Sustainable Cultural Tourism Strategy and Promotion: An ICT Management Platform

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Abstract. Cultural tourism (CT) is a significant element of today's economy, accounting for around 37% of the total tourist industry and expanding at a pace of over 15% each year. This function and economic impact can benefit some EU and non-EU locations and areas with high cultural, social, and environmental potential. Other synergistic variables such as know-how, Information Communication Technologies (ICTs), gastronomy, identity, local culture, values, intangible legacy, or other characteristics also contribute to this influence. The work presented in this paper is part of the Social Innovation and TEchnologies for Sustainable Growth through Participative Cultural TOURism (TExTOUR) project, which brings together partners from the quintuple social innovation helix (knowledge, business, society, government, and entrepreneurs) to co-design, validate, and scale up policies and strategies that have a positive impact on socio-economic territorial development based on cultural tourism. TExTOUR collaborates with eight Cultural Tourism Pilots in lesser-known destinations to develop collaborative work methodologies for developing CT strategies for local sites, utilizing ICTs and social innovation tools. The Cultural Tourism Labs assist stakeholders in putting CT ad hoc strategies and action plans into action, monitoring them, and validating them. As a result, a technological platform (ICT tool) is presented in this paper, with its components outlined.

Keywords: Social Innovation · Sustainable Growth · Cultural Tourism and Heritage · Digital Data Acquisition · Information Management Systems

1 Introduction

Tourism is a major engine of economic development and has a great impact on the conservation of the heritage, but lack of destination management can create a burden difficult to bear among the inhabitants. Each territory or heritage site has visitors "carrying capacity", and above it its sustainability is in risk. The basic principle of the European Tourism Indicators System' (ETIS) is destination responsibility, ownership, and decision-making. Therefore, engaging different stakeholders to structure, collect and report information is a powerful way to undertake effective destination management and tourism planning [24].

ICTs have the potential to enhance the quality of destination management in economic and social aspects by reinforcing tourism activities such as developing genuine tourism offerings that rely on

local productions and traditions (for ex. food, furniture, handicrafts, and constructions. It can bring some benefits for saving time, for instance collecting and analyzing tourism information [3]. The ICT platforms for smart tourism aim to provide Decision Support Systems (DSS) to aid decision-makers to monitor, understand and take an action based on the given information. Recently, the DSS is designed to serve via a web interface, without the need to install any software. Establishing meaningful and strong connections between the cultural heritage, ICT platform and services is critical for managing destination by e-services innovation [21].

The notion of Cultural Heritage (CH) is undoubtedly complicated, and it is defined as follows by the Faro Convention [7]: "a collection of hereditary resources that people identify as a reflection and expression of their continually evolving values, beliefs, knowledge, and traditions, regardless of ownership. It encompasses all characteristics of the environment originating from people's and places' interactions across time." Heritage is frequently associated with tangible artefacts, but its equally vital intangible component should not be overlooked. Furthermore, since many ideas were directly generated in a digital format over the previous three decades, the digital legacy has become increasingly important.

Destinations management platforms in smart tourism should take bottom-up methods that focus on customizing sophisticated technological platforms to local demands instead of deploying complex technologies [21]. By providing new dimensions to the four domains scheme of sustainability in CT, the TExTOUR project supports the four domains scheme of sustainability in cultural tourism: environmental, economic, social, and cultural. In addition, Policies and ICTs are the two new domains. Refereeing Figure 1, TExTOUR's planned six-domains strategy will provide a novel method to achieving urban and regional development by leveraging sustainable cultural tourism. TExTOUR intends to analyze the potential of lesser-known, peripheral, or remote sites and areas, and to propose models to contribute to their development through sustainable cultural tourism, using the six domains method as a reference point.

The project employs the Cultural Tourism Lab (Pilots) technique to test and evaluate the created models at various dimensions and levels. This entails being place-based and promoting action co-design with all stakeholders, including policymakers, practitioners, civil society, and local residents. In this perspective, the project brings together eighteen partners from the "quintuple social innovation helix": knowledge, business, society, government, and entrepreneurs to develop TExTOUR sustainable cultural tourism strategies and activities in eight pilot locations.

The notable contributions of this paper in terms of a web-based ICT Tool are summarized as follows:

- Mechanism to create and implement CT strategies, from baseline definition to effect assessment
- Provision of implicit services: Facilitating CT-Labs Input, Decision-Making, Formulation of Smart EU Strategies, and Monitoring of ETIS
- Provision of explicit services: Point of Interest, Promotion of Route, Event, and Local Products, Occupancy Rate, Visitor's Satisfaction
- Single point of access for CT policy makers.

The reminder of the paper is organized into five sections: Section 2 describes related works in three different European tourism management projects. Section 3 presents proposed ICT model in subjective of TExTOUR project. Section 4.3 explains the platform component specification and finally Section 5 summarizes the result of this work and draws conclusions.

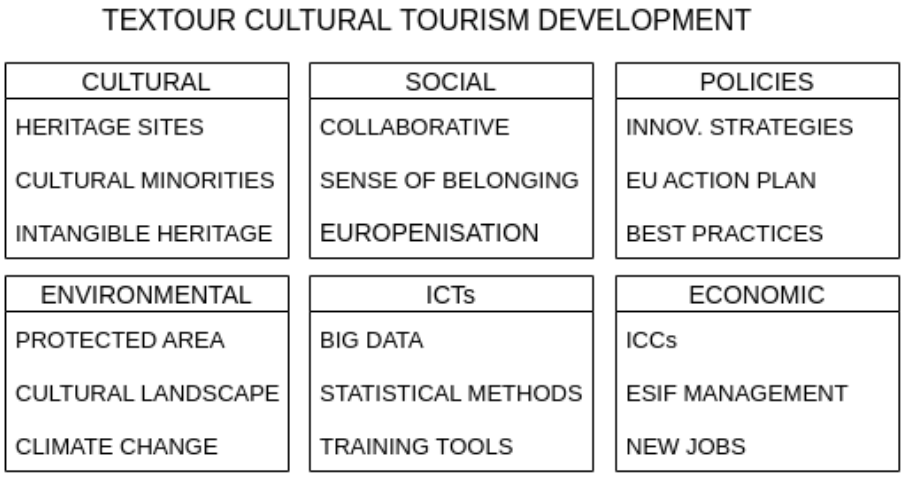

Fig. 1. TExTOUR: Six Domains to Develop Sustainable Cultural Tourism.

2 Related Work

The architecture for smart tourism is composed of three layers: the smart terminals, the cloud platform, and the service scenarios. Each of these layers is designed to perform a certain function [13]. The core functional modules for tourism services may include recommendations, events, guides and navigation, local sites information. The aim of the services is making tourism be able to swiftly locate what they are looking for by using the platform. This section provides an overview of present ICT solutions and services for destination and tourist management that are being developed as part of European initiatives.

Decision support systems (DSS) is one of the useful and common services in tourism ICT platforms. The Cultour Plus [23] project creates a decision-support system that will use a combination of classic and non-traditional data sources to monitor the regions comprehensively. In-depth desk research will be conducted to determine which sustainable cultural tourism policies have a good impact and to develop ideas for future municipal actions. The designed platform called FLAME integrates media and provides media integration to the ICT platform as a service. The Cross-Layer Management and Control (CLMC) component facilitates the collection of data from several layers. While such data is useful and required for control-level decisions like service endpoint activation, it also provides a rich pool of data for media service providers to develop insights into resource specifications, adjust critical longer-term strategies like content placement or media adaptation, and dimension Service-Level Agreements (SLAs) that will govern Business to Business (B2B) and Business to Customer (B2C) relationships. To evaluate demand, resourcing, and performance features of media service function chains implemented within the FLAME platform, the CLMC combines time-series and graph analytic. Individual service function and link time-series measurements are collected and then linked using hierarchical typologies of infrastructure, service function endpoints, and the entire service function chain [16].

One of the solutions for destination management is using smart city platforms which is applied in HERIT-DATA project [22]. HERIT-DATA aims to identify innovative solutions, with the support of new technologies and big data, to reduce the negative impacts of tourism on cultural and natural

heritage sites by monitoring and controlling destination by Snap4City platform. The Snap4City answer is capable of running with a couple of facts channels of any kind, as well as multiple FIWARE solutions. As soon as data channels are installed, city entities are modeled in a understanding Base (grounded [12] on Km4City ontology and Linked Information (LD)) and turn out to be equipped for semantic queries exploiting relationships as: spatial, temporal and relational. A couple of brokers, devices and side devices can be connected and controlled through the Internet of Things (IoT) listing. Far Flung IoT facet devices may be maintained, additionally updating the good judgment of manage and facts processing based totally on Node-red. Snap4City can control open and private data for each area and enterprise [12].

Another challenge in Tourism sector is defining and visualising the indicators related to tangible and intangible assets. SmartCulTour [17] aims to support regional development in all European regions with significant tangible and intangible cultural assets, including rural and urban fringes, through sustainable cultural tourism. The SmarCulTour DSS is formulated to be altogether open and profoundly versatile. Its substance is primarily grounded in a user-friendly set of information visualizations, which is encapsulated inside a tastefully pleasing, intuitive format. In arrange to supply the greatest convenience, the DSS formats are organized making utilize of web widget innovation as its central component.The DSS dashboard aims to visualize indicators and fill the gap between the collection of indicators and destination management. The end-users will be entrepreneurs, decision-makers, and researchers who will work with both traditional and new data sources. Web gadgets are self-contained, reusable web applications that do not require site-specific assembly. The DSS implementation on the official SmartCulTour website is done using a specific widget typology called iFrame. This enables easy-to-use integration of all DSS functions on a single platform, simplifying and optimizing content distribution and distribution operations [4].

In table 1 the summary of the proposed services by the aforementioned projects are shown.

Table 1. ICT services provided by European Projects in Tourism Management.

ICT services / Platform	Cultour	Herit-Data	SmartCulTour
Information	✓	✓	✓
Social Network	✓	✓	×
Promote Tangible & Intangible Asset	×	×	✓
Planning EU Policy	×	✓	×
Monitoring KPIs	✓	✓	✓
Georeferencing	×	✓	×
DSS Recommendation	✓	×	✓

3 Proposed TExTOUR ICT Conceptual Model

This section discusses the overall requirements engineering technique and how it translates into solution requirements, specifically for TExTOUR's ICT Platform for Sustainable CT Promotion.

3.1 Requirements Engineering Methodology

According to IEEE (Institute of Electrical and Electronics Engineers) definitions and requirements categorized as follows [15]:

– a condition or capability needed by a user (person or system) to solve a problem goal,

– a condition or capability, which has to be provided by a system or part of a system, to fulfill a contract, a standard, a specification, or any other formal documents,
– documented representation of a condition or capability, as in points 1 or 2.

An important part of the requirements definition phase is to establish a set of overall objectives that the system should meet. These should not necessarily be expressed in terms of the system', functionality but should define why the system is being procured for a particular environment.

A "good requirement" demands certain quality criteria parameters. There are different methodologies from elicitation to validation requirements in a project. statements underpin the following Requirement Engineering (RE) definition, indeed, it is the first major activity which involves understanding problem domain, solution determination, and specification of a solution that is testable, understandable, maintainable, and that satisfies project quantity guidelines [6] (ISO:9001, 1989). The proposed methodology follows the main RE-described phases, namely the requirements elicitation, analysis, specification, and validation, is shown Figure 2. In addition, and to prepare information required for the process, a previous phase is considered at the beginning of the proposed methodology. As a result, this information through a series of processes can be transformed into more concrete software requirements. The applied requirements engineering methodology consists of four steps: elicitation, analysis, specification, and validation.

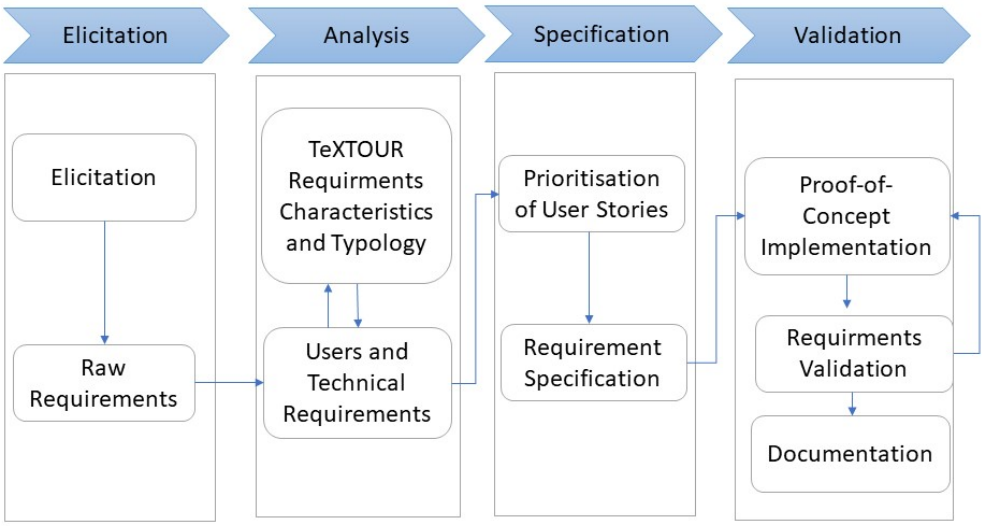

Fig. 2. Requirements Engineering Methodology.

3.2 Platform Framework

This subsection discusses the TExTOUR system's High-Level Design (HLD). The architecture diagram displays the overall system, emphasizing the key components that will be built for future stakeholders. The TExTOUR platform's high-level architecture was created following a thorough examination of all of the aforementioned technical needs. As illustrated in Figure 3, it is made up of various interrelated components that each play a specialized role in the platform's functionality.

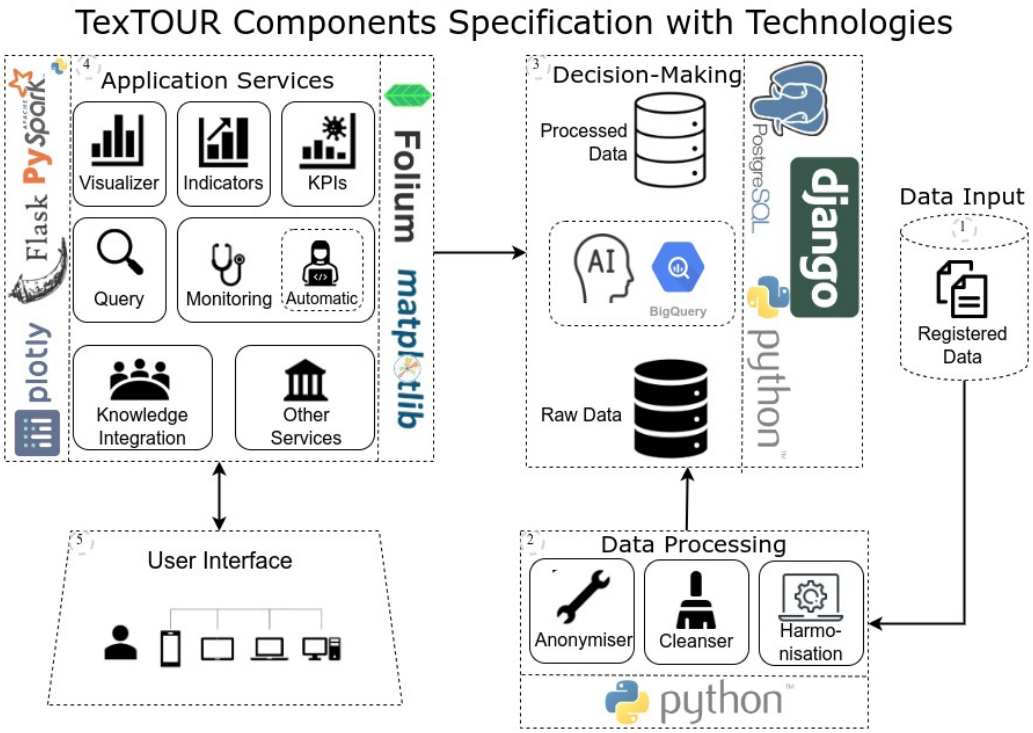

Fig. 3. TExTOUR Platform Framework.

The TExTOUR platform is comprised of five core aspects (which are discussed in detail in the next section). The Data Input is the platform's information gateway. It comprises information from numerous Pilots, Stakeholders, and the public/government sector. These input data may proceed via a data processing module if desired. This module is handled by an optional component, which has been divided into three parts for ease of analysis: the Anonymiser, Cleanser, and Harmoniser. The TExTOUR platform will provide the Anonymiser to filter data that needs to be kept confidential, such as datasets containing personal information or datasets including corporate information that cannot be shared with third parties. The Cleanser can be used to perform simple and/or more advanced cleansing tasks, such as data type transformations, substitution or exclusion of data outside of thresholds, or interpolation or extrapolation techniques in the case of missing values, if the entire dataset contains noisy and/or erroneous data. The Harmoniser is responsible of doing data extraction and is primarily responsible for tuple extraction from the incoming dataset. In its most basic form, the Harmoniser should be able to provide a tabular view of the incoming dataset, allowing only the data that is valuable to TExTOUR stakeholders to be kept, while the rest of the data that should not be included due to privacy concerns or does not provide any direct value in the TExTOUR value chain is removed.

The Data Storage module, which follows the Data Processing module under Decision-Making, encapsulates the TExTOUR platform's storage solution. It will hold all of the massive data and semantically tagged metadata. As with any other data project, the storage solution will provide

a set of important qualities that are critical to the platform's success. Horizontal scalability, high availability, and flexibility will all be features of data storage. It will be able to efficiently store and manage enormous amounts of potentially unrelated and complex data. The storage solution's high-performance querying and indexing capabilities are also listed in the list of essential attributes. Data storage will ensure that material is broadly accessible and highly available to the rest of the components, as well as providing superior data security.

The extracted and semantically enriched data is delivered to the Query Builder in parallel with the data storage. The Query Builder's goal is to restore real-time indexing and advanced querying functionality. To be equipped for subject indexing, the datasets are saved in archiving in a predefined structural format, together with indexes developed during processing time.

Following Open-source Application Software, the first version of the high-level architecture description has been published as a result of the translation of technical requirements into the design and specification of TExTOUR components within the context of the platform framework, as seen in Figure 3. Python is chosen as the programming language [18] of choice for data processing modules, followed by Django [10] and PostgreSQL [1] for decision making. PySpark [8] will be utilized in conjunction with Flask [14] at the service level, and Folium [26] and Matplotlib [2] will be used for geospatial visual representation.

The next section describes how the component communicates with other components, as well as the actions that can be performed on it and how those actions influence the dependencies.

4 Platform Component Specifications

4.1 Input Module

The main logic of an event system can be defined and altered in an Input Module. In terms of the TExTOUR project's goal, the platform's input module comprises of data specifications, Key Performance Indicator (KPI) specifications, and strategy specifications. The data collecting methods and procedures from resources, as well as integration and ingestion strategies, are referred to as the input module.

- **Data Specifications** — The data for the TExTOUR platform was acquired through a comprehensive, bottom-up methodology in which Lab communities assessed knowledge gaps, challenges, needs, and conditions from a holistic and multidisciplinary perspective in order to effectively solve CT while enabling cross-border cooperation. To contrast quantitative and qualitative data, an triangulation process was utilized to collect data, which included 1) internet surveys (both for qualitative and quantitative data), 2) semi-structured interviews, and 3) focus groups. Aside from that, statistics data from the locale and region will be complemented by the obtained data. The obtained data will be examined to provide final criteria and indicators, which will then be utilized to develop TExTOUR strategies.
- **KPI Specification** — KPIs will be produced based on the Data Specifications results, and will be utilized to identify the drivers and barriers in building the pilot strategy guidelines. This assignment will create the initial set of KPIs that will be used to track and analyze the effectiveness of measurements and concepts developed during the project. In 2021, the basic data on which KPIs are based will be gathered from qualitatively and thematically different publicly available databases. The timeliness of these data varies based on the conditions for collecting and gain at the local, regional, and national levels. Each KPI will be assigned a unique ID that

includes data from one of four domains, a code for the pilot site, and the sequential indicator number. As a result, each KPI will have seven characters: two letters and five digits. The first two characters are two letters that correspond to the domain type. SC denotes social domain, EC denotes economic domain, CL denotes cultural domain, and EN denotes environmental domain. The third and the fourth characters represent the number of the pilot area, and the last three digits constitute the consecutive KPI number.

- **CT Strategies Specification** — Cultural tourism strategies have the potential to have a significant impact on the economic and social development of European regions and cities. Given the interconnected nature of the sectors involved in tourist development and execution, new ways are required to make the most of the vast amounts of data available to policymakers. To this purpose, it is critical to promote the employment of cutting-edge technologies and innovation in cultural tourism practices. The effective application of ICT can play a critical role in shaping and guiding future actions here, as it can in many other areas of governance and management. In the digital age, the upgrading of cultural heritage for tourism can take advantage of the potential provided by ICTs to provide increased tourist connection and integration with the environment. Technology and innovation, particularly ICT, can increase the quality of the visitor experience, governance, profits, and the wellness of people, according to the UNWTO (World Tourism Organization) [11], as well as maintain intangible and tangible cultural heritage for cultural tourism's long-term development.

4.2 Data Processing & Analysis Module

Data Processing A data processing system is a collection of machines, people, and processes that creates a defined set of outputs in response to a set of inputs. Depending on the interpreter's relationship to the system, the inputs and outputs are interpreted as data, facts, or information [5]. Data Processing components such as Anonymizer, Cleanser, and Harmoniser are explained in this subsection.

- **Anonymizer** — The Anonymiser is an offline data anonymization program. Data anonymization is essential when datasets must be published or shared on a platform. When exchanging personal data, it is typical for information to be unable to be sent across a boundary, which could be a company network, an organization, or a personal perspective. Anonymiser needs to meet privacy issues, remove the possibility of unintentional disclosure, and protect sensitive personal data. It needs to be able to handle sensitive properties in a way that prevents privacy threats like attribute or identity exposure. Murthy et al. [20] mentioned Data Masking, Pseudonymization, Generalization, Data Swapping, Data Perturbation, and Synthetic Data as strategies for anonymization. However, the Anonymiser module, as shown in Figure 3, does not meet any specific technological requirements because anonymizing sensitive data was not judged necessary during the stakeholders' needs analysis. The Anonymiser, however, has been provided as an optional component because such a need may arise in the future, and therefore the delivery of such a tool may be judged useful for a stakeholder desiring to share a data source through the TExTOUR platform.
- **Cleanser** — Data cleansing [9] is the act of going through all of the data in a database and either eliminating or replacing information that is incomplete, wrong, incorrectly formatted, duplicated, or irrelevant. Cleaning up data that has been obtained in a particular location, such as data from a single spreadsheet field, is what data cleansing normally comprises. It's not enough to prevent faulty data from entering the system to have a good data management/cleaning

plan. It must also go over database information on a regular basis to update obsolete data and repair errors that occurred during data input and storage. Removing duplicate or irrelevant observations, Fixing structural mistakes, Filtering undesired outliers, and Handling missing data are all steps in the cleansing technique [19].
- **Harmoniser** — A data harmonizer is a necessary step before entering numerous data source entries in the database, given the variety of each pilot and its data. Harmoniser will solve the problem of data from these sources being saved in various formats by providing a layer of abstraction over the data and storing it in a common metadata context. The goal is to create a unified query method that allows this data to be queried as if they were different data sources. In the case of continuous inputs, the harmonizer will later send metadata information to the input source for more efficient process execution.
- **Data Storage** — A datastore is a repository for storing and managing collections of data that includes not only databases but also simpler store types such as simple files, emails, and so on. Relational databases, which store data in a sequence of tables, are one type of data storage. Oracle, MySql, SqlServer, HSQL, Postgres, and SQLite are the most commonly used database management systems [25]. We'll be using SQLite as our database management system in TExTOUR. SQLite is a C library that provides a disk-based database that does not require a separate server process and may be accessed using a nonstandard SQL query language. SQLite can be used for internal data storage in applications. It's also possible to use SQLite to prototype an application before moving the code to a larger database like PostgreSQL or Oracle.

Data Analysis Exploratory data analysis is a statistical strategy to evaluating data sets to summarize their major properties, which commonly involves the use of statistical graphics and other data visualization techniques. The Decision Making and Query Builder module of the TExTOUR platform is described in this subsection, which is followed by the Service module.

- **Decision Making** — The Decision-Making Module is the component in responsible of initiating and monitoring the specified algorithm's execution. The module will be able to execute advanced analyses using a wide range of algorithms on numerous datasets available on the Data Storage and offer findings in a timely and efficient manner. The following needs are addressed by the module: It enables the execution of data analytic algorithms, such as descriptive, predictive, and prescriptive analytics, on data stored/linked in the TExTOUR platform. It simplifies the storage of analysis results into datasets that may be analyzed further with other algorithms.
- **Query Builder** — The Query Builder is the component that allows TExTOUR dataset users to explore, integrate, and define sophisticated searches. End-users who are unfamiliar with formal query languages or the structure of the underlying data will nevertheless be able to express complicated searches on top of many datasets thanks to the user interface's ease of use. The Query Builder's goal is straightforward, but it's capable of describing the great majority of queries. The capability of the tool to use information from the Data Storage Metadata Repository to better predict users' requirements and intentions, aid them with typical tasks, and provide superior insights in the realm of interlinking data across datasets will be its strength.

4.3 Application Services Module

In the ICT platform, all the strategies will be implemented as a set of services. These services could correspond to either explicit or implicit methods. Explicit strategies are those that need the use

of software tools to be applied and evaluated. Those software tools will be developed or integrated into the ICT platform in this scenario. Implicit strategies are those that do not require the use of a software tool to be assessed.

Implicit Service The ICT platform will provide a monitoring system of indicators and KPIs based on external data from project capitalization and internal data from Labs community Pilots paired with Smart Strategies. Aside from that, the ICT platform will include a tool for managing CT initiatives that can support several data sources (as human input). It will then determine the best strategies for the various Cultural Tourism categories in order to avoid unbalanced development, taking into account environmental, cultural, and socioeconomic impacts, as well as governance, business models, and investment, local stakeholder engagement methods and diversification, and marketing. The ICT platform will review and characterize the best CT practices that have been found. The platform's information will primarily focus on the strategies identified through the literature study and Labs Community, as well as their application requirements and hurdles. There will be a decision-making and monitoring component that will make recommendations based on the users' ambitiousness levels. Thus, five implicit service modules namely, (1) CT-Labs Input, (2) Queries, (3) Decision-Making, (4) Smart Strategies, and (5) Monitoring are proposed.

Explicit Services Based on the survey from eight pilots of the project, we found out the common requested services which are shown in table 2

Table 2. ICT Platform-List of Explicit Services.

S.no.	Service Name	Service Feature	Percentage of Requests
1	POI	- Digital Map with POIs, digital information - Dynamic upload of new POI	1.00
2	Route	- Digital Map with different thematic routes - Dynamic upload of new Routes - Users' live location	1.00
3	Event	- Event list and redirecting to the event web page - Post event data upload	0.625
4	Local Product Promotion	- Digital Map with area-wise famous local products - local product history and significant	0.375
5	Occupancy Rate	- Offering Live occupancy rate - Waiting time	0.125
6	Visitor's Satisfaction	- visitor's satisfaction	0.375

POI service helps in information dissemination related to the point of interests,museum documentary, history of villages.The information from POI will be facilitated by QR codes containing information in text,audio and video formats. **Route** provides information about accessible routs to connect bordered cities even in different counties, and showing different types of thematic routes. **Event** corresponds event announcement,post cultural events, workshops. **Local Product Promotion** introduces and promotes local foods, products, and vendors. **Occupancy Rate** is sort of tourism Flow monitoring and feed-back system. **Visitor's Satisfaction** provides user´s feedback regarding the events, routs, places and so on.

5 Summary and Future Work

This paper describes the TExTOUR platform and services' key features and backbone. It also considers the strategy to building and constructing the platform, which is based on requirements. In terms of TExTOUR requirements features and typology, the chosen Requirements Engineering technique involves four key steps: requirements elicitation, analysis, specification, and validation, which assists and adds to the analysis phase. Indicators and KPIs from MS EXCEL, LibreOffice CALC, and other sheets will be parsed (transferred and/or updated) into a platform database module that will manage data entry into the system.

TExTOUR ICT platform contains a methodology for constructing requirements, platform modules, and services, as well as all the tools and services needed to create and implement Cultural Tourism strategies, from baseline definition to effect assessment. The suggested platform module's five core modules are data input, data processing, decision making, application services, and user interface. The platform's information gateway, the data input, contains data from a variety of Pilots, dtakeholders, and public/government sector information. If desired, these input data can be sent to a data processing module. The decision making module is in responsible of starting and monitoring the execution of the given algorithm. The ICT platform services will be created as a user-friendly tool that can be utilized to support explicit and implicit services.

Despite the fact that the generalized approach (Figure 3) comprises of various high complex modules/steps, the entire framework can still be improved to achieve a greater overall performance. We want to expand this effort in the future, not just to improve the individual processes, but also to:

- Determine the best way to integrate the methods in a way that fits the needs and preferences of the pilots when it comes to analyzing cultural tourism impacts.
- A method for evaluating and ranking cultural tourism strategies
- During the project's life cycle, cultural tourism strategies are modified on a regular basis.

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