communication of digital outputs to broader stakeholder groups	Public authorities, tourism organisations, local stakeholders	Evaluation / Transfer Phase
Demonstration and replication support activities	Presentation of pilot results and support to new territories interested in adopting UC1 solutions	Public authorities, heritage bodies, stakeholder networks	Evaluation / Transfer Phase

4.1.4 KPIs and Monitoring Mechanisms

The KPI framework for UC1 is structured across three performance levels, ensuring a comprehensive assessment of technical deployment, operational uptake, and long-term impact within the Sustainable Tourism Model.

This structure builds on the monitoring approach applied during the pilot implementation phase and reflects the need for measurable, governance-integrated performance tracking. It is aligned with the implementation methodology underpinning the Sustainable Tourism Model, ensuring methodological continuity between pilot testing, performance monitoring, and transfer processes, while also reflecting key performance dimensions derived from the HERIT ADAPT methodological framework and pilot implementation evidence base, particularly in relation to

digital documentation, heritage monitoring, conservation support, and data-driven decision-making.

Each performance level captures a distinct dimension of system validation, ranging from technical deployment and operational use to behavioural change and long-term resilience outcomes.

Pilot Output Indicators focus on the direct results of implementation and include:

- Extent of pilot site digitally documented through 2D and 3D modelling processes.
- Volume and completeness of high-resolution 2D/3D digital assets created and archived.
- Completion of digital models and associated digital documentation resources.
- Availability of documentation describing the digital twin development process.

Short-to-Medium Term Outcome Indicators assess changes in user engagement, site management practices, and operational use of digital outputs, including:

- Level of user interaction with digital tools supporting enhanced understanding of heritage assets.
- Use of digital content and visualisation tools within visitor engagement and interpretation processes.
- Extent to which digital outputs support conservation and site management decision-making processes.

Long-Term Impact Indicators evaluate the contribution of UC1 to heritage resilience and sustainable management, including:

- Evidence of improved conservation monitoring and site condition assessment practices.
- Integration of climate adaptation or conservation measures into site management frameworks.

Monitoring is conducted under the responsibility of the designated governance body in coordination with relevant stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as Territorial Working Groups (TWGs) in the pilot context), ensuring that KPI results are systematically integrated into decision-making cycles and adaptive management processes. Data are collected periodically, assessed against predefined benchmarks, and reviewed through structured performance cycles.

Where applicable, KPI values are assessed against baseline conditions established during the initial implementation phase, ensuring comparability between pre- and post-intervention performance levels and supporting evidence-based evaluation within the governance and monitoring framework of the Sustainable Tourism Model. Where performance thresholds are not met, corrective measures are discussed within the governance structure and adjusted implementation steps are activated.

KPI monitoring is embedded within the governance structure as an operational mechanism supporting coordinated decision-making, stakeholder alignment, and continuous performance improvement within the Sustainable Tourism Model. Through relevant stakeholder coordination mechanisms, data outputs are translated into actionable insights that inform conservation planning, site management practices, and adaptive responses.

The KPI framework also supports transferability by providing a standardized but adaptable structure that can be applied across different territorial contexts, while allowing calibration based on local conditions and governance capacity.

4.1.5 Indicative Transfer Timeline

The transfer of UC1 follows a structured and phased implementation process, aligned with the operational logic of the Sustainable Tourism Model and the pilot implementation experience. The timeline is presented in the form of a Gantt chart, providing a consolidated overview of the sequencing and interrelation of key implementation phases, from initial preparation and data acquisition to validation, governance integration, performance monitoring, and replication. This structured representation supports the coordination of activities, ensures methodological consistency, and facilitates the practical planning of UC1 transfer across different territorial contexts.

Table 19 Indicative Timeline for UC1 Transfer and Implication

Phases	M1-M3			M4-M6			M7-M9			M10-M12			M13-M15			M16-M18		
Phase 1- Initial Site Assessment and Preparation																		
Phase 2- Data Acquisition and Digital Modelling Development																		
Phase 3- Validation of Outputs and Operational Testing																		
Phase 4 – Integration into Governance and Management Processes																		
Phase 5 – Performance Monitoring and Adaptive Adjustment																		
Phase 6 – Consolidation, Replication, and Scaling																		

Colored cells indicate the periods during which each phase is active. The timeline is indicative and phases may overlap depending on site-specific conditions.

Phase 1 is typically concentrated in the early implementation stage, although its duration may vary depending on data availability and institutional readiness.

Preparatory actions for consolidation and replication may begin during the late stages of Phase 5, prior to full deployment in the final phase.

4.1.6 Evaluation and Performance Review Process

The evaluation framework for UC1 is structured as a continuous and iterative process, supporting both performance validation and adaptive management. It is aligned with the phased implementation logic described in Section 4.1.5 and integrates monitoring results into governance and decision-making processes.

The evaluation approach is aligned with the iterative logic of the Sustainable Tourism Model, ensuring a consistent progression from monitoring to adaptive refinement and final validation.

Evaluation is structured across three interconnected stages:

Stage 1 – Ongoing Monitoring and Interim Assessment

Performance data are collected continuously through the KPI framework (Section 4.1.4) and reviewed at predefined intervals. This stage enables early identification of deviations from expected performance and supports timely adjustments.

Stage 2 – Mid-Term Evaluation and Adaptive Adjustment

At intermediate stages of implementation, results are assessed against validation criteria, including technical performance, operational usability, and integration into management processes. Findings are reviewed in coordination with Territorial Working Groups (TWGs), enabling adaptive adjustments and alignment with site-specific conditions.

Stage 3 – Final Evaluation and Consolidation of Results

The final evaluation phase assesses the overall effectiveness of UC1, including its contribution to conservation planning, governance integration, and sustainable site management. This stage consolidates lessons learned, identifies best practices, and supports the definition of conditions for replication and scaling.

Across all stages, evaluation considers not only the technical quality of digital outputs but also their operational relevance, their contribution to site protection, and their integration into institutional workflows, as defined within the operational scope of the Use Case. The evaluation process therefore functions as a core governance mechanism supporting continuous improvement, informed decision-making, and long-term sustainability of heritage management practices.

Evaluation practices across pilot sites demonstrate variations in focus and maturity levels, reflecting differences in operational readiness, data availability, and governance structures, while maintaining alignment with the common evaluation logic of the Sustainable Tourism Model.

The evaluation approach follows a multi-level performance logic, where results are assessed across immediate outputs, short-to-medium term outcomes, and long-term strategic impacts. This ensures that UC1 performance is evaluated not only in terms of technical deployment, but also in relation to behavioural change, governance integration, and contribution to long-term heritage resilience.

4.2 UC2 – XR/AR for Enhanced Visibility

4.2.1 Participating Pilot Territories and Pilot Implementation Insights

UC2 includes the following pilot territories:

- **Roman Houses of Celio Hill (Rome) – Italy**
- **Museo Chiossone (Genoa pilot area) – Italy**
- **Monumental Complex of Alhambra and Generalife (Granada) – Spain (potential)**

Implementation across the selected pilot territories demonstrates how XR/AR technologies can be applied to enhance the visibility, accessibility, and interpretative capacity of cultural heritage assets. In the implemented pilot cases, immersive and semi-immersive solutions were deployed to provide enriched visitor experiences, improve understanding of heritage values, and enable alternative forms of access to sensitive or less accessible areas.

Applications in urban heritage environments, such as Rome and Genoa, highlight the role of XR/AR tools in supporting visitor orientation, interpretive clarity, and integration of physical and digital layers of information. These deployments demonstrate how immersive content can function as an extension of the physical site, enabling both guided and autonomous exploration while maintaining compatibility with conservation requirements.

In parallel, the Granada pilot case provides analytical insight into the potential use of immersive and digital interpretive tools to support visitor-flow redistribution and territorial visibility. The integration of digital narratives, QR-based access points, and potential AR applications illustrates how immersive technologies may contribute to connecting highly visited heritage sites with surrounding cultural landscapes, supporting more balanced tourism patterns.

Across the pilot territories, implementation insights indicate that XR/AR solutions operate most effectively when embedded within structured visitor management processes. Their contribution extends beyond enhanced experience, supporting accessibility, the redistribution of visitor flows, and the communication of complex cultural narratives. These insights inform the transfer pathway of UC2, emphasizing the role of immersive technologies as functional components within a broader sustainable tourism management framework.

While XR/AR applications were fully implemented and tested in selected pilot territories, the case of the Alhambra and Generalife provides a complementary analytical perspective, representing a potential deployment scenario rather than a fully operationalized application.

In this context, the pilot contributes to the understanding of how immersive and digital interpretive tools may support visitor-flow redistribution, territorial connectivity, and enhanced visibility of surrounding heritage assets. This distinction reinforces the transferability of UC2 by incorporating both validated applications and forward-looking implementation scenarios, strengthening its adaptability across diverse territorial conditions.

4.2.2 Strategic Objective of the Use Case

XR/AR technologies support the operationalization of the Sustainable Tourism Model by enhancing the visibility, accessibility, and interpretative capacity of cultural and natural heritage assets. Through immersive and interactive content, these tools enable the communication of complex narratives, facilitate visitor engagement, and extend access to sites and areas that may be physically restricted, fragile, or less accessible.

In this context, XR/AR applications function as structured interpretive and management tools rather than standalone digital experiences. They support the integration of digital content into visitor journeys, enabling both on-site and remote interaction with heritage assets, while maintaining alignment with conservation requirements and site-specific constraints.

The implementation of XR/AR solutions contributes to improving spatial orientation, interpretive clarity, and inclusivity by incorporating multilingual content, accessibility features, and alternative modes of engagement. At the same time, these tools support the redistribution of visitor flows by enhancing the visibility of secondary or under-visited areas, contributing to more balanced tourism patterns across territories. The outputs generated through UC2 can be integrated into communication strategies and visitor management plans coordinated through Territorial Working Groups (TWGs). This integration enables the use of immersive technologies as part of structured management cycles, supporting adaptive responses to visitor behaviour, site pressures, and evolving territorial conditions.

Overall, UC2 contributes to the Sustainable Tourism Model by linking digital interpretation with governance-enabled visitor management, ensuring that enhanced visibility and engagement are aligned with long-term heritage preservation and sustainable territorial development objectives.

4.2.3 Transfer Methodology

The transfer of UC2 follows a structured and phased implementation pathway, ensuring that XR/AR applications are effectively integrated into visitor management and interpretation processes. The process includes assessment of digital content readiness, definition of interpretive objectives, development and calibration of immersive applications, and integration into local tourism management and communication strategies.

The transfer pathway combines tested implementation experience with additional analytical insights derived from potential deployment scenarios, particularly in cases where immersive content can function as a gateway between highly visited heritage sites and surrounding areas. Adaptation parameters may vary depending on territorial typology, including high-density tourism destinations, urban heritage environments, or low-density rural and remote sites. These variations influence the scale of deployment, content complexity, and integration with physical infrastructure, while maintaining the core logic of governance-supported implementation.

The transferability of UC2 is therefore not based on the simple replication of immersive technologies, but on the replication of a structured implementation process. This process integrates stakeholder co-design, user testing, performance monitoring, and iterative content refinement, ensuring that XR/AR solutions are effectively embedded within different territorial, institutional, and visitor-management contexts.

4.2.3.1 Implementation Preconditions

Effective transfer of UC2 requires a minimum level of institutional, technical, and operational readiness to support both the deployment and use of immersive applications. These include the availability of digitized and structured cultural content, baseline interpretive material, and adequate visitor access infrastructure (on-site and/or digital). Clear institutional coordination between cultural authorities, tourism management bodies, and technology providers is required, alongside defined responsibilities for content management, updating, and long-term maintenance. Pilot experience further indicates that accessibility considerations (e.g. multilingual content, inclusive design), and the ability to deploy non-invasive solutions within sensitive heritage environments, constitute critical enabling factors.

4.2.3.2 Required Tools and Resources

The implementation of UC2 relies on a combination of digital tools and technical resources supporting the development, deployment, and operational use of immersive experiences within the Sustainable Tourism Model.

Based on the pilot implementation experience, the following tools and resources are associated with UC2:

- XR/AR technologies supporting the development of immersive and interactive visitor experiences.
- Virtual and augmented reality applications enabling enhanced interpretation and visualization of cultural heritage assets.
- Digital content development tools supporting the creation of multimedia, narrative, and interactive materials.
- Web-based and mobile interfaces enabling user access to immersive content across different devices.
- QR-based or digital access systems facilitating on-site interaction with XR/AR content.
- Tools supporting multilingual content delivery and accessibility features for diverse user groups.
- Digital platforms supporting the dissemination and integration of immersive content within tourism and communication channels.

For the effective operational deployment and transferability of UC2, the above tools are typically supported by complementary capacities, reflecting operational requirements related to data collection, user interaction monitoring, and governance integration, which may include:

- Content management systems supporting the organization, updating, and distribution of XR/AR content.
- User analytics and interaction tracking environments supporting the assessment of engagement and behavioural patterns.
- Integration mechanisms enabling the connection of XR/AR applications with existing tourism platforms and digital infrastructures.
- Visualization and interface design capacities supporting usability, accessibility, and user experience optimization.

- Technical expertise in XR/AR development, digital content creation, and user experience design.
- Coordination capacities supporting the alignment of immersive content with communication strategies and visitor management objectives.

4.2.3.3 Key Success Factors

Successful replication of UC2 depends on the effective integration of immersive technologies within visitor management, stakeholder engagement, and data-informed decision-making processes, as reflected in the pilot implementation experience and the project methodological framework.

Table 20 Key Success Factors supporting UC2 Implementation and Transfer

Key Success Factor	Description
Integration of immersive technologies into visitor experience	The use of XR/AR applications to enhance visitor understanding, accessibility, and engagement with cultural heritage sites.
Alignment with site-specific narratives and interpretation frameworks	The development of digital content that reflects the cultural, historical, and territorial context of each site.
Accessibility and inclusiveness of digital content	The provision of multilingual and accessible content supporting diverse visitor profiles and inclusive experiences.
Monitoring of visitor interaction and engagement	The use of digital tools and analytics to track user interaction, engagement levels, and behavioural patterns.
Use of engagement data to support decision-making	The integration of user interaction data into visitor management strategies and planning processes.
Stakeholder engagement through structured governance mechanisms	The involvement of stakeholders through Territorial Working Groups (TWGs) supporting coordination, validation, and implementation.
Integration into tourism management and promotion strategies	The alignment of XR/AR solutions with broader tourism strategies, including visitor flow management and territorial visibility.
Continuous evaluation and adaptation based on user feedback	The collection and use of feedback and performance data to refine content, improve usability, and support adaptive management processes.

4.2.3.4 Potential Barriers and Mitigation Considerations

The transfer of UC2 may be influenced by technical, operational, and governance-related conditions affecting the deployment and integration of immersive XR/AR applications within visitor experience and engagement processes, as reflected in the pilot implementation experience and the project methodological framework.

Table 21 Potential Barriers and Mitigation Considerations supporting UC2 Implementation and Transfer

Potential Barrier	Mitigation Consideration
Variability in visitor engagement and interaction levels	Supporting the use of monitoring systems and analytics tools to assess user interaction, engagement patterns, and behavioural responses.
Challenges in integrating XR/AR solutions into existing tourism and management processes	Supporting the alignment of immersive applications with tourism strategies, visitor management frameworks, and communication approaches.
Site-specific constraints related to accessibility and infrastructure	Adapting implementation approaches to territorial conditions, taking into account accessibility limitations and infrastructure characteristics.
Conservation requirements limiting physical or technical interventions	Supporting the use of non-invasive digital solutions aligned with conservation and heritage protection requirements.
Fragmentation of responsibilities related to content and site management	Strengthening coordination mechanisms among stakeholders through structured governance processes.
Limited use of data to support visitor management decisions	Supporting the use of interaction data and analytics outputs to inform planning and visitor flow management strategies.

4.2.3.5 Key Actors and Stakeholders

The implementation of UC2 involves a multi-level set of actors contributing to both technical deployment and governance integration, as reflected in the pilot implementation experience and the project methodological framework. The level of impact reflects the degree of involvement of each stakeholder group in governance, decision-making, and operational processes, as derived from the roles identified within this framework and the pilot implementation experience.

Table 22 Key Actors and Stakeholders supporting UC2 Implementation and Transfer

Stakeholder	Role	Level of Impact	Engagement Approach
Municipal and Regional Authorities	Coordination of implementation and integration of immersive solutions into planning and decision-making processes	High	Participation in management and decision-making processes
Cultural Heritage Management Bodies	Oversight of heritage interpretation and alignment of immersive content with conservation and cultural requirements	High	Continuous involvement in content validation and planning processes
Stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as Territorial Working Groups – TWGs, as applied in the pilot context)	Facilitation of coordination among stakeholders and contribution to participatory planning and decision-making processes	High	Structured participation through coordination processes, consultations, and collaborative activities
Tourism Organizations	Integration of immersive applications into tourism strategies and visitor experience management	Medium–High	Contribution to planning processes and use of tools for visitor engagement

Stakeholder	Role	Level of Impact	Engagement Approach
Content Creators and Cultural Mediators	Development of immersive content and adaptation of narratives to local cultural and historical context	Medium–High	Participation in content development and interpretation processes
Technology Providers and XR/AR Developers	Development, deployment, and maintenance of immersive applications and digital platforms	Medium	Technical implementation and system support activities
Site Managers and Visitor-Facing Staff	Operational use of immersive applications within the visitor experience and on-site interaction	Medium	Operational involvement and feedback provision
Local Stakeholders and Communities	Contribution to local narratives, identity, and acceptance of immersive solutions	Medium	Participation in engagement and awareness-related activities

4.2.3.6 Proposed Action Plan for Transfer and Dissemination

The following action plan outlines indicative transfer and dissemination activities supporting the operational uptake of UC2, as derived from the pilot implementation experience and the project methodological framework.

Table 23 Proposed Transfer and Dissemination Activities supporting UC2 Implementation and Transfer

Proposed Activity	Brief Description	Actors Involved	Indicative Timing
Stakeholder engagement workshops	Organisation of workshops supporting stakeholder coordination, knowledge exchange, and alignment on the use of digital applications in visitor experience	Municipal and regional authorities, cultural heritage bodies, tourism organisations, local stakeholders	Preparatory Phase
Technical training and capacity building	Training activities supporting the use and management of digital tools applied in visitor engagement and interpretation	Technology providers, technical experts, site managers, public authorities	Implementation Phase
Demonstration activities	Demonstration of digital applications supporting visitor interaction and interpretation within pilot contexts	Technology providers, cultural heritage experts, site managers	Implementation Phase
Content development and co-creation activities	Collaborative activities supporting the development and adaptation of content aligned with local narratives and site characteristics	Cultural heritage bodies, communication experts, local stakeholders	Implementation Phase
Knowledge exchange activities	Exchange of practices and experiences supporting understanding of implementation requirements and operational use conditions	Public authorities, tourism organisations, heritage bodies	Implementation / Operational Phase

Proposed Activity	Brief Description	Actors Involved	Indicative Timing
Preparation of operational guidelines	Development of guidelines supporting the use and integration of digital applications into visitor management and interpretation processes	Public authorities, cultural heritage bodies, technical experts	Operational / Monitoring Phase
User engagement and testing activities	Activities supporting feedback collection and refinement of digital applications based on user interaction	Site managers, tourism organisations, local stakeholders	Operational / Monitoring Phase
Awareness and communication actions	Activities supporting dissemination of results and promotion of digital tools to broader stakeholder groups	Public authorities, tourism organisations, local stakeholders	Evaluation / Transfer Phase

4.2.4 KPIs and Monitoring Mechanisms

The KPI framework for UC2 is structured across three performance levels, ensuring a comprehensive assessment of digital application deployment, user engagement, and long-term contribution to sustainable tourism management. This structure enables the evaluation of both the technical implementation of immersive solutions and their operational integration within visitor management and governance processes.

It builds on the monitoring approach applied during the pilot implementation phase and reflects the need for measurable, governance-integrated performance tracking. It is aligned with the implementation methodology underpinning the Sustainable Tourism Model, ensuring methodological continuity between pilot testing, performance monitoring, and transfer processes, while also reflecting key performance dimensions derived from the HERIT ADAPT methodological framework and pilot implementation evidence base, particularly in relation to visitor flow management, accessibility, cultural visibility, and user engagement. Each performance level captures a distinct dimension of system validation, ranging from deployment and accessibility to behavioural change and territorial impact.

Pilot Output Indicators focus on the direct results of implementation and include:

- Availability and operational status of digital applications supporting visitor interaction and interpretation.
- Extent of accessibility features and multilingual content integrated within digital applications.
- Level of user interaction with digital applications within the pilot context.
- Completion and availability of digital content aligned with interpretive and usability requirements.

Short-to-Medium Term Outcome Indicators assess changes in visitor engagement, perception, and spatial behaviour, including:

- Level of visitor interaction with digital tools supporting enhanced site understanding
- Use of digital content and applications across on-site and remote interaction.

- Use of access points (e.g. QR-based or equivalent mechanisms) supporting interaction with digital content.
- Changes in visitor engagement patterns and duration of interaction.

Long-Term Impact Indicators evaluate the contribution of UC2 to sustainable tourism management and territorial development, including:

- Evidence of changes in visitor distribution patterns, including increased use of alternative routes or areas.
- Improvement in visitor perception related to accessibility, inclusiveness, and quality of experience.
- Extent to which digital engagement data support institutional decision-making and strategic planning.

Monitoring is conducted under the responsibility of the designated governance body in coordination with relevant stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as TWGs in the pilot context), ensuring that performance data are systematically integrated into decision-making cycles. Data are collected through appropriate data collection and analysis mechanisms (e.g. analytics tools, user interaction tracking, surveys, and feedback processes) and are reviewed at predefined intervals.

Where applicable, KPI values are assessed against baseline conditions established during the initial implementation phase, enabling the evaluation of changes in visitor behaviour, engagement levels, and spatial distribution patterns. In this context, user interaction data and engagement metrics are not treated as isolated performance indicators, but as operational inputs supporting decision-making on visitor flow management, content positioning, and territorial visibility strategies. Where performance thresholds are not achieved, corrective measures may include content adaptation, improvement of user interaction processes, enhanced integration within visitor management approaches, and targeted communication.

KPI monitoring is embedded within the governance structure as an operational mechanism supporting coordinated decision-making, stakeholder alignment, and continuous improvement. Through relevant stakeholder coordination mechanisms, engagement data are translated into actionable insights that inform visitor management strategies, interpretive approaches, and adaptive responses to changing visitor behaviour and site conditions. The KPI framework also supports transferability by providing a structured but adaptable monitoring system that can be applied across different territorial contexts, while allowing calibration based on local characteristics, visitor profiles, and governance capacity.

4.2.5 Indicative Transfer Timeline

The transfer of UC2 follows a structured and phased implementation process, aligned with the operational logic of the Sustainable Tourism Model and the pilot implementation experience. The timeline is presented in the form of a Gantt chart, providing a consolidated overview of the sequencing and interrelation of key implementation phases, including content preparation, development of digital applications, validation through user interaction, integration into tourism management processes, performance monitoring, and replication. This structured representation supports coordinated implementation, ensures methodological consistency, and facilitates the practical planning of UC2 transfer across different territorial contexts.

Table 24 Indicative Timeline for UC2 Transfer and Implementation

Phases	M1-M3			M4-M6			M7-M9			M10-M12			M13-M15			M16-M18		
Phase 1- Content Readiness and Territorial Assessment																		
Phase 2- XR/AR Development and Configuration																		
Phase 3- Pilot Testing and User Validation																		
Phase 4 – Integration into Tourism and Governance Processes																		
Phase 5 – Performance Monitoring and Adaptive Adjustment																		
Phase 6 – Consolidation, Replication, and Scaling																		

Colored cells indicate the periods during which each phase is active. The timeline is indicative and phases may overlap depending on site-specific conditions.

Phase 1 is typically concentrated in the early implementation stage, although its duration may vary depending on content readiness, visitor profiles, and institutional capacity.

Preparatory actions for consolidation and replication may begin during the late stages of Phase 5, reflecting the progressive refinement of XR/AR content and user engagement strategies prior to full deployment in the final phase

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4.2.6 Evaluation and Performance Review Process

The evaluation framework for UC2 is structured as a continuous and iterative process, supporting both performance validation and adaptive management. It is aligned with the phased implementation logic described in Section 4.2.5 and ensures that evaluation outcomes are systematically integrated into governance and decision-making processes. The evaluation approach is aligned with the iterative logic of the Sustainable Tourism Model, ensuring a consistent progression from monitoring to adaptive refinement and final validation.

Evaluation is structured across three interconnected stages:

Stage 1 – Ongoing Monitoring and Interim Assessment
Performance data are collected continuously through the KPI framework (Section 4.2.4), focusing on user engagement, interaction patterns, accessibility performance, and content effectiveness. Data are reviewed at predefined intervals, enabling early identification of deviations from expected performance and supporting timely corrective actions.

Stage 2 – Mid-Term Evaluation and Adaptive Adjustment
At intermediate stages of implementation, results are assessed against validation criteria, including usability, user experience quality, accessibility compliance, and alignment with tourism management objectives. Findings are reviewed in coordination with relevant governance bodies and stakeholders, enabling structured adaptation of content, communication strategies, and technological configurations.

Stage 3 – Final Evaluation and Consolidation of Results
The final evaluation phase assesses the overall effectiveness of UC2, including its contribution to visitor engagement, tourism diversification, accessibility enhancement, and integration into institutional workflows. This stage consolidates lessons learned, identifies transferable practices, and supports the definition of conditions for replication and scaling in new territorial contexts.

Across all stages, evaluation considers not only quantitative performance indicators but also qualitative insights derived from stakeholder feedback, user experience analysis, and participatory processes. Particular emphasis is placed on the operational relevance of XR/AR applications, their usability across different user groups, and their contribution to sustainable tourism management objectives.

The evaluation process functions as a core governance mechanism supporting continuous improvement, coordinated decision-making, and long-term sustainability. Through structured review cycles, evaluation results are translated into actionable insights that inform content updates, system optimization, and strategic adjustments in tourism management approaches.

The evaluation approach follows a multi-level performance logic, where results are assessed across immediate outputs, short-to-medium term outcomes, and long-term strategic impacts. This ensures that UC2 performance is evaluated not only in terms of technological deployment, but also in relation to behavioural change, accessibility, governance integration, and contribution to sustainable destination management.

While evaluation practices may vary depending on territorial conditions, including visitor profiles, technological maturity, and institutional capacity, they remain aligned with the common evaluation logic of the Sustainable Tourism Model.

4.3 UC3 – AI-Enabled Storytelling

4.3.1 Participating Pilot Territories and Pilot Implementation Insights

UC3 includes the following pilot territories:

- **Monumental Complex of Alhambra and Generalife (Granada) – Spain**

The pilot experience focuses on AI-enabled storytelling and adaptive interpretation mechanisms, representing a targeted application of AI-driven content generation and personalization within a cultural heritage context.

The implementation explores how AI-generated narratives, delivered through digital channels and on-site interaction points, can dynamically adapt content to visitor profiles, preferences, and behavioural patterns. These mechanisms enable the communication of complex cultural and territorial narratives in a more accessible, engaging, and context-sensitive manner.

In contrast to static interpretive approaches, AI-driven storytelling introduces the capacity to influence visitor awareness, perception, and decision-making processes. By guiding visitors towards less-visited areas and promoting alternative routes and experiences, these applications contribute to visitor-flow redistribution and support more balanced tourism dynamics across the wider territory.

The pilot therefore provides a focused evidence base for understanding the role of AI-enabled interpretation not only as a communication tool, but as a strategic mechanism supporting behavioural change, territorial integration, and adaptive visitor management. These insights inform the transfer pathway of UC3, highlighting the importance of aligning AI-generated content with governance structures, communication strategies, and sustainable tourism objectives.

4.3.2 Strategic Objective of the Use Case

AI-enabled storytelling supports the operationalization of the Sustainable Tourism Model by introducing adaptive interpretation mechanisms that influence visitor behaviour, perception, and decision-making processes.

Through the generation and delivery of personalized and context-aware narratives, UC3 enhances visitor engagement while enabling a more targeted and strategic communication of cultural and territorial content. These mechanisms allow heritage sites and destinations to move beyond static interpretation models, providing dynamic content that responds to visitor profiles, preferences, and interaction patterns.

In this context, AI-driven storytelling functions as a behavioural management tool, supporting the redistribution of visitor flows, the promotion of alternative routes and experiences, and the increased visibility of under-visited areas. This contributes to more balanced tourism dynamics, while maintaining alignment with conservation priorities and site-specific constraints.

From a governance perspective, the outputs generated under UC3 can be integrated into communication strategies, visitor management frameworks, and policy-oriented decision-making processes. Through structured coordination mechanisms, including Territorial Working Groups (TWGs), AI-generated insights can support adaptive management by informing responses based on monitored performance data and enabling the continuous refinement of tourism strategies.

Overall, UC3 contributes to the Sustainable Tourism Model by linking digital communication with governance-enabled behavioural influence, ensuring that visitor engagement is aligned with long-term sustainability, territorial cohesion, and resilience objectives.

4.3.3 Transfer Methodology

The transfer of UC3 follows a structured and phased implementation pathway, ensuring that AI-enabled storytelling mechanisms can be effectively integrated into communication strategies and visitor management frameworks.

The process includes the assessment of data availability and governance conditions, definition of interpretive and communication objectives, calibration of AI-driven content generation mechanisms, and integration of adaptive narratives into official digital platforms and visitor interaction channels. Particular emphasis is placed on aligning AI-generated outputs with site-specific narratives, cultural context, and strategic tourism management priorities.

Adaptation parameters may vary depending on territorial typology, including high-density tourism destinations, urban heritage environments, or low-density rural areas. These variations influence data availability, content complexity, and the level of integration with existing digital infrastructure, while maintaining the core logic of governance-supported implementation.

The transferability of UC3 is based on the replication of a structured implementation process integrating data-informed content design, stakeholder coordination, performance monitoring, and iterative refinement.

4.3.3.1 Implementation Preconditions

Effective transfer of UC3 requires a minimum level of institutional, technical, and operational readiness to support the deployment and responsible use of AI-enabled storytelling applications. Based on pilot implementation experience, the availability of structured and reliable datasets constitutes a critical prerequisite, including visitor interaction data, contextual information, and content inputs that can support adaptive content generation and personalization processes.

In contrast to other Use Cases primarily focused on content delivery or data representation, UC3 introduces adaptive and data-driven content generation mechanisms that directly influence visitor perception and behavioural patterns, therefore requiring a higher level of governance oversight and control.

Clear data governance conditions, including data ownership, access rights, content validation responsibilities, and compliance with applicable data protection frameworks (including GDPR where relevant), constitute a fundamental requirement for ensuring the accuracy, consistency, and appropriateness of AI-generated outputs. In this context, transparent data management practices support both operational reliability and institutional trust in the use of AI-based systems.

The designation of a responsible authority for content oversight and system supervision is essential to ensure that AI-generated outputs remain aligned with site-specific narratives, cultural values, and communication strategies. This includes the establishment of appropriate oversight mechanisms for algorithm governance, ensuring transparency, traceability, and accountability in the generation, validation, and deployment of adaptive content.

Pilot experience further indicates that effective implementation presupposes a minimum level of digital maturity, including the capacity to manage digital platforms, integrate AI-generated outputs into existing communication channels, and coordinate across institutional actors. Interdepartmental collaboration and the involvement of relevant stakeholders, including those participating in TWGs, support the alignment of AI applications with broader tourism management and governance processes.

Finally, the ability to integrate AI-generated storytelling outputs into official communication environments, such as tourism platforms, visitor information systems, and digital interfaces—constitutes a key enabling condition. This ensures that adaptive content is not deployed in isolation, but functions as part of a governance-supported communication ecosystem contributing to sustainable tourism management.

In addition, ethical considerations, including transparency, explainability, and responsible use of AI-generated content, should be explicitly addressed to ensure alignment with applicable regulatory and governance frameworks.

4.3.3.2 Required Tools and Resources

The implementation of UC3 relies on a combination of digital tools and technical resources supporting the development, deployment, and operational use of adaptive and narrative-driven communication within the Sustainable Tourism Model.

Based on the pilot implementation experience, the following tools and resources are associated with UC3:

- Artificial intelligence–based tools supporting the generation and adaptation of digital content and narratives.
- Digital platforms supporting the delivery and dissemination of multimedia and narrative-based content.
- Tools supporting the development of interactive and personalized communication experiences across digital environments.
- Web-based and mobile interfaces enabling user access to digital storytelling content in both on-site and remote contexts.
- QR-based or digital access systems facilitating user interaction with narrative content.
- Tools supporting multilingual content delivery and accessibility features for diverse user groups.
- Digital communication channels supporting the integration of narrative content within tourism promotion and visitor engagement strategies.

For the effective operational deployment and transferability of UC3, the above tools are typically supported by complementary capacities, reflecting operational requirements related to data processing, user interaction monitoring, and governance integration, which may include:

- Content management systems supporting the organization, updating, and distribution of AI-generated and narrative content.

- User analytics and interaction tracking environments supporting the assessment of engagement and behavioural responses.
- Data processing environments supporting the interpretation and validation of user interaction data.
- Integration mechanisms enabling the connection of narrative systems with existing tourism platforms and communication infrastructures.
- Visualization and interface design capacities supporting usability, personalization, and user experience optimization.
- Technical expertise in AI-supported content generation, digital storytelling, and data analysis.
- Coordination capacities supporting the alignment of narrative content with communication strategies, visitor management objectives, and governance processes.

4.3.3.3 Key Success Factors

Successful replication of UC3 depends on the effective use of data-driven approaches, stakeholder engagement mechanisms, and the integration of AI-enabled content within governance-supported communication and visitor management processes, as reflected in the pilot implementation experience and the project methodological framework.

Table 25 Key Success Factors supporting UC3 Implementation and Transfer

Key Success Factor	Description
Use of data to support content generation and adaptation	The use of available data sources to inform the development and adaptation of digital narratives aligned with site-specific characteristics.
Monitoring of user interaction and behavioural patterns	The collection and analysis of user interaction data to assess engagement levels and behavioural responses.
Integration of behavioural insights into content adaptation	The use of interaction data and feedback to support the refinement of digital content and communication approaches.
Alignment of digital narratives with cultural and interpretive context	Ensuring that generated content reflects the cultural, historical, and territorial identity of the site.
Stakeholder engagement through structured governance mechanisms	The involvement of stakeholders through Territorial Working Groups (TWGs), supporting validation, coordination, and alignment of communication approaches.
Integration into communication and visitor management processes	The use of AI-enabled storytelling within broader communication strategies and visitor management frameworks.
Continuous evaluation through monitoring and feedback mechanisms	The use of monitoring systems and feedback tools to support adaptive management and content refinement.
Governance-supported use of digital content	The embedding of AI-enabled storytelling within structured governance and decision-making processes to ensure consistency and operational relevance.

4.3.3.4 Potential Barriers and Mitigation Considerations

The transfer of UC3 may be influenced by technical, operational, and governance-related conditions affecting the development, adaptation, and use of data-driven content and storytelling mechanisms informed by monitoring and data collection processes, as reflected in the pilot implementation experience and the project methodological framework.

Table 26 Potential Barriers and Mitigation Considerations supporting UC3 Implementation and Transfer

Potential Barrier	Mitigation Consideration
Dependence on the availability and quality of input data	Supporting the use of structured data collection and monitoring processes to ensure the availability and relevance of data used for content development.
Variability in user engagement and behavioural response	Supporting the use of monitoring systems and analytics tools to assess interaction patterns and engagement levels.
Challenges in aligning digital content with site-specific narratives	Supporting the alignment of digital content with cultural, historical, and territorial context through structured communication and interpretation approaches.
Limited integration of digital content into communication and management processes	Supporting the integration of digital content within communication strategies and visitor management frameworks.
Fragmentation of responsibilities among stakeholders	Strengthening coordination mechanisms among stakeholders through structured governance processes.
Limited use of behavioural data in decision-making processes	Supporting the use of interaction data and feedback to inform content adaptation and management strategies.
Need for continuous adaptation of content based on monitoring results	Supporting continuous evaluation and adjustment processes based on monitoring outputs and user feedback.

4.3.3.5 Key Actors and Stakeholders

The implementation of UC3 involves a multi-level set of actors contributing to both technical deployment and governance integration, as reflected in the pilot implementation experience and the project methodological framework.

The level of impact reflects the degree of involvement of each stakeholder group in governance, decision-making, and operational processes, as derived from the roles identified within this framework and the pilot implementation experience.

Table 27 Key Actors and Stakeholders supporting UC3 Implementation and Transfer

Stakeholder	Role	Level of Impact	Engagement Approach
Municipal and Regional Authorities	Coordination of implementation and integration of data-driven content into communication and decision-making processes	High	Participation in management and decision-making processes
Cultural Heritage Management Bodies	Oversight of content alignment with cultural,	High	Continuous involvement in validation and planning processes

Stakeholder	Role	Level of Impact	Engagement Approach
	historical, and conservation requirements		
Stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as Territorial Working Groups – TWGs, as applied in the pilot context)	Facilitation of coordination among stakeholders and contribution to participatory planning and decision-making processes	High	Structured participation through coordination processes, consultations, and collaborative activities
Tourism Organizations	Integration of content outputs into tourism strategies and visitor management approaches	Medium–High	Contribution to planning processes and use of outputs for visitor engagement
Communication Experts and Content Developers	Development and adaptation of content in alignment with local narratives and communication objectives	Medium–High	Participation in content development and communication processes
Technology Providers and Data Specialists	Development, configuration, and maintenance of data processing and content generation systems	Medium	Technical implementation and system support activities
Academic and Research Institutions	Contribution to analytical approaches and methodological support for data use and evaluation	Medium	Participation in analytical support and knowledge-sharing activities
Site Managers and Local Operators	Operational use of content outputs within visitor interaction and site management activities	Medium	Operational involvement and feedback provision
Local Stakeholders and Communities	Contribution to local knowledge, narrative validation, and acceptance of implemented solutions	Medium	Participation in engagement and awareness-related activities

4.3.3.6 Proposed Action Plan for Transfer and Dissemination

The following action plan outlines indicative transfer and dissemination activities supporting the operational uptake of UC3, as derived from the pilot implementation experience and the project methodological framework, reflecting the operational requirements associated with data use, content management, and stakeholder engagement.

Table 28 Proposed Transfer and Dissemination Activities supporting UC3 Implementation and Transfer

Proposed Activity	Brief Description	Actors Involved	Indicative Timing
Stakeholder engagement workshops	Organisation of workshops supporting stakeholder coordination, knowledge exchange, and alignment on the use of data-driven content within visitor communication and management processes	Municipal and regional authorities, cultural heritage bodies, tourism organisations, local stakeholders	Preparatory Phase

Proposed Activity	Brief Description	Actors Involved	Indicative Timing
Technical training and capacity building	Training activities supporting data use, content management, and operational use of digital systems	Technology providers, technical experts, site managers, public authorities	Implementation Phase
Demonstration activities	Demonstration of digital content applications within visitor communication and interpretation processes in pilot contexts	Technology providers, cultural heritage experts, site managers	Implementation Phase
Content development and adaptation activities	Collaborative activities supporting development and adaptation of content aligned with local narratives and site-specific characteristics	Cultural heritage bodies, communication experts, local stakeholders	Implementation Phase
Knowledge exchange activities	Exchange of practices and experiences supporting understanding of implementation requirements and operational use conditions	Public authorities, tourism organisations, heritage bodies	Implementation / Operational Phase
Preparation of operational guidelines	Development of guidelines supporting structured use and integration of digital content into communication and management processes	Public authorities, cultural heritage bodies, technical experts	Operational / Monitoring Phase
User feedback and evaluation activities	Activities supporting collection and use of feedback for refining content and improving its operational relevance	Site managers, tourism organisations, local stakeholders	Operational / Monitoring Phase
Awareness and communication actions	Activities supporting dissemination of results and communication of digital content to broader stakeholder groups	Public authorities, tourism organisations, local stakeholders	Evaluation / Transfer Phase
Demonstration and evaluation activities	Controlled application of digital content solutions to assess usability and operational integration in real conditions	Public authorities, site managers, technical experts	Evaluation / Transfer Phase

4.3.4 KPIs and Monitoring Mechanisms

The KPI framework for UC3 is structured across three performance levels, ensuring a comprehensive assessment of data-driven content deployment, user engagement, and integration within governance and tourism management processes. This structure supports the evaluation of both the technical implementation of digital content systems and their effectiveness in influencing visitor perception and interaction patterns.

It builds on the monitoring approach applied during the pilot implementation phase and reflects the need for measurable, governance-integrated performance tracking. It is aligned with the implementation methodology underpinning the Sustainable Tourism Model, ensuring methodological continuity between pilot testing, performance monitoring, and transfer processes, while also reflecting key performance dimensions derived from the HERIT ADAPT

methodological framework and pilot implementation evidence base, particularly in relation to visitor engagement, content use, and territorial narrative integration.

Each performance level captures a distinct dimension of system validation, ranging from content production and user interaction to behavioural change and long-term territorial impact.

Pilot Output Indicators focus on the direct results of implementation and include:

- Volume and availability of digital narrative content developed and integrated into communication platforms.
- Level of user interaction with digital content across available communication channels.
- Use of access points (e.g. QR-based or equivalent mechanisms) supporting access to digital narratives.
- Extent of stakeholder engagement activities supporting content development and communication processes.

Short-to-Medium Term Outcome Indicators assess changes in visitor behaviour, perception, and engagement, including:

- Level of visitor satisfaction and perceived value associated with digital content.
- Evidence of changes in visitor awareness and interest in additional or lesser-known areas.
- Level of user engagement with digital narratives across interaction channels.
- Increase in awareness of territorial connections and cultural narratives among visitors.

Long-Term Impact Indicators evaluate the contribution of UC3 to sustainable tourism management and territorial development, including:

- Evidence of redistribution of visitor flows towards secondary or under-visited areas.
- Level of stakeholder participation in content-related and communication activities.
- Adoption of digital content approaches by additional sites or territories.
- Contribution to the development of new or enhanced tourism experiences based on digital narratives.

Monitoring is conducted under the responsibility of the designated governance body in coordination with relevant stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as TWGs in the pilot context), ensuring that performance data are systematically integrated into evidence-based decision-making processes and adaptive management cycles.

Data are collected through appropriate data collection and analysis mechanisms (e.g. analytics tools, user interaction tracking, surveys, and stakeholder feedback processes) and are reviewed at predefined intervals.

Where applicable, KPI values are assessed against baseline conditions established during the initial implementation phase, enabling the evaluation of changes in visitor behaviour, engagement levels, and perception over time. Particular emphasis is placed on comparing pre- and post-intervention responses, ensuring that digital communication approaches are assessed within the governance and monitoring framework of the Sustainable Tourism Model.

Where performance benchmarks are not achieved, structured corrective actions are activated, including content adaptation, refinement of communication approaches, and adjustment of

engagement strategies. These actions are validated through the governance structure and progressively integrated into subsequent implementation cycles.

The KPI framework also supports transferability by providing a structured but adaptable monitoring system that can be applied across different territorial contexts, while allowing calibration based on visitor profiles, data availability, and institutional capacity.

4.3.5 Indicative Transfer Timeline

The transfer of UC2 follows a structured and phased implementation process, aligned with the operational logic of the Sustainable Tourism Model and the pilot implementation experience. The timeline is presented in the form of a Gantt chart, providing a consolidated overview of the sequencing and interrelation of key implementation phases, including content preparation, development of digital applications, validation through user interaction, integration into tourism management processes, performance monitoring, and replication. This structured representation supports coordinated implementation, ensures methodological consistency, and facilitates the practical planning of UC2 transfer across different territorial contexts

Table 29 Indicative Timeline for UC3 Transfer and Implementation

Phases	M1-M3			M4-M6			M7-M9			M10-M12			M13-M15			M16-M18		
Phase 1- Data Readiness and Contextual Assessment																		
Phase 2- Algorithm Configuration and Content Development																		
Phase 3- Pilot Testing and Behavioural Validation																		
Phase 4 – Integration into Communication and Governance Processes																		
Phase 5 – Performance Monitoring and Adaptive Calibration																		
Phase 6 – Consolidation, Replication, and Scaling																		

Colored cells indicate the periods during which each phase is active. The timeline is indicative and phases may overlap depending on site-specific conditions.

Phase 1 is typically concentrated in the early implementation stage, although its duration may vary depending on content availability, data inputs, and institutional readiness.

Preparatory actions for consolidation and replication may begin during the late stages of Phase 5, reflecting the progressive refinement of AI-generated content and behavioural adaptation mechanisms prior to full deployment in the final phase.

4.3.6 Evaluation and Performance Review Process

The evaluation framework for UC3 is structured as a continuous and iterative process, supporting both performance validation and adaptive management. It is aligned with the phased implementation logic described in Section 4.3.5 and ensures that evaluation outcomes are systematically integrated into governance and decision-making processes.

The evaluation approach reflects the iterative logic of the Sustainable Tourism Model, ensuring a consistent progression from monitoring to adaptive refinement and final validation, with particular emphasis on behavioural response, personalization effectiveness, and ethical data governance.

Evaluation is structured across three interconnected stages:

Stage 1 – Ongoing Monitoring and Interim Assessment

Performance data are collected continuously through the KPI framework (Section 4.3.4), focusing on user interaction patterns, behavioural responses, content engagement, and system performance. Monitoring also includes oversight of data processing practices and compliance with established data governance principles. Data are reviewed at predefined intervals, enabling early identification of deviations and supporting timely recalibration of AI-generated content and communication approaches.

Stage 2 – Mid-Term Evaluation and Adaptive Adjustment

At intermediate stages of implementation, results are assessed against validation criteria, including personalization effectiveness, user acceptance, interpretive relevance, and alignment with tourism management objectives. Evaluation includes both quantitative indicators and qualitative feedback from stakeholders and user groups. Findings are reviewed within the governance structure, enabling structured adjustments to algorithms, content logic, and communication strategies.

Stage 3 – Final Evaluation and Consolidation of Results

The final evaluation phase assesses the overall effectiveness of UC3, including its contribution to visitor behaviour guidance, tourism flow redistribution, communication efficiency, and integration into institutional workflows. This stage consolidates lessons learned, identifies transferable practices, and defines conditions for replication and scaling in new territorial contexts.

Across all stages, evaluation considers not only system performance and behavioural outcomes, but also transparency, fairness, and ethical use of data within AI-enabled processes. Particular attention is given to stakeholder trust, acceptance of adaptive content mechanisms, and the ability of institutions to manage and oversee algorithmic systems.

The evaluation process functions as a core governance mechanism supporting continuous improvement, coordinated decision-making, and long-term sustainability. Through structured review cycles, evaluation results are translated into actionable insights that inform system calibration, communication strategies, and adaptive tourism management responses.

The evaluation approach follows a multi-level performance logic, where results are assessed across immediate outputs, short-to-medium term outcomes, and long-term strategic impacts. This ensures that UC3 performance is evaluated not only in terms of technological deployment,

but also in relation to behavioural change, governance integration, and contribution to sustainable tourism management.

While evaluation practices may vary depending on territorial conditions, including data availability, institutional capacity, and digital maturity, they remain aligned with the common evaluation logic of the Sustainable Tourism Model.

4.4 UC4 – Big Data & IoT Integration

4.4.1 Participating Pilot Territories and Pilot Implementation Insights

UC4 includes the following pilot territories:

- **Canigó Grand Site / Villefranche de Conflent – France**
- **Rector's Palace (Dubrovnik) – Croatia**
- **Mausoleum–Ossuary, Koprivshtitsa – Bulgaria**
- **Monumental Complex of Alhambra and Generalife (Granada) – Spain (potential)**

The pilot implementation of UC4 focuses on the deployment of integrated data ecosystems combining IoT-based monitoring and Big Data processing mechanisms to support evidence-based tourism management and site monitoring. In the implemented pilot territories, sensor networks and data integration platforms were used to collect, process, and analyse real-time and aggregated data related to visitor flows, environmental conditions, and site performance indicators.

Applications across the pilot sites demonstrate how data-driven monitoring systems can support the identification of tourism pressure patterns, environmental risks, and operational constraints, enabling more informed and timely decision-making processes. These systems contribute to the transition from reactive to proactive site management by providing continuous insights into evolving site conditions and visitor behaviour.

In parallel, the case of the Alhambra and Generalife provides an indicative perspective on the potential application of integrated data monitoring systems within complex and high-pressure heritage environments. While not fully implemented within the pilot phase, this case highlights the relevance of UC4 in supporting large-scale visitor management, predictive analysis, and strategic planning through advanced data integration approaches.

Across the pilot territories, implementation insights indicate that UC4 delivers the greatest value when embedded within decision-making processes. The integration of real-time data into institutional workflows enables continuous monitoring, performance assessment, and adaptive management, reinforcing the role of data ecosystems as a core component of sustainable tourism management.

These operational insights inform the transfer pathway of UC4, emphasizing the importance of combining technological infrastructure with governance capacity, data interpretation mechanisms, and institutional coordination in order to ensure effective and transferable implementation across diverse territorial contexts.

4.4.2 Strategic Objective of the Use Case

Big Data and IoT integration support the operationalization of the Sustainable Tourism Model by establishing a continuous, data-driven monitoring and decision-support system enabling real-time and predictive management of tourism dynamics and site conditions.

Through the collection, integration, and analysis of data from multiple sources—including IoT sensor networks, environmental monitoring systems, and visitor flow tracking mechanisms—UC4 enables the generation of actionable insights supporting evidence-based planning and operational interventions. These systems allow for the identification of patterns related to visitor behaviour, tourism pressure, and environmental impact, enhancing the capacity of authorities to respond in a timely and informed manner.

In contrast to static monitoring approaches, UC4 introduces a dynamic and anticipatory management logic, where real-time data streams and aggregated datasets support both immediate operational responses and longer-term strategic planning. This enables a transition from reactive management practices to proactive and predictive governance models.

From a governance perspective, the outputs generated under UC4 are systematically integrated into decision-making processes, performance monitoring cycles, and adaptive management frameworks. Through structured coordination mechanisms, including TWGs, data-driven insights inform planning priorities, risk mitigation strategies, and resource allocation decisions.

Overall, UC4 functions as a core enabling layer of the Sustainable Tourism Model, linking data collection, analysis, and governance integration. By supporting continuous monitoring, performance evaluation, and adaptive response mechanisms, UC4 reinforces the capacity of territorial systems to manage tourism sustainably, enhance resilience, and respond effectively to evolving environmental and operational conditions.

4.4.3 Transfer Methodology

The transfer of UC4 follows a structured and phased implementation pathway, ensuring that Big Data and IoT-based monitoring systems are effectively integrated into site management and decision-support processes.

The process includes the assessment of existing infrastructure and data availability, definition of monitoring objectives and performance parameters, deployment of IoT sensor networks, and configuration of data integration and visualization platforms. Particular emphasis is placed on ensuring interoperability between data sources and the capacity to transform raw data into actionable insights through structured analytics environments.

Adaptation parameters may vary depending on territorial typology, including high-density tourism destinations, environmentally sensitive heritage sites, or low-capacity rural areas. These variations influence the scale of sensor deployment, data granularity, and system complexity, while maintaining the core logic of governance-integrated implementation.

The transferability of UC4 is therefore based on the replication of a structured implementation process integrating data collection, system interoperability, performance monitoring, and governance coordination.

In practical terms, territories considering the adoption of UC4 are required to establish basic monitoring infrastructure, clearly assign governance responsibilities, and ensure the operational

capacity to interpret and act upon data outputs as a prerequisite for implementation. The absence of these conditions may limit the operational effectiveness of the system and should be addressed prior to implementation.

4.4.3.1 Implementation Preconditions

Effective transfer of UC4 requires a minimum level of institutional, technical, and operational readiness to support the deployment and continuous operation of integrated monitoring and data-processing systems. Based on pilot implementation experience, the availability of reliable connectivity infrastructure, sensor deployment capacity, and interoperable data environments constitutes a fundamental prerequisite for enabling real-time data collection and system functionality.

Clear data governance conditions, including data ownership, access rights, data-sharing protocols, and responsibilities for data validation and system maintenance, are essential to ensure the reliability, consistency, and usability of collected data.

In this context, the ability to integrate multiple data sources into a unified monitoring environment represents a critical enabling factor for effective system operation.

In contrast to Use Cases focused primarily on content generation or representation, UC4 requires the establishment of predefined operational protocols linking data thresholds to decision-making and response mechanisms. This includes the definition of performance indicators, alert thresholds, and corresponding response actions, ensuring that data outputs are systematically translated into timely and coordinated interventions.

Institutional readiness for real-time response constitutes a key condition for successful implementation. This includes the capacity of responsible authorities to interpret data outputs, activate response protocols, and coordinate actions across relevant stakeholders and governance structures. The involvement of Territorial Working Groups (TWGs) further supports the integration of data-driven insights into broader management and planning processes.

Pilot experience further indicates that effective implementation depends on a sufficient level of digital maturity, interdepartmental coordination, and the ability to embed monitoring systems within existing governance and operational workflows. These conditions ensure that UC4 functions not only as a data collection system, but as an integrated decision-support mechanism.

However, in cases where basic digital infrastructure, data governance capacity, or institutional response mechanisms are not sufficiently developed, the implementation of UC4 may not be immediately feasible. In such contexts, preliminary capacity-building and infrastructure development steps are required before full system deployment can be effectively realized.

If the objective is to ensure that monitoring systems effectively support timely and coordinated interventions, the linkage between defined data thresholds and predefined response actions should be clearly established. This connection enables monitoring outputs to systematically inform and trigger appropriate responses within the governance framework.

4.4.3.2 Required Tools and Resources

The implementation of UC4 relies on a combination of digital tools and technical resources supporting data collection, integration, monitoring, and operational use within the Sustainable Tourism Model.

Based on the pilot implementation experience, the following tools and resources are associated with UC4:

- IoT-based monitoring systems supporting real-time data collection related to environmental conditions and site performance.
- Sensor networks enabling continuous monitoring of key parameters such as climate conditions, site exposure, and visitor-related pressures.
- Tools supporting the integration of multiple data sources into unified data environments.
- Digital platforms supporting the aggregation, analysis, and interpretation of monitoring data.
- Data visualization tools supporting the interpretation of system outputs for operational and strategic use.
- Tools supporting tourism flow monitoring and the analysis of visitor patterns and site usage.
- Digital infrastructures supporting the use of data outputs within planning and management processes.

For the effective operational deployment and transferability of UC4, the above tools are typically supported by complementary capacities, reflecting operational requirements related to data collection, integration, and governance processes, which may include:

- Data management and storage infrastructures ensuring the organization, continuity, and accessibility of collected datasets.
- Data processing and analysis environments supporting the interpretation and operational use of monitoring outputs.
- Interoperability mechanisms enabling the integration of heterogeneous data sources into unified data environments.
- Visualization and interface tools facilitating the use of data outputs within decision-making processes.
- Technical expertise in data engineering, system maintenance, and data analysis.

Coordination capacities supporting the integration of data-driven insights into governance and management processes.

4.4.3.3 Key Success Factors

Successful replication of UC4 depends on the effective use of data collection, monitoring systems, and integrated data analysis processes supporting governance and decision-making, as reflected in the pilot implementation experience and the project methodological framework.

Table 30 Key Success Factors supporting UC4 Implementation and Transfer

Key Success Factor	Description
Continuous data collection through monitoring systems	The use of sensor networks and monitoring tools to collect environmental, operational, and tourism-related data.
Integration of multiple data sources	The aggregation of data from different sources (e.g. environmental, tourism, infrastructure) into a unified data management framework.
Data analysis supporting decision-making processes	The processing and interpretation of collected data to support planning, monitoring, and management actions.
Real-time or periodic monitoring of site conditions	The use of monitoring systems to assess site conditions, detect changes, and support timely responses.
Linkage between monitoring outputs and management actions	The use of data outputs to inform operational decisions and activate response mechanisms.
Governance integration of data-driven processes	The embedding of monitoring and data analysis within governance structures and decision-making cycles.
Stakeholder coordination through structured mechanisms	The involvement of stakeholders through Territorial Working Groups (TWGs) to support data interpretation and coordinated responses.
Continuous evaluation and adaptive management	The use of monitoring results to support periodic review, adjustment of actions, and improvement of management strategies.

4.4.3.4 Potential Barriers and Mitigation Considerations

The transfer of UC4 may be influenced by technical, operational, and governance-related conditions affecting the collection, integration, and operational use of monitoring data within system-level decision-making processes, as reflected in the pilot implementation experience and the project methodological framework.

Table 31 Potential Barriers and Mitigation Considerations supporting UC4 Implementation and Transfer

Potential Barrier	Mitigation Consideration
Dependence on the availability and reliability of monitoring systems and data collection tools	Supporting the use of structured monitoring systems, including sensors and data collection tools, to ensure consistent data availability.
Challenges in integrating data from multiple sources and systems	Supporting the use of data integration approaches enabling the combination of heterogeneous data sources within a unified monitoring environment.
Fragmentation of data across institutions and systems	Strengthening coordination mechanisms supporting data sharing and the use of common data management approaches.
Limited integration of monitoring outputs into decision-making processes	Supporting the use of analytical outputs and dashboards to inform planning and management decisions.
Variability in the use and interpretation of monitoring data	Supporting structured data analysis and interpretation processes linked to management and governance functions.

Potential Barrier	Mitigation Consideration
Constraints related to site-specific infrastructure and environmental conditions	Adapting implementation approaches to territorial conditions, taking into account infrastructure characteristics and environmental factors.
Need for continuous monitoring and system adjustment	Supporting continuous evaluation and adjustment processes based on monitoring outputs and observed system performance.

4.4.3.5 Key Actors and Stakeholders

The implementation of UC4 involves a multi-level set of actors contributing to both technical deployment and governance integration, as reflected in the pilot implementation experience and the project methodological framework.

The level of impact reflects the degree of involvement of each stakeholder group in governance, decision-making, and operational processes, as derived from the roles identified within this framework and the pilot implementation experience.

Table 32 Key Actors and Stakeholders supporting UC4 Implementation and Transfer

Stakeholder	Role	Level of Impact	Engagement Approach
Municipal and Regional Authorities	Coordination of implementation and integration of monitoring outputs into planning and decision-making processes	High	Participation in management and decision-making processes
Cultural Heritage Management Bodies	Oversight of alignment between monitoring activities and conservation and site management requirements	High	Continuous involvement in monitoring validation and planning processes
Stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as Territorial Working Groups – TWGs, as applied in the pilot context)	Facilitation of coordination among stakeholders and contribution to participatory planning and decision-making processes	High	Structured participation through coordination processes, consultations, and collaborative activities
Data Analysts and Domain Experts	Interpretation of monitoring outputs and support to decision-making processes	Medium–High	Participation in data interpretation and advisory activities
Tourism Organizations	Use of monitoring outputs to support visitor flow management and tourism planning	Medium–High	Contribution to planning processes and use of outputs for tourism-related decision-making
Technology Providers and Technical Experts	Development, deployment, and maintenance of monitoring systems and data platforms	Medium	Technical implementation and system support activities
Academic and Research Institutions	Contribution to analytical approaches supporting interpretation and use of monitoring data	Medium	Participation in analytical support and knowledge-sharing activities

Stakeholder	Role	Level of Impact	Engagement Approach
Site Managers and Local Operators	Operational use of monitoring outputs within site management and day-to-day activities	Medium	Operational involvement and feedback provision
Local Stakeholders and Communities	Contribution to awareness, acceptance, and local validation of monitoring-related interventions	Medium	Participation in engagement and awareness-related activities

4.4.3.6 Proposed Action Plan for Transfer and Dissemination

The following action plan outlines indicative transfer and dissemination activities supporting the operational uptake of UC4, as derived from the pilot implementation experience and the project methodological framework.

Table 33 Proposed Transfer and Dissemination Activities supporting UC4 Implementation and Transfer

Proposed Activity	Brief Description	Actors Involved	Indicative Timing
Stakeholder engagement workshops	Organisation of workshops supporting coordination, knowledge exchange, and alignment on monitoring objectives and data use in planning processes	Municipal and regional authorities, cultural heritage bodies, tourism organisations, local stakeholders	Preparatory Phase
Technical training and capacity building	Training activities supporting operation and use of monitoring systems, data handling, and interpretation of outputs	Technology providers, technical experts, site managers, public authorities	Implementation Phase
Demonstration activities	Demonstration of monitoring system operation and use of outputs within site management and planning processes in pilot contexts	Technology providers, cultural heritage experts, site managers	Implementation Phase
Knowledge exchange activities	Exchange of practices and experiences supporting understanding of implementation requirements and operational use conditions	Public authorities, tourism organisations, heritage bodies	Implementation / Operational Phase
Preparation of operational guidelines	Development of guidelines supporting system use, maintenance, and integration of monitoring outputs into management processes	Public authorities, cultural heritage bodies, technical experts	Operational / Monitoring Phase
Data management and integration activities	Activities supporting organisation, accessibility, and integration of monitoring data within operational and decision-making processes	Technical experts, data specialists, public authorities	Operational / Monitoring Phase
Monitoring and evaluation activities	Activities supporting interpretation of monitoring outputs and their use in assessing performance and informing management decisions	Site managers, public authorities, tourism organisations	Operational / Monitoring Phase

Proposed Activity	Brief Description	Actors Involved	Indicative Timing
Awareness and communication actions	Activities supporting dissemination of results and communication of monitoring outputs to broader stakeholder groups	Public authorities, tourism organisations, local stakeholders	Evaluation / Transfer Phase
Demonstration and evaluation activities	Activities illustrating use of monitoring outputs and supporting evaluation of their role in management and planning processes	Public authorities, site managers, technical experts	Evaluation / Transfer Phase

4.4.4 KPIs and Monitoring Mechanisms

The KPI framework for UC4 is structured across three performance levels, ensuring a comprehensive assessment of system deployment, operational performance, and the contribution of monitoring systems to governance and decision-making processes. This structure enables the evaluation of both the technical functionality of monitoring systems and their effectiveness in supporting adaptive and responsive tourism management. It builds on the monitoring approach applied during the pilot implementation phase and reflects the need for measurable, governance-integrated performance tracking. It is aligned with the implementation methodology underpinning the Sustainable Tourism Model, ensuring methodological continuity between pilot testing, performance monitoring, and transfer processes, while also reflecting key performance dimensions derived from the HERIT ADAPT methodological framework and pilot implementation evidence base, particularly in relation to monitoring, data integration, and data-informed decision-making.

Each performance level captures a distinct dimension of system validation, ranging from infrastructure deployment and data integration to operational responsiveness and long-term impact on site management and sustainability.

Pilot Output Indicators focus on the direct results of implementation and include:

- Operational status and functionality of monitoring system components.
- Extent of integration of multiple data sources within monitoring processes.
- Availability and functionality of data processing and visualization tools.
- Continuity and availability of data records generated through monitoring systems.

Short-to-Medium Term Outcome Indicators assess system performance, data usability, and institutional response capacity, including:

- Reliability and continuity of data collection and transmission processes.
- Identification of events or conditions requiring monitoring-based attention.
- Extent to which monitoring outputs support operational responses and management actions.
- Integration of monitoring outputs into operational decision-making processes.

Long-Term Impact Indicators evaluate the contribution of UC4 to adaptive management and sustainable tourism governance, including:

- Evidence of improved management of visitor flows and site pressure based on monitoring outputs.
- Evidence of reduced environmental or operational risks through data-informed interventions.
- Extent to which management actions and strategies are supported by integrated data use.
- Adoption of monitoring-based approaches by additional sites or territories.

Monitoring is conducted under the responsibility of the designated governance body in coordination with relevant stakeholder coordination mechanisms (e.g. multi-stakeholder working groups, such as Territorial Working Groups (TWGs) in the pilot context), ensuring that performance data are systematically integrated into decision-making processes. Data are collected through appropriate monitoring and data collection mechanisms (e.g. monitoring systems, analytics tools, and data processing environments) and are reviewed at predefined intervals.

Where applicable, KPI values are assessed against baseline conditions established during the initial system activation phase, enabling the evaluation of system performance improvements, response capacity, and the effectiveness of data-informed interventions. Monitoring outputs are used to support coordinated operational and strategic decision-making processes within the governance framework.

Where performance benchmarks are not achieved, corrective measures may include adjustments in system operation, refinement of monitoring approaches, and adaptation of management processes, ensuring continuous improvement of system performance and governance integration. Continuous monitoring and evaluation ensure that UC4 operates as an effective decision-support system supporting timely interventions and adaptive management.

The KPI framework supports transferability by providing a structured yet adaptable monitoring system applicable across diverse territorial contexts, allowing calibration based on infrastructure capacity, data availability, and institutional readiness.

4.4.5 Indicative Transfer Timeline

The transfer of UC4 follows a structured and phased implementation process, aligned with the operational logic of the Sustainable Tourism Model and the pilot implementation experience. The timeline is presented in the form of a Gantt chart, providing a consolidated overview of the sequencing and interrelation of key implementation phases, including infrastructure preparation, system deployment, validation of monitoring processes, integration into governance and decision-making structures, performance monitoring, and replication.

This structured representation supports coordinated implementation, ensures methodological consistency, and facilitates the practical planning of UC4 transfer across different territorial contexts.

Table 34 Indicative Timeline for UC4 Transfer and Implementation

Phases	M1-M3			M4-M6			M6-M9			M9-M12			M12-M15			M15-M18		
Phase 1- Infrastructure Assessment and System Preparation																		
Phase 2- Sensor Deployment and Data Integration Setup																		
Phase 3- System Activation and Operational Testing																		
Phase 4 – Integration into Governance and Response Mechanisms																		
Phase 5 – Performance Monitoring and Adaptive Calibration																		
Phase 6 – Consolidation, Replication, and Scaling																		

Colored cells indicate the periods during which each phase is active. The timeline is indicative and phases may overlap depending on site-specific conditions.

Phase 1 is typically concentrated in the early implementation stage, although its duration may vary depending on infrastructure readiness, data availability, and institutional capacity.

Preparatory actions for consolidation and replication may begin during the late stages of Phase 5, reflecting the progressive stabilization and optimization of monitoring systems prior to full deployment in the final phase.

4.4.6 Evaluation and Performance Review Process

The evaluation framework for UC4 is structured as a continuous and iterative process, supporting both system performance validation and governance responsiveness. It is aligned with the phased implementation logic described in Section 4.4.5 and ensures that monitoring outputs trigger coordinated decision-making and response actions.

The evaluation approach reflects the iterative logic of the Sustainable Tourism Model, ensuring a consistent progression from real-time monitoring to adaptive response and final validation, with particular emphasis on system reliability, data accuracy, and institutional responsiveness.

Evaluation is structured across three interconnected stages:

Stage 1 – Ongoing Monitoring and System Performance Assessment

Performance data are collected continuously through the KPI framework (Section 4.4.4), focusing on sensor functionality, data transmission reliability, system uptime, and real-time monitoring capacity. This stage also evaluates the consistency and accuracy of incoming data streams, ensuring that monitoring systems provide a reliable basis for decision-making. Data are reviewed at predefined intervals, enabling early detection of system failures, data gaps, or inconsistencies, and supporting timely technical and operational adjustments.

Stage 2 – Mid-Term Evaluation and Governance Response Assessment

At intermediate stages of implementation, evaluation focuses on the effectiveness of governance response mechanisms triggered by monitoring outputs. This includes the assessment of response time, coordination between responsible actors, and the alignment of actions with predefined thresholds and decision protocols. Findings are reviewed within the governance structure, including Territorial Working Groups (TWGs), enabling the refinement of response procedures, escalation mechanisms, and interdepartmental coordination processes.

Stage 3 – Final Evaluation and Consolidation of Results

The final evaluation phase assesses the overall effectiveness of UC4, including the reliability of monitoring systems, the consistency of data-driven decision-making, and the integration of real-time data into long-term management strategies. This stage consolidates lessons learned, identifies best practices in system deployment and governance activation, and supports the definition of conditions for replication and scaling in new territorial contexts.

Across all stages, evaluation considers both technical system performance and institutional capacity to respond effectively to monitoring outputs. Particular attention is given to the alignment between data signals and decision-making actions, ensuring that real-time information leads to timely and appropriate responses.

The evaluation process functions as a core governance mechanism supporting continuous improvement, coordinated decision-making, and long-term system sustainability. Through structured review cycles, evaluation results are translated into actionable insights that inform system calibration, infrastructure optimization, and the refinement of governance response protocols.

The evaluation approach follows a multi-level performance logic, where results are assessed across immediate outputs, short-to-medium term outcomes, and long-term strategic impacts. This ensures that UC4 performance is evaluated not only in terms of technological deployment,

but also in relation to governance activation, operational responsiveness, and contribution to adaptive and resilient tourism management.

While evaluation practices may vary depending on territorial conditions, including infrastructure capacity, data maturity, and institutional readiness, they remain aligned with the common evaluation logic of the Sustainable Tourism Model.

5. Funding Instruments and European Programmes Supporting Transfer

The long-term sustainability of the Sustainable Tourism Model (STM) depends on the availability of structured financing pathways that enable replication, scaling, and institutional consolidation beyond the pilot phase. The funding dimension of the Transferability Plan does not concern isolated technological upgrades, but the progressive embedding and expansion of the governance-enabled mechanism developed within the HERIT ADAPT project (Sustainable Tourism Model and associated Use Cases).

This chapter outlines the strategic alignment between the Use Case architecture and relevant European funding instruments and defines coherent financing pathways supporting structured replication in new territorial contexts.

5.1 Alignment between Use Cases and EU Funding Instruments

The four Use Cases (UC1–UC4) represent functional components of the Sustainable Tourism Model, each addressing specific dimensions of digital transition, climate resilience, visitor management, and governance innovation. While the STM operates as an integrated system, individual components may align with thematic priorities defined under various European funding frameworks.

UC1 (Digital Twin & 3D Modeling) and UC4 (Big Data & IoT Integration) align strongly with funding strands supporting digital infrastructure, smart territorial management, environmental monitoring, and climate adaptation. These components correspond to EU priorities related to data-driven governance, resilience planning, and digital public sector transformation.

UC2 (XR/AR for Enhanced Visibility) and UC3 (AI-Enabled Storytelling) align with strands addressing cultural innovation, digital engagement, creative industries, AI deployment, and smart tourism strategies. These components support visitor redistribution, behavioral guidance, and adaptive communication policies within heritage contexts.

At system level, the Sustainable Tourism Model aligns with broader European objectives concerning sustainable tourism, green transition, digital transformation, climate resilience, and cultural heritage preservation. Financing alignment operates at two complementary levels:

- Thematic alignment of specific Use Case components
- Structural alignment of the integrated governance-enabled model.

This dual alignment ensures flexibility in accessing funding while preserving the integrity of the overall system architecture, with the selection of funding instruments guided by the maturity level of the territory and the specific Use Case configuration being deployed, ensuring strategic

alignment between investment priorities, implementation capacity, and expected operational outcomes.

5.2 Relevant European Programmes

European funding programmes supporting sustainable tourism, digital transition, climate resilience, and cultural heritage innovation may provide potential pathways for supporting the replication and scaling of the Sustainable Tourism Model.

The identification of relevant programmes will depend on territorial priorities, governance capacity, and alignment with regional development strategies. In this context, the following European programmes and funding instruments provide indicative pathways for supporting the replication and scaling of the Sustainable Tourism Model:

- **Interreg Programmes** support cross-border and transnational cooperation in sustainable tourism, climate resilience, and digital innovation. Follow-up Interreg initiatives may enable scaling of the STM in new territories through policy exchange, pilot extension, and governance strengthening.
- **Horizon Europe** provides opportunities for research and innovation projects related to digital heritage, AI applications, smart cities, climate adaptation, and data-driven governance systems. STM components involving advanced analytics, predictive modeling, and AI-enhanced visitor management may align with relevant clusters.
- **LIFE Programme** supports environmental protection, climate adaptation, and sustainable development initiatives. STM applications focusing on visitor pressure mitigation, environmental monitoring, and resilience planning may align with LIFE priorities.
- **Digital Europe Programme** supports digital infrastructure deployment, AI integration, advanced digital skills, and public sector digital transformation. Use Cases involving data platforms, IoT systems, and digital governance integration may fall within this scope.
- In addition, **European Regional Development Fund (ERDF)** instruments under Cohesion Policy may support infrastructure consolidation and smart specialization strategies at regional level.

The funding landscape therefore functions as an enabling framework rather than a predetermined financing route.

Table 35 Indicative Alignment between Use Cases and European Funding Instruments

Use Case	Relevant EU Programmes	Type of Supported Actions
UC1 – Digital Twin & 3D Modeling	• Horizon Europe • ERDF	• Digital heritage documentation • 3D modelling • conservation technologies • innovation in cultural heritage
UC2 – XR/AR for Enhanced Visibility	• Interreg • Creative Europe	• Cultural interpretation • immersive technologies • tourism diversification

		• visitor engagement
UC3 – AI-Enabled Storytelling	• Horizon Europe • Digital Europe	• AI applications • data-driven communication • personalization systems • smart tourism solutions
UC4 – Big Data & IoT Integration	• LIFE • Digital Europe • ERDF	• Environmental monitoring • IoT deployment • data platforms • climate adaptation • resilience systems

At system level, the integrated Sustainable Tourism Model may be supported through Interreg programmes and Cohesion Policy instruments, enabling territorial scaling, cross-border cooperation, and policy integration.

The selection of funding instruments should be strategically guided by the maturity level of the territory and the specific Use Case configuration being deployed, ensuring alignment between investment priorities, implementation capacity, and expected operational outcomes.

5.3 Strategic Financing Pathways for Replication

The strategic financing pathways supporting the replication and territorial uptake of the Sustainable Tourism Model in new contexts are structured to enable its progressive consolidation, scaling, and integration within territorial governance systems. Financing mechanisms are therefore positioned as enabling instruments supporting institutional strengthening, infrastructure development, and the long-term embedding of the model into policy frameworks.

Replication of the Sustainable Tourism Model follows a phased financing logic, structured around progressive consolidation rather than one-off project funding. It may be supported through a combination of complementary European funding instruments, as outlined in Section 6.2, and territorial investment mechanisms. This phased approach includes initial pilot consolidation, infrastructure and system scaling, and long-term integration into regional and national policy frameworks.

Phase 1 – Institutional Consolidation and Capacity Building
Initial financing focuses on strengthening governance structures, enhancing digital readiness, and integrating monitoring mechanisms into existing institutional workflows. This phase may include technical assistance, training programmes, and limited-scale pilot extensions.

Phase 2 – Infrastructure Scaling and System Integration
Subsequent financing supports the expansion of digital infrastructure, the integration of additional data sources, the enhancement of analytical capacity, and the consolidation of interdepartmental coordination mechanisms. At this stage, Use Case components are further embedded into formal policy frameworks.

Phase 3 – Policy Integration and Mainstreaming
In mature contexts, the Sustainable Tourism Model may be integrated into regional development strategies, climate adaptation plans, or smart specialization agendas. Financing at this stage supports scaling across additional heritage assets, territorial clusters, and cross-border cooperation frameworks.

This phased approach ensures that replication remains controlled, adaptive, and institutionally anchored. Rather than pursuing isolated funding for individual technological tools, the strategic objective is to secure sustained support for the governance-enabled tourism management mechanism as a whole. Through this structured financing pathway, the Sustainable Tourism Model can transition from pilot-based innovation to long-term operational integration across diverse territorial contexts.

This financing logic reinforces the transition from pilot-based innovation to structured territorial deployment, ensuring that the Sustainable Tourism Model can be progressively institutionalized and sustained beyond project duration. The combination of funding instruments should be strategically selected based on the maturity level of implementation and the specific Use Case configuration to be scaled, ensuring alignment between investment priorities, operational capacity, and expected outcomes.

6. Conclusions and Strategic Recommendations

The Transferability Plan consolidates the methodological, operational, and governance foundations required for the structured replication of the Sustainable Tourism Model (STM) in new territorial contexts. Building upon the pilot implementation experience and the Use Case architecture defined in the methodology of the Sustainable Tourism Model, the Plan establishes a coherent pathway through which data-driven tools are embedded within institutional workflows and adaptive management cycles.

The analysis confirms that effective transfer does not depend solely on technological deployment, but on the preservation of the systemic configuration linking data collection, analytical processing, governance activation, and performance monitoring. The four Use Cases (UC1–UC4) operate as complementary components within this integrated architecture, and their successful replication requires alignment between territorial readiness, institutional coordination, and structured monitoring mechanisms.

This concluding section summarizes the critical methodological and governance considerations supporting the structured transfer of the Sustainable Tourism Model, while synthesizing the key enabling conditions and forward-looking strategic recommendations necessary to ensure its sustainable and controlled replication across diverse territorial environments.

6.1 Key Enablers for Effective Transfer

Effective transfer of the Sustainable Tourism Model is contingent upon a combination of institutional, technical, and governance-related enablers. Pilot experience across the nine territories demonstrates that replicability is strengthened when technological applications are embedded within formal decision-making structures rather than operating as standalone digital tools.

A primary enabler is the existence of a clearly designated coordinating authority responsible for integrating analytical outputs into policy cycles. The presence of Territorial Working Groups (TWGs) or equivalent governance bodies ensures that data-driven insights are systematically reviewed, validated, and translated into operational measures. Institutional ownership and accountability mechanisms therefore constitute foundational conditions for sustainable transfer.

Data governance maturity represents a second critical enabler. Interoperable datasets, transparent data-sharing agreements, and defined thresholds for intervention enable structured monitoring and adaptive management. Where data flows remain fragmented or unregulated, technological potential cannot translate into effective governance outcomes.

Capacity-building and stakeholder alignment further enhance transfer effectiveness. Pilot implementation confirms that continuous training, cross-departmental coordination, and clear communication of system objectives reduce resistance to innovation and increase operational uptake. Successful territories demonstrated that governance preparedness and technical literacy must evolve in parallel.

Finally, phased implementation sequencing serves as a stabilizing factor. The structured timeline integrating preparation, deployment, governance embedding, and performance review reduces systemic risk and ensures measurable progression toward operational consolidation.

6.2 Strategic Considerations for Replication in New Territories

Replication in new territories requires careful calibration between the standardized architecture of the Sustainable Tourism Model and the contextual variability of territorial typologies. While the Use Case framework provides a stable structural reference, adaptation parameters must be adjusted according to governance configuration, digital maturity level, tourism intensity, and environmental exposure.

Urban high-pressure heritage cores may prioritize monitoring and redistribution mechanisms, while remote or environmentally sensitive sites may require strengthened simulation and predictive planning tools. Smaller-scale institutions may focus initially on digital engagement and data structuring before scaling toward advanced analytics. The replication strategy must therefore balance structural consistency with contextual responsiveness.

Strategically, new territories should approach transfer as a governance reform process supported by digital tools, rather than as a technology acquisition exercise. Early-stage readiness assessment, stakeholder mapping, and data infrastructure evaluation are recommended as preparatory steps prior to deployment. Formal integration of monitoring mechanisms into institutional procedures should be secured before technological activation. Long-term sustainability depends on the establishment of continuous evaluation cycles, transparent performance tracking, and adaptive recalibration mechanisms. The system must remain dynamic, allowing incremental refinement based on monitoring results and emerging territorial needs.

In conclusion, the Sustainable Tourism Model offers a replicable governance-enabled framework capable of supporting resilient and evidence-based tourism management across heterogeneous contexts. Its transferability lies not in technological replication, but in the preservation of its systemic logic: a governance-enabled, data-driven mechanism supporting adaptive, accountable, and resilient tourism management across diverse territorial contexts.