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# Multidimensional Readiness Evaluation of Smart Tourism Destinations: A Natural Language Processing and Thematic Analysis Approach

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**ABSTRACT** The rapid expansion of the tourism sector, driven by technological progress, has led to smart tourism, improving visitor experiences and streamlining destination administration. In underdeveloped nations, such as Indonesia, destinations often are not adequately prepared to use smart technology, resulting in inefficiencies and unsuccessful projects. Existing models for evaluating tourism progress typically concentrate on specific regions or isolated dimensions, lacking a comprehensive assessment of governance, socioeconomic conditions, and information technology (IT) awareness. This research addresses this gap by introducing a multidimensional framework for evaluating smart tourism readiness based on the Technology-Organization-Environment (TOE) paradigm. The study starts with a thorough review of existing literature using the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method to find key factors for readiness, and it uses a combination of both qualitative and quantitative research methods. We conducted a quantitative examination using natural language processing (NLP) to cluster the dimensions of the existing evaluation models. In the qualitative phase, two validation processes were conducted. The first process involved expert interviews with stakeholders to validate the dimensions identified in the previous step. In the second validation process, we simplified the information by matching the proposed dimensions with IT governance components from well-known frameworks like COBIT and ITIL 4. This mapping ensures the proposed dimensions are aligned with IT governance components, supporting the effective management of smart technology in smart tourism destinations. The study identifies seven critical readiness dimensions as a key finding: governance, sustainability, online tourism services, smart technology, accessibility, innovation culture, and socioeconomic conditions. The findings contribute to a holistic readiness evaluation framework, offering actionable insights for policymakers and tourism stakeholders to inform strategic planning and policy development. This comprehensive model supports the successful implementation of smart tourism initiatives, addressing the unique challenges of developing countries and fostering long-term sustainability.

**INDEX TERMS**: Multidimensional Evaluation, Natural Language Processing (NLP), Smart Tourism, Technology-Organization-Environment (TOE) Theory, Thematic Analysis, Tourism Readiness.

## I. INTRODUCTION

The rapid advancement of information technology (IT) has significantly impacted many industries [1]. Tourism is one of the largest and fastest-growing sectors contributing to global economic growth [2]. This technological evolution has led to the concept of smart tourism, integrating digital innovations to enhance tourist experiences and destination management in recent decades [3], [4]. Japan, South Korea, China, and Australia have implemented smart tourism through public investment programs aimed at improving these aspects [5], [6].

Despite these efforts, challenges persist, particularly in developing countries like Indonesia, where the readiness of destinations to adopt smart technologies is a concern. Insufficient preparation can lead to inefficiencies, financial losses, and failed initiatives [7]. Assessing a destination's readiness for smart tourism transformation is crucial to ensuring that infrastructure, policies, and systems supporting this shift are successfully implemented [7]. A comprehensive

tourism development policy must integrate factors that address the needs and expectations of citizens while considering the long-term economic, social, and environmental impacts of tourism activities [8], [9].

Different perspectives have led to the development of several smart tourism frameworks. For instance, the Smart Tourism Destination Governance model proposed by Errichiello provides insights into the steps necessary to develop smart tourism governance [10], indicator systems to assess the implementation progress of a smart tourism destination [11], [12] and maturity measurement of smart tourism destination governance [5], [13]. The rapid growth of smart tourism has introduced major challenges for destinations seeking to adopt these innovations. Nevertheless, the literature review indicates that no model exists to assess a destination's readiness to become a smart tourism destination. Many initiatives have failed due to the lack of a comprehensive framework for assessing readiness [5], [12]. This limitation presents significant challenges, especially in developing countries like Indonesia, where technological adaptation is essential for successful transformation. Meanwhile, the Technology-Organization-Environment (TOE) framework is a frequently referenced theory for readiness evaluation [14], [15], [16], [17], [18]. This theory posits that three key aspects—technology, environment, and organization—influence readiness for innovation adoption in this context. This study uses the TOE framework to explore areas that haven't been fully examined in smart tourism research, especially the readiness of socioeconomic factors, skills of the workforce, and understanding of information technology (IT) among people. TOE describes how the government in a destination uses technology to manage tourism resources [16].

Drawing on the TOE theory, this study aims to bridge this gap by proposing multidimensional readiness factors for smart tourism destinations. This effort was guided by the central research question: What factors influence a destination's readiness for smart tourism transformation? This research finds the key factors that affect readiness by using a combination of methods, including a numerical analysis of existing data using NLP and confirming results through interviews with experts. The findings provide actionable insights for stakeholders and policymakers to support strategic planning and effectively implement smart tourism initiatives. The following objectives were formulated: (1) to identify and cluster key readiness dimensions for smart tourism using NLP techniques and (2) to validate these dimensions through expert interviews and align them with IT governance frameworks (COBIT 2019 and ITIL 4).

Indonesia is the case study due to its significant tourism potential and opportunities for implementing the smart tourism concept, aligning with the country's growing smart city initiatives [19]. Acknowledging Indonesia as a starting point, its unique conditions serve as an ideal case study and a reference for other countries with similar contexts, such as those with significant tourism potential[2], rapidly developing IT infrastructure development that drives digital transformation across various sectors, and a promising pool of digital talent[20]. However, overall IT literacy among its population remains relatively low. This condition poses a challenge for the successful implementation of smart technology, highlighting the need for thorough preparation to ensure its effectiveness. The study explores a context where such readiness evaluations are critically needed. This study formulates and validates the dimensions by integrating various data sources, including literature, theories, and global frameworks. This approach ensures that the findings can be generalized to other countries and regions with appropriate adaptations. The study explores a context where such readiness evaluations are critically needed. This study formulates and validates the dimensions by integrating various data sources, including literature, theories, and global frameworks. This approach ensures that the findings can be generalized to other countries and regions with appropriate adaptations.

This paper has six sections. Section 1 provides an overview and background information, emphasizing the significance of smart tourism and identifying gaps in existing literature. Section 2 presents related studies, focusing on the primary dimensions of smart tourism destination readiness and the existing evaluation models. Section 3 delineates the methodology, highlighting the application of Natural Language Processing (NLP) for numerical analysis in identifying the key dimensions. It then uses thematic analysis and data condensation to confirm the findings qualitatively. Section 4 presents the analysis results, including dimensional clustering and expert validation. Section 5 discussed the research implications. Finally, Section 6 summarizes the study's main contributions and offers recommendations for future research and practical applications.

## II. RELATED STUDIES

### A. Technological Foundations of Smart Tourism

Smart tourism is defined in various ways, depending on specific research perspectives [12], [21]. Some studies highlight technological aspects [22], [23], [24], focusing on tourism systems enhanced by smart technology to improve tourist experiences and facilitate knowledge sharing among stakeholders. This technological implementation benefits tourists, destinations, and residents alike. The original concept of smart technology in tourism revolved around platforms that integrate information on tourist activities, consumption, and resource status [25]. Such platforms have created information networks that connect stakeholders, promoting collaboration and knowledge exchange [26].
Effective tourism destinations must be equipped with centralized smart systems that manage information for

tourists and local communities [27]. The current evolution of technology is geared toward real-time data collection and sharing, enhanced by analytics and recommendation systems to better meet customer needs. Providing tourists with up-to-date information before, during, and after their trips enriches their overall experience [28]. The effect is demonstrated by various smart tourism tools implemented globally, as shown in Table 1 [29].

TABLE 1. SMART TOURISM TECHNOLOGY TOOLS [29]

| Type | Example of the Application |
|---|---|
| Smart Information System | Tourist Attraction Home Page |
| | Free Wi-Fi |
| | Online Information Access |
| | Mobile Application |
| | Quick-Response Code |
| | Electronic Touch Screen |
| Intelligence Tourism Management | Smart Card (Band) |
| | Electronic-Entrance-Guard System |
| | Tourist Flow Monitoring |
| | Crowd Handling |
| | Smart Education |
| Smart Sightseeing | Personal-Itinerary Design |
| | Intelligent Guide System |
| | E-Tourism Recommendation System |
| | E-Tour Map |
| E-Commerce System | Mobile Payment |
| | Online Coupon |
| | Online Booking |
| Smart Safety | Intelligent Environment Monitoring |
| | Travel Safety Protection |
| | Smart Emergency Response System |
| Intelligent Traffic | Smart Vehicle Scheduling |
| | Real-Time Traffic Broadcast |
| Smart Forecast | Tourist Flow Forecast |
| | Queuing Time Forecast |
| | Weather Forecast |
| Virtual Tourist Attraction | Virtual Tourism Experience |
| | Virtual Travel Community |

### B. Smart Tourism from a Governance and Information System Perspective

Research has examined smart tourism from the governance and management perspectives [10], [30], [31]. Tourism governance is about the systems and practices that manage how public and private groups, like governments, businesses, service providers, tourists, and local communities, work together to create and carry out sustainable tourism plans. Related research has conceptualized destination governance as a process-oriented framework, highlighting the following key steps [10]:

- **Assembling**: Analyzing tourism stakeholders and resources and establishing collaboration agreements.
- **Ordering**: Setting strategic objectives for tourism development.
- **Implementation**: Defining roles, processes, and coordination strategies for governance-focused public–private partnerships, supported by smart technologies and platforms to facilitate real-time collaboration.
- **Evaluation**: Monitoring the efficiency and effectiveness of smart governance strategies and organizational practices.
- **Transformation**: Establishing initiatives that strengthen partnerships or revisiting governance structures, coordination, and integration mechanisms to promote continuous improvement and adaptability to emerging challenges.

From the information system (IS) perspective, smart tourism poses opportunities and challenges for academic and practical research. The focus is on leveraging IS to generate new value, enhance tourism operations, and incorporate technology and social frameworks to offer innovative and sustainable solutions [30]. These varied perspectives consistently prioritize improving tourist experiences [23], [31], [32], [33], the well-being of residents [33], [34], and industry value [33], [35], [36].

### C. Evaluation Model for Smart Tourism Destinations

Assessing the achievement of established objectives, the evaluation serves as a reliable basis for deciding whether to continue, modify, or terminate a program [37]. In investment project development, three main evaluation models are commonly utilized: readiness, maturity, and measurement. These models are typically applied in Industry 4.0 projects, digital transformation, smart cities, and tourism initiatives. Readiness and maturity evaluations are formative, providing insights into service and quality improvements during project development [37], whereas measurement evaluations are summative and conducted after project completion.

In the context of Industry 4.0, readiness evaluation analyzes the prerequisites for digitalization [38]. It marks the starting point of development, reflecting the current state necessary to achieve specific objectives [39], [40]. In smart cities, readiness evaluation measures preparedness to implement and promote initiatives, outlining the essential conditions for progress [40]. It signifies the initial stage of transformation [41], applicable to the digital evolution of smart tourism destinations. In contrast, maturity evaluation assesses completeness or progress in system development, focusing on enhancing capabilities over time and indicating progress toward future goals [39]. Thus, readiness evaluations are conducted before the transformation begins, whereas maturity and measurement evaluations assess ongoing and completed processes [39], [42].

Smart tourism has been pursued through public investment in countries such as Japan, Australia, China, and South Korea [5], [30], yet achieving full success has often been elusive [5]. Effective implementation requires comprehensive preparation to avoid financial issues [7] and inefficiencies [43]. Evaluating destination readiness is essential for guiding transformation, offering valuable insights into requirements [14], budget needs [7], and areas for improvement. Moreover, readiness assessments provide a shared understanding among planners and stakeholders regarding the current infrastructure and necessary preparations[44], [45].

While smart tourism evaluation systems are under development, their availability remains limited [12]. These systems often integrate smart tourism models with city evaluation frameworks and other methodologies. The dimensions influencing the achievement of objectives are assessed by indicators measuring current conditions[5], [11], [12], [13]. For instance, Spain's system of smart destination indicators functions as both a research tool and an official protocol for implementing smart tourism [12]. Studies have also examined coastal sites in Spain [11] and the maturity of developments in towns in Japan [5] and Switzerland [13]. However, there is a lack of research specifically assessing readiness for transformation into smart tourism destinations.

Table 2 summarizes the smart tourism evaluation systems and their dimensions. These systems usually follow well-known models that emphasize competitiveness and sustainability, but they might not cover the complete readiness evaluations required for different uses

### D. Challenges and Gaps in Current Research

The research highlights several challenges in smart tourism initiatives. One major challenge is ensuring that destinations are prepared for transformation, as many initiatives face setbacks and limited success [5], [12]. These efforts typically involve the early identification of readiness factors to support project sustainability. Another challenge is the underdevelopment of comprehensive evaluation systems for managing smart tourism destinations [12]. Technological, organizational, and environmental readiness influence the adoption of IT, according to the TOE theory [46]. While this theory has been applied in various contexts, smart tourism evaluation models often contain overlapping dimensions (Table 2) and lack comprehensive coverage from a TOE perspective.

This research extracted key readiness dimensions from existing evaluation models to address these gaps and create a more comprehensive framework. These dimensions can serve as the foundation for measurement tools that include destination readiness indicators, which future studies should further analyze and refine.

TABLE 2. EVALUATION METHOD IN TOURISM

| Evaluation Model | Description | Type | Dimension |
|---|---|---|---|
| **Smart Destination Progress Indicator System** [12] | A system of indicators for smart tourism destinations is essential for gaining a clearer understanding of the current status of various destinations in the process of implementing smart tourism policies. | Measurement Model | • Governance<br>• Sustainability<br>• Innovation<br>• Accessibility<br>• Connectivity<br>• Intelligence<br>• Online Marketing<br>• Evolution of tourism activity |
| **Indicators of Smart Coastal Destinations** [11] | System of smart coastal destination indicators (SD-Coast): Design that measures the level achieved by a destination | Measurement Model | • Smart Governance<br>• Smart Business<br>• Universal Access<br>• Smart Environment<br>• Smart Technology<br>• Smart Innovation |
| **Model Capability Maturity Model** [5] | Capability maturity model for smart tourism governance | Maturity Model | • Governing Smart Tourism<br>• Managing Data and Tourism Resources<br>• Managing the Infrastructure and Services<br>• Fostering Public Tourism Awareness<br>• Facilitating Co-Creation<br>• Realizing the Tourism Value |
| **Smart Tourism Maturity** [13] | Diagnosing smart tourism maturity | Maturity Model | • Culture<br>• Connectivity and Controlling<br>• Customer Relationship<br>• Communication<br>• Commercialization<br>• Customer Experience |
| **Sustainable Tourism Indicators**[47] | Sustainable tourism indicator for conventional tourism | Measurement Model | • Sustainable Management<br>• Socioeconomic Sustainability |

| Evaluation Model | Description | Type | Dimension |
|---|---|---|---|
| | | | • Cultural Sustainability<br>• Environmental Sustainability |
| **Competitive Tourism Indicator** [2], [48] | Travel & tourism development index for conventional tourism | Measurement Model | • Business Environment<br>• Safety and Security<br>• Health and Hygiene<br>• Human Resources and Labor Market<br>• ICT Readiness<br>• Prioritization of Travel and Tourism<br>• International Openness<br>• Price Competitiveness<br>• Air Transport<br>• Infrastructure<br>• Ground and Port Infrastructure<br>• Tourist Service Infrastructure<br>• Natural Resources<br>• Cultural Resources<br>• Non-Leisure Resources<br>• Environmental Sustainability<br>• Socioeconomic Resilience and Conditions<br>• Travel and Tourism<br>• Demand Pressure and Impact |

## III. RESEARCH METHOD

This research aimed to identify the dimensions necessary for assessing the readiness of smart tourism destinations. The study employed an explanatory mixed-method approach [49] preceded by data collection using the PRISMA method. A mixed-method approach ensures a study's comprehensiveness by using quantitative and qualitative procedures together rather than individually [50]. The explanatory mixed-method is a type of mixed-method approach that sequentially combines quantitative and qualitative methods, where the quantitative method analyzes data, followed by the qualitative method, which further explores and deepens the quantitative findings [50], as reflected in the research process undertaken in this study. This research begins with a quantitative phase that implements natural language processing (NLP) in a descriptive comparative analysis of existing dimensions, aiming to identify these dimensions. The NLP approach utilizes text clustering to generate dimension groupings to minimize subjectivity in dimension comparison and provide objective recommendations for grouping. The subsequent phase validates the dimensions qualitatively. The dimension groupings from the earlier phase are checked in two steps: first, by talking to experts who are involved, and second, by linking these dimensions to IT governance parts using the COBIT 2019 and ITIL 4 frameworks. We design the expert interviews to identify the dimensions that influence smart tourism readiness, drawing on the grouping from the previous stage. The identified dimensions are then connected to IT governance components to make sure they match the key parts needed for managing an IT-based system. Figure 1 illustrates the flowchart of the research method.

### A. Data Collection

Using the PRISMA method [51], [52], [53], the data collection process involved a systematic literature review using the PRISMA method to identify the key dimensions of smart tourism readiness. The PRISMA method comprises multiple steps: identification, screening, eligibility, and inclusion. All relevant research from multiple databases was classified using specific query methods in the identification step. Furthermore, duplicate results were reviewed in the screening step to eliminate irrelevant titles and abstracts based on predefined eligibility criteria. Each full-text article was examined in the eligibility step to confirm inclusion or exclusion. Finally, we extracted the included research with a specific focus in mind. Data sources included peer-reviewed journals and government regulations focusing on smart tourism evaluation models. The final dataset comprised 47 dimensions extracted from six established evaluation models, covering various aspects, as shown in Table 2. Table 3 shows an example of some conceptual definitions of the defined dimensions as raw data, which will be clustered during the study.

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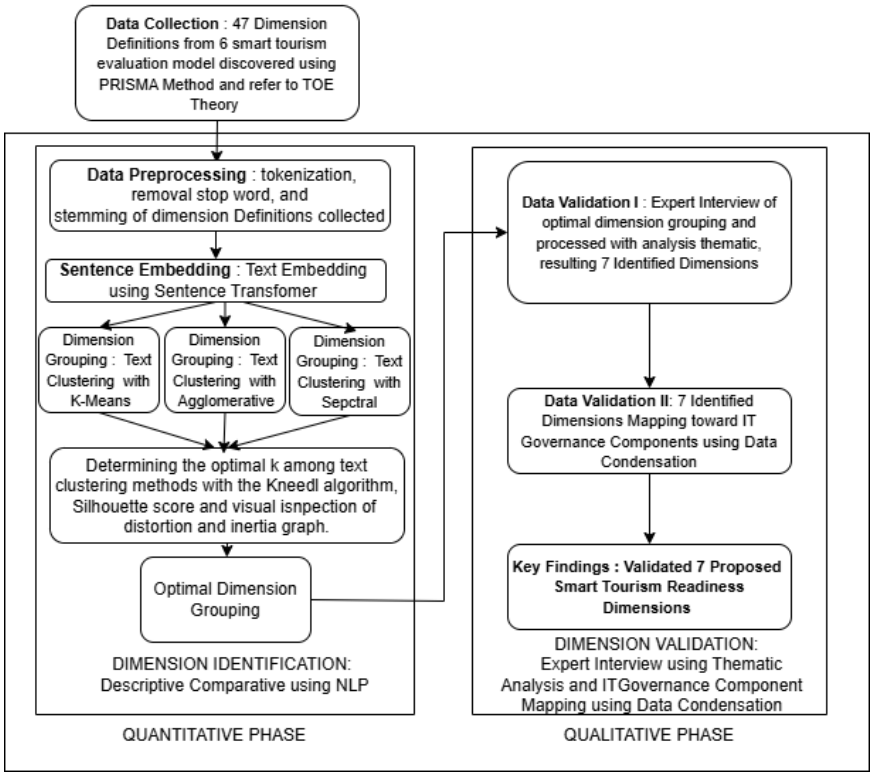


*Figure 1. Research Method using Explanatory Mixed-Method*

TABLE 3. ILLUSTRATION OF DIMENSION CONCEPTUAL DEFINITION AS RAW DATA

| Code | Dimension | Conceptual Definition |
|---|---|---|
| **A1** | **Governance** | Governance refers to the management, coordination, and decision-making processes involved in the development and implementation of smart destination initiatives. It encompasses the organizational structures, policies, and processes that guide collaboration, stakeholder engagement, policy development, decision-making, performance monitoring, and capacity building in the context of smart destinations. Effective governance ensures effective coordination, collaboration, and accountability among stakeholders, leading to more efficient and sustainable development and management of smart tourism initiatives. |
| **A2** | **Sustainability** | Sustainability refers to the principle of achieving sustainable tourism development through managing and developing the destination in a way that balances the needs of the environment, the local community, and the tourism industry. The goal includes minimizing negative impacts on the environment, preserving cultural heritage and local traditions, promoting social and economic benefits for the local community, and ensuring the long-term viability of the destination for future generations. Sustainability in tourism destinations involves practices such as responsible resource management, waste reduction, conservation of natural and cultural assets, community engagement and empowerment, and equitable distribution of economic benefits. It aims to create a positive and harmonious relationship between tourism development and the natural and cultural resources of the destination. |
| **A3** | **Accessibility** | Accessibility refers to the degree to which a destination and its tourism resources and services are accessible and inclusive for all individuals, including those with disabilities. It focuses on ensuring that people with disabilities have equal opportunities to access and enjoy the destination's attractions, facilities, and information. The document outlines several indicators related to accessibility, including the accessibility of tourism resources and attractions, information services adapted to the needs of people with disabilities, compliance with web accessibility standards, initiatives for promoting accessible tourism, dynamic information about tourism resources and accessible services, and the adaptation of the public transportation system to the needs of people with disabilities. Overall, accessibility in the document emphasizes the importance of physical accessibility, inclusive information services, compliance with web accessibility standards, promotion of accessible tourism initiatives, and the provision of accessible public transportation systems. |

### B. Dimension Identification: Descriptive Comparative Analysis Using NLP

Descriptive comparative analysis applies analytical methods to compare distinct or grouped objects, even in scenarios that exceed human cognitive capabilities. This method forms the basis for a specific type of comparative intellectual analysis, which relies on natural human intelligence and logical reasoning [54]. Descriptive comparative analysis examines a set of objects to identify the extent of similarities and dissimilarities without analyzing their relationships [55].

This research utilized descriptive comparative analysis to explore various dimensions derived from multiple tourism evaluation models. Many dimensions had similar names but different meanings, and vice versa. To solve this problem, descriptive comparative analysis grouped dimensions that had similar meanings, making them potential candidates for specific readiness dimensions.

NLP was used to perform a descriptive comparative analysis of the conceptual dimension definitions using a text clustering method to minimize research subjectivity. he potential for human intelligence to introduce errors during qualitative comparisons justified this approach [56].

NLP, a branch of artificial intelligence (AI), focuses on the interaction between computers and human language. It enables computers to understand, interpret, and generate text or speech in a natural language format. Advancements in NLP have significantly enhanced the development of various applications, including chatbots, translation systems, sentiment analysis tools, and information retrieval mechanisms [56]. However, to ensure high-quality NLP outcomes, essential text preprocessing steps must be performed in related activities [57]. This research uses text processing on 47-dimensional conceptual definitions from the data, which includes breaking the text into smaller parts, removing common words, shortening words to their basic forms, and creating sentence embeddings. Tokenization breaks text data into manageable units, whereas stopword removal and stemming eliminate unnecessary words and convert them to their root forms. Sentence embedding utilizes a sentence transformer to convert each text into compact vector representations that encode the semantic meaning of the sentences. This capability enables various NLP tasks, including measuring similarity, clustering, categorization, and information retrieval [58].

### C. Text Clustering for Dimensional Grouping

As previously mentioned, this study employs descriptive comparative analysis to group dimensions with similar conceptual definitions using NLP. Text clustering was used to create dimension groupings from various tourism evaluation models. We applied multiple text clustering algorithms, including agglomerative, k-means, and spectral clustering [59], [60], [61]. These algorithms represent different methods, such as partitioning (k-means), hierarchical approaches (agglomerative), and graph-based concepts (spectral clustering) [57]. The characteristics and size of the data influenced the selection of these three algorithms. The dataset comprises comprehensive conceptual definitions of the tourism and smart tourism evaluation model dimensions. Despite its limited size, the dataset demonstrates high dimensionality. Furthermore, it is complex due to overlapping aspects across different dimensions. Although the number of clusters was not predetermined, it was estimated by referencing the range of dimensions in the evaluation models, which varied between 4 and 19 clusters (Table 2). No clustering algorithm perfectly matches the criteria of the research dataset; thus, the choice of clustering algorithms was made based on their complementary strengths in handling textual data and uncovering meaningful patterns. Table 4 outlines the dataset characteristics that are optimal for clustering using the selected clustering algorithms.

TABLE 4. TEXT CLUSTERING ALGORITHM COMPARISON

| Dataset Characteristic | K-Means | Agglomerative | Spectra |
|---|---|---|---|
| **High Dimensional** | Optimal | Optimal | Optimal |
| **Structure Complexity** | Less Optimal | Optimal | Optimal |
| **Determination of the Number of Clusters** | Yes | No | Yes |
| **Scalability** | High | Low | Low |

The next challenge is to determine the optimal number of clusters. Since multiple clustering algorithms generate different combinations of dimensions, a standardized technique is required to identify the optimal number of clusters across these algorithms. To reduce potential bias in determining the optimal *k*, this study employs several metrics, such as the elbow method [57] using the *Kneedle* algorithm[62], the Silhouette score[63], and visual inspection of the elbow point in the graphs of distortion and inertia [64]. Another challenge that arises after selecting the optimal number of clusters is validating the formed clusters, given the dataset's complex structure and overlapping aspects. Therefore, a qualitative review by experts is required, as further explained in the next section. The next section elaborates on the text clustering algorithms and the methods used to determine the optimal number of clusters for dimensional grouping.

#### 1) AGGLOMERATIVE CLUSTERING

NLP uses agglomerative clustering, a hierarchical method, to group similar textual data into clusters. The algorithm incrementally constructs these clusters, starting at the lowest level, where each data point is initially treated as an individual cluster. It then iteratively merges the two closest clusters based on a defined distance or similarity measure. This merging process continues until all data points are combined into a single cluster, forming a hierarchical structure. The number of final clusters is determined by the

user, who cuts the hierarchical tree at an appropriate level to achieve the desired grouping [57].

The distance $D(A, B)$ between two clusters $A$ and $B$ is defined by Formula (1), where $dist(\bar{a}, \bar{b})$ represents the Euclidean distance between the centroids $\bar{a}$ and $\bar{b}$ of the clusters, as shown in Formula (2). These formulas are essential for quantifying the similarity between clusters and guiding the merging decisions during the clustering process.

$$D(A,B) = \frac{|A|.\ |B|}{|A| + |B|}\ .\ dist(\bar{a},\ \bar{b})^2 \tag{1}$$

$$dist(\bar{a}, \bar{b}) = \sqrt{\sum(\ a_i\ -\ b_i)^2} \tag{2}$$

### 2) K-MEANS CLUSTERING

In the *k*-means algorithm, the centroid represents the mean position of the points within a cluster. Initially, *k* points are randomly selected from dataset *D* to serve as the initial cluster centers. Each remaining data point is then assigned to the cluster with the nearest centroid, measured using the Euclidean distance, as defined in Formula (3). The algorithm repeatedly improves the clustering by updating the cluster centers based on the data points assigned in the final round, trying to reduce the differences within each cluster. Formula (4) shows that the recalculated centroids serve as new cluster centers, reassigning data points as necessary. This process continues until the clusters stabilize, as indicated by consistent cluster assignments across successive iterations [57].

$$dist(x_i, \mu_k) = \sqrt{\sum_{j=1}^{n}\left(x_{ij\ -}\ \mu_{ij}\right)^2} \tag{3}$$

$$\mu_k = \frac{1}{|C_k|}\ \sum_{x_i \in C_k} x_i \tag{4}$$

where:
$x_i$ is the *i*-th data point,
$\mu_k$ is the centroid of cluster *k*,
*n* is the number of dimensions (features) in the dataset,
$C_k$ is the set of all points assigned to cluster *k,*
$|C_k|$ is the number of points in cluster *k.*

### 3) SPECTRAL CLUSTERING

Developed and widely implemented as a clustering technique, spectral clustering is a method for grouping documents [65]. This algorithm uses the eigenvectors of the similarity matrix derived from the text data to reduce dimensionality before the clustering process. The algorithm comprises several steps:

- Build the text similarity matrix *A*, where $A_{ij}$ is the similarity score between texts *i* and *j* using any text similarity algorithm.
- Calculate the unnormalized Laplacian matrix using Formula (5).

$$LM = D - A \tag{5}$$

where:
*LM* is the Laplacian matrix,
*D* is the diagonal matrix of A,
*A* is the similarity matrix.

- Calculate the eigenvalues of the Laplacian matrix using Formula (6).

$$LM\ u_i = \lambda_i\ u_i \tag{6}$$

where for each *i*:
$\lambda_i$ is the eigenvalue,
$u_i$ is the corresponding eigenvector.

- Use the clustering algorithm in Formula (7) to group the data into $\{C_1, C_2, \ldots, C_n\}$.

$$\min_{C} \sum_{i=1}^{n} \left\| u_{i-\ \mu_{c(i)}} \right\|^2 \tag{7}$$

where:
*C* is the cluster assignment,
$\mu c(i)$ is the centroid of cluster *c(i)*.

### D. Determining the Optimal Number of Clusters

To determine the optimal number of clusters for each clustering algorithm, we applied several metrics to reduce the potential bias of the result. For each value of k generated by the three text clustering algorithms, we find the best k using three approaches: (1) the elbow method with the Kneedle algorithm looking at inertia and distortion values, (2) the Silhouette score, and (3) checking the elbow point on the inertia and distortion graphs visually. We then compare the results from these methods to decide the final optimal k. The following presents further discussion of each metric used.

The *Kneedl* algorithm is one metric used to automatically identify the elbow point as the optimal number of clusters, in clustering algorithm. In the *Kneedl* algorithm, the squared Euclidean distance between each point on the elbow graph and a straight line connecting the graph's endpoints is calculated. The point with the maximum distance is identified as the optimal elbow point [62]. The following steps illustrate the Kneedl algorithm:

1. Normalize *x* and *y* to the [0,1] range into *x'* and *y'*, where *x* is k and *y* is the inertia/distortion value
2. Calculate the ideal curve: $y = 1 - x'$
3. Calculate *s(x')*, which is the difference between the actual y′ and the ideal curve:
$$s(x') = (1 - x') - y' \tag{8}$$
4. The elbow point is the maximum value of *s(x')*.

The Silhouette score is a commonly used metric for identifying the optimal number of clusters. A higher Silhouette score suggests better clustering

performance[66]. In (9) [66], the formula for the Silhouette score appears.

$$s(i) = \frac{b(i) - a(i)}{\max(a(i), b(i))} \quad (9)$$

For each data point *i*:

*a(i)* is the average distance between i and all other points within the same cluster (cohesion).

*b(i)* is the average distance between i and all points in the nearest different cluster (separation).

Distortion (WCSS) measures the average squared distances from each data point to its cluster centroid, assessing how far the data points are from the center of their respective cluster [57]. The distortion formula is shown in (10).

$$Distortion = \frac{1}{n}\sum_{i=1}^{n} \left\| x_{i-\,\mu_{c(i)}} \right\|^2 \quad (10)$$

where:

$n$ is the number of data points in the dataset,

$x_i$ is the *i-th* data point,

$\mu_{c(i)}$ is the centroid of the cluster *c(i),*

$||x_i - \mu_{c(i)}||^2$ is the shared Euclidean distance between $x_i$ and its centroid $\mu_{c(i)}$.

The total squared distance between each data point and its closest cluster centroid is known as inertia, as shown in Formula (11). The lower inertia indicates that the clustering algorithm effectively minimizes the distances between data points and their respective centroids. The result suggests that the clusters are more compact and well-defined.

To determine the best clustering result, the distortion and inertia values for the optimal *k* in each clustering algorithm were compared. Smaller values indicate a higher degree of clustering accuracy, as they reflect minimized distances between data points and their cluster centroids.

$$Inertia = \sum_{i=1}^{n}\sum_{j=1}^{k} 1 \cdot (data\ point\ i \in cluster\ j).\|x_i - \mu_j\|^2 \quad (11)$$

where:

$n$ is the total number of data points,

$k$ is the number of clusters,

$x_i$ is the data point *i,*

$\mu_j$ is the centroid of cluster *j,*

$||x_i - \mu_k||^2$ is the squared Euclidean distance between data point $x_i$ and centroid $\mu_j$,

1• is the indicator function, which equals 1 if data point $x_i$ belongs to cluster *j*; otherwise, it equals 0.

### *E. Dimension Validation I: Expert Interview using Thematic Analysis*

Two sequential processes validated the dimensions. We figured out the dimensions needed for smart tourism destinations by analyzing themes from expert interviews and compared them with IT governance parts from two well-known frameworks, which helped us assess how the adoption process works in different areas.

Experts validated the results of the dimensional extraction from the quantitative method qualitatively through interviews, which we then evaluated using thematic analysis.

We utilized Atlas.ti as a qualitative analysis tool and focused the validation process on expert participation, primarily from tourism stakeholders. The use of multiple informants is believed to enhance research validity. However, this approach presents challenges in selecting suitable informants, assessing consensus, and aggregating responses [67], [68]. These challenges make informant quality even more crucial for accurate judgment and reliable data collection [69], [70]. This study involves three key informants holding strategic positions in the tourism sector with over five years [71], aligning with research suggesting an optimal informant number between 2 and 5[67]. To strengthen the validation results, the informants' validation findings are further validated through a mapping process against the best practice framework of IT governance.

The experts held strategic positions, serving either as tourism regulator, facilitator, or operator. The panel of experts proposed a conceptual definition for the dimensional clusters, which formed the foundation for the validation process. We asked each expert to evaluate the naming conventions. The interview process was both focused and flexible, allowing participants to share their insights and viewpoints concerning the phenomenon [72].

We obtained the desired information based on the transcribed data patterns by conducting thematic analysis of the interview results [73]. Figure 2 illustrates the diverse stages of thematic analysis [74]. Atlas.ti, a qualitative data analysis software, facilitated the completion of all related processes.

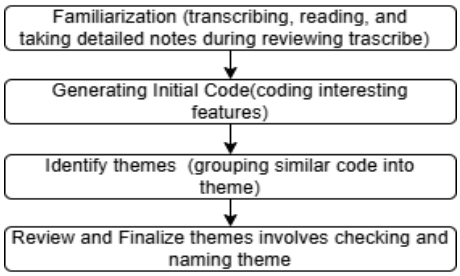


*Figure 2. Analysis of the Thematic Process*

### *F. Dimension Validation II: Mapping Dimensions into IT Governance Components Using Data Condensation*

The next step involves validating the identified smart tourism destination readiness dimensions from the previous stage by referring to IT governance components of the best practices framework in IT Governance. COBIT 2019 and

ITIL 4 are the most widely recognized IT governance frameworks currently employed across diverse industries. The fulfillment of IT governance components can ensure that the utilization of information technology aligns with the organization's business objectives through regulation and control based on standardized structures, processes, and best practices. Therefore, validation at this stage is essential to ensure that the identified dimensions of smart tourism destination readiness adequately cover the IT governance components from well-known best practice frameworks to support the achievement of smart tourism destination objectives. IT governance components of ITIL 4 address four service management dimensions. Managing the IT service lifecycle is its main focus. These dimensions include organization and people, technology and information, supplier and partner, and process and value streams [75]. Additionally, the seven components of COBIT 2019—processes; organizational structures; principles, policies, and framework; information; culture, ethics, and behavior; people, skills, and competencies; and services, infrastructure, and applications—provide extensive guidance for managing risk and ensuring compliance [76]. This framework offers comprehensive guidance for achieving IT governance objectives.

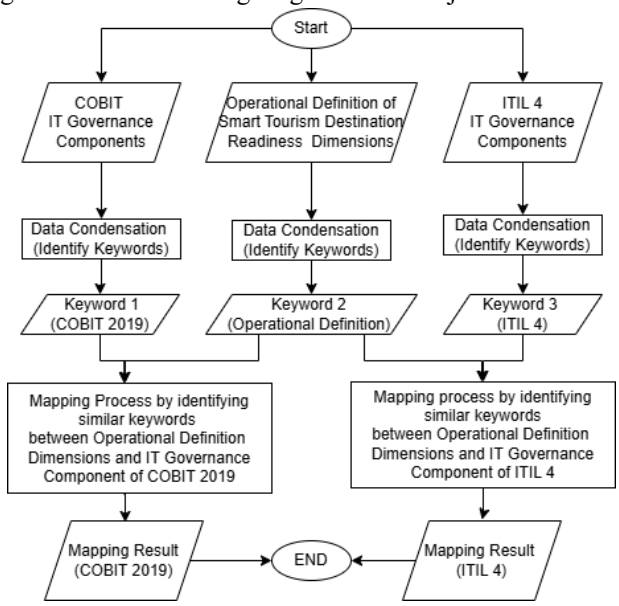


*Figure 3. Flowchart of Mapping Process with Data Condensation*

The IT governance components of COBIT 2019 and ITIL 4 were mapped to these dimensions based on their operational definitions using a data condensation approach, as shown in Figure 3. Data condensation entails selecting, focusing, simplifying, abstracting, and transforming written data, including field notes, documents, and other empirical materials. This method was applied to the definitions of IT governance components from COBIT 2019 and ITIL 4, as well as the operational definitions of the seven identified dimensions, by selecting relevant keywords. Simplifying or adjusting terminology occurred to standardize terms with the same meaning but different wording. Once standardized, the keywords from the IT governance components were mapped to the keywords in the operational dimensions. IT governance components were considered related to a specific readiness dimension if they shared common keywords.

The mapping process established the basis for ensuring that every element of IT governance aligns with the readiness dimensions of smart tourist destinations. Consequently, efficiently regulating IT implementation in these areas supports the achievement of defined objectives [77].

## IV. RESULTS AND ANALYSIS

### A. OVERVIEW OF KEY RESULTS

The findings highlighted key factors influencing a destination's readiness to transition to a smart tourism destination. These dimensions were examined using an explanatory mixed-method approach, following the steps outlined in Figure 1.

#### 1) DATA COLLECTION

The data from several tourism-related evaluation procedures were collected using the PRISMA method. The data collection process identified 47 dimensions derived from six evaluation models related to tourism and smart tourism.

#### 2) QUANTITATIVE PHASE

During the quantitative phase, a descriptive comparative analysis was conducted on 47 conceptual definitions of dimensions to generate dimensional groupings. NLP-based text clustering was employed for analysis, minimizing the need for manual intervention in the grouping process. Accordingly, data preprocessing was applied before clustering, using several text clustering algorithms, namely k-means, agglomerative clustering, and spectral clustering. The resulting groupings were then analyzed using several metrics to determine the optimal number of clusters, such as the Kneedl algorithm, Silhouette score, and visual inspection of elbow point in the inertia and distortion graph. This quantitative phase resulted in ten-dimensional groups, each representing a factor influencing smart tourism destination readiness.

#### 3) QUALITATIVE PHASE

During the qualitative phase, these dimensional groups underwent two sequential data validations. The first involved seeking expert opinions to determine a destination's readiness to become a smart tourism destination based on these groups. These results then underwent thematic analysis using Atlas.ti software, consolidating the ten-dimensional groups into seven dimensions of smart tourism readiness: governance, accessibility, online tourism service, smart technology, innovative culture, sustainability, and socioeconomic

factors. As the second validation stage, these dimensions were mapped to two widely used IT governance frameworks, COBIT 2019 and ITIL 4. The second validation aimed to ensure that each dimension aligns with IT governance components, enabling tourism destinations to manage technology and information effectively. The subsequent sections provide a detailed explanation of the results.

### B. DETAIL RESULTS

#### 1) DATA COLLECTION RESULTS

The PRISMA method, as illustrated in Figure 4 below, gathered various current evaluation models and readiness factors from secondary data. The identification step examined keywords such as smart tourism indicator, smart tourism maturity, or smart city readiness as criteria for selecting relevant materials in ScienceDirect and Emerald, yielding 304 relevant articles. After careful screening, 51 papers and six evaluation methods, comprising 47 dimensions, were selected as the research dataset, as shown in Table 2.

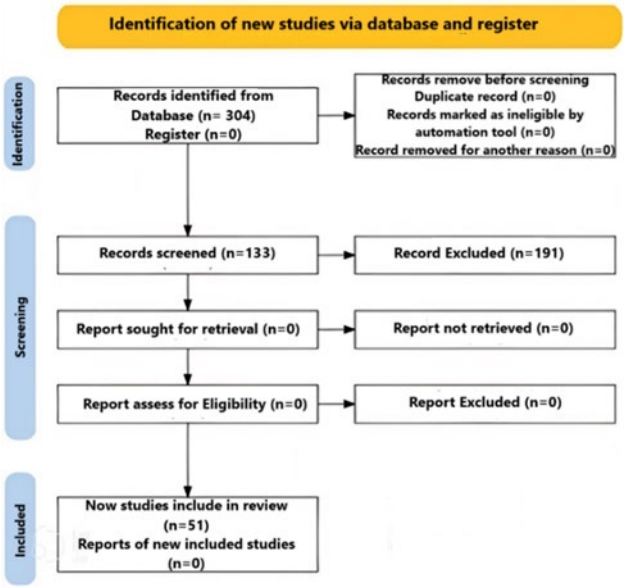


*Figure 4. Secondary Data Collection with the PRISMA Method*

The next step categorized the readiness factors from various papers into the three pillars of the TOE framework: technology, organization, and environment. This categorization was necessary due to the integration of smart tourism and the use of relevant infrastructure to enhance related services [78]. The Smart City Council defines the technological aspect of readiness to include factors such as instrumentation and control, connectivity, interoperability, data management and analytics, and security and privacy [14], [15], [79]. Several studies have focused on the technological aspects of smart tourism, such as accessibility, informativeness, interactivity, and personalization [80], [81]; security and privacy [17]; ICT infrastructure; mobile equipment; cloud computing services; end-user internet services; the Internet of Things; Wi-Fi coverage; and IS [82]. From an organizational perspective, smart tourism destinations involved assessing firms' readiness to manage related projects. Organizational readiness includes IT professionals, top management support, and a viable funding strategy [14]. Financial resources, regulatory policies, service quality levels, and a trained workforce all influence the development of smart tourism destinations organizationally [82]. The environmental aspect encompasses government support, IT investments, online social services, tourists' awareness of smart destination services, access to accurate and up-to-date information, innovation, security measures, a culture of welcoming tourists, and the availability of resources [82]. For government-led smart tourism initiatives, analyzing political, economic, and sociocultural dimensions is essential [10]. Table 5 presents the TOE framework and its influencing factors.

TABLE 5. FACTORS IN THE TOE ASPECT

| TOE Aspect | Code | Dimension | Reference |
|---|---|---|---|
| Environment | C4 | Investing in IT | [82] |
| | C11 | Online Social Services | |
| | C15 | Tourism Sector Innovation | |
| | C16 | Tourists' Security | |
| | C17 | Tourist Reception Culture | |
| | C19 | Tourist Resources | |
| | E1 | Political | [10] |
| | E2 | Economic | |
| | E3 | Socio Culture | |
| Organization | C1 | Financial Resources | [82] |
| | C2 | Developing Policies for Smart Tourism | |
| | C12 | Tourist Awareness of Smart Destination Services | |
| | C13 | Level of Service Quality | |
| | C18 | Trained Workforce | |
| | D1 | IT Professional Support | [14] |
| | D2 | Top Management Support | |
| Technology | SC1 | Instrumentation and Control | [79], [83], [84] |
| | SC2 | Connectivity | |
| | SC3 | Interoperability | |
| | SC4 | Data Management and Analytics | |
| | SC5 | Security and Privacy | |
| | C5 | ICT Infrastructure, Quality, and Reliability | [82] |
| | C6 | Role of the Mobile Equipment | |
| | C8 | Use of End-User Internet Services | |
| | C7 | Use of Cloud Computing Services | |
| | C20 | Information Systems | |
| | H2 | Informativeness | [85], [86] |
| | H3 | Interactivity | |
| | H4 | Personalization | |

Currently, researchers have developed only a limited number of evaluation systems for smart tourism [12]. Several regions in Spain have adopted these indicators for assessments, and Spain has established them as the official protocol for implementing smart tourism destinations [12]. The TOE theory addressed the factors constituting the organizational aspect. From a technological standpoint,

some evaluation systems fail to include data security and privacy factors [17]. Similarly, certain systems omit environmental factors such as political, economic, and sociocultural aspects [10], a welcoming tourism culture, and security [82]. The evaluation system also considers environmental and cultural sustainability and destination accessibility for all visitors, including individuals with disabilities. These factors must be considered when developing both conventional and smart tourism destinations [9].

Spain has developed a smart tourism evaluation system for its Mediterranean beach destinations [11]. According to TOE theory, this system may have limitations in facilitating security and privacy [17], particularly concerning the personalization of data or information [81], [87]. Furthermore, the organizational aspect must consider efforts to enhance service quality and train the workforce [82]. An analysis of the environmental aspect revealed that previous evaluation systems have not sufficiently considered many relevant factors. The evaluation currently takes into account political, economic, and sociocultural factors [10], tourist reception culture, security, and the commitment to maintaining the quality and reliability of ICT infrastructure [82]. In the current evaluation system, a sustainable environment and destination accessibility—within the context of inclusive infrastructure and a smart business ecosystem—are significant topics of discussion.

Japan has developed a maturity evaluation system [5] that utilized TOE theory in its research. However, several smart technologies were not explicitly reviewed, including mobile equipment, cloud computing, the Internet of Things (IoT), and end-user internet services [82]; interactivity[81], [87]; instrumentation and control; connectivity; interoperability; and security and privacy [14], [79], [84]. From an organizational perspective, financial resources must be addressed [82]. We have not discussed tourist security [81] or political, economic, and sociocultural factors [10] from an environmental perspective.

Switzerland has developed a maturity evaluation system for mountain destinations that addresses all technological aspects [13]. However, organizationally, there has been insufficient attention to enhancing service quality [82]. At the same time, several environmental aspects have not been adequately addressed, such as tourist security, reception culture, resources, and government support [82]. Additionally, the evaluation system has overlooked political, economic, and sociocultural factors [10].

Following programs initiated by the United Nations, two evaluation systems have served as references for several destinations in many countries. These systems include the competitive evaluation system/travel and tourism development index (TTDI) [2] and sustainability [47]. We applied TOE theory to both evaluation systems. From a technological perspective, the TTDI includes a pillar for ICT readiness, covering many technological aspects. However, this pillar does not explicitly address data management and analytics, security and privacy [14], [79], [84], or interactivity and personalization [81], [87]. In contrast, the sustainable tourism evaluation system does not cover technological aspects at all. From an organizational perspective, the TTDI does now address financial resources and service quality [82]. Meanwhile, the sustainable tourism evaluation system provides an overview of management and governance in these regions, focusing on destination management policies. Regarding environmental factors, the TTDI focuses on this aspect but does not explicitly address innovation in this sector or the culture of tourist reception. In contrast, the sustainable tourism evaluation system solely examines government [82], political, and economic support. Additionally, this system does not address socioeconomic, cultural, or [10] environmental sustainability issues.

Table 6 presents the findings from analyzing various evaluation systems using the TOE theory.

TABLE 6. ANALYSIS OF THE EVALUATION METHOD BASED ON THE TOE THEORY

| Evaluation Model | Uncovered TOE Aspect | Existing Factor |
|---|---|---|
| **Smart Destination Progress Indicator System** [12] | Technology: interactivity, security and privacy<br>Environment: politics, economy, socio culture, tourist reception culture, tourist security. | Sustainability, Accessibility (including for disable), Digital Marketing |
| **Indicators of Smart Coastal Destinations** [11] | Technology: security and privacy, personalization<br>Organization: level of service quality, trained workforce<br>Environment: politics, economy, social culture, tourist reception culture, tourist security, ICT infrastructure, quality and reliability | Sustainability, Accessibility (including for disable), Smart Business |
| **Model Capability Maturity Model**[5] | Technology: mobile equipment, cloud computing, IoT, end-user internet service, interactivity, instrumentation and control, connectivity, interoperability, security and privacy<br>Organization: financial resource<br>Environment: politics, economy, socio culture, tourist security. | Revenue Generation, Job Creation, Cultural Preservation, and Environmental Sustainability |
| **Smart Tourism Maturity** [13] | Organization: ICT infrastructure, quality, and reliability<br>Environment: tourists' security, tourist reception culture, tourist resource, government support, politics, economy, social culture | Digital Marketing |
| **Sustainable Tourism Indicators**[47] | Technology: mobile equipment, cloud computing, IoT, end-user internet service, interactivity, instrumentation and control, connectivity, interoperability, security and privacy<br>Organization: financial resource<br>Environment: politics, economy, socio culture, tourist security. | Sustainability |
| **Competitive Tourism Indicator** [2], [48] | Technology: data management and analysis, security and privacy, personalization, interactivity<br>Organization: financial resources, level of service quality<br>Environment: tourism sector innovation, tourists' reception culture | Environmental and Culture Sustainability, Government Support to Business |

The TOE framework, when analyzing several evaluation models, did not adequately address the political, economic, and sociocultural dimensions, including tourist security. However, one of the four models did consider tourist reception culture. Additionally, the TOE framework factors do not sufficiently cover sustainability-related issues. From an environmental and cultural perspective, the inclusivity of destination accessibility must consider the needs of all visitors, and digital marketing plays a key role in leveraging IT to promote tourism destinations. Therefore, the factors influencing readiness to implement smart tourism must be reformulated to comprehensively address various aspects of the TOE framework, enabling the evolution into smart tourism destinations.

### 2) RESULTS OF QUANTITATIVE PHASE (DIMENSION IDENTIFICATION): DESCRIPTIVE COMPARATIVE ANALYSIS USING NLP

As shown in Figure 1 (Research Methodology section), the quantitative step utilized an NLP approach to conduct a descriptive comparative analysis of 47 dimensions based on their respective conceptual definitions from the previous step. Examples of some conceptual definitions can be seen in Figure 2. The descriptive comparative analysis grouped the 47 dimensions according to their conceptual definitions using a text clustering algorithm. with each group representing a factor influencing smart tourism destinations' readiness.

Before clustering, data preprocessing was performed, including tokenization, stop-word removal, and stemming. Since the data consisted of text, which forms complex vectors when converted, sentence embedding was executed using a sentence transformer. Subsequently, clustering was conducted using three text clustering algorithms—K-Means, agglomerative, and Spectral clustering—with the number of clusters ($k$) ranging from 4 to 19. The lower and upper bounds of $k$ represent the minimum and maximum number of dimensions in the evaluation model (Table 2). The clustering algorithms were selected based on their complementary strengths in handling textual data and uncovering meaningful patterns, as no single clustering algorithm perfectly fits the research dataset criteria (see subsection B of the Research Methodology section). The following Table 7 presents some of the clustering results, specifically clusters 4 and 6 and their respective members.

TABLE 7. ILLUSTRATION OF CLUSTERING RESULTS FOR CLUSTER NUMBER 4 AND 6

| Dimensions | Source of the Evaluation Model | Cluster Number |
|---|---|---|
| **Governance** | Ivars, 2021 | 4 |
| **Smart Governance** | Robles, 2022 | 4 |
| **Governing Smart Tourism** | Lim, 2019 | 4 |
| **Facilitating Co-Creation** | Lim, 2019 | 4 |
| **Smart Environment** | Robles, 2022 | 6 |
| **Natural Resources** | TTDI, 2022 | 6 |
| **Environmental Sustainability** | TTDI, 2022 | 6 |
| **Sustainable Management** | GSTC, 2019 | 6 |
| **Environmental Sustainability** | GSTC, 2019 | 6 |

Several metrics are used to determine the optimal number of clusters (k optimal) to reduce potential bias of the result. For each k generated by the three text clustering algorithms, we check the best k using three approaches: (1) the elbow method with the *kneedl* function that looks at inertia and distortion values, (2) the silhouette score, and (3) looking at the elbow point in the graphs of inertia and distortion. We then analyze the results from these three metrics to select the final optimal k. Figure 5 and Figure 6 show the inertia and distortion graphs for different values of k, while Table 8 presents the final optimal k values calculated by each metric.

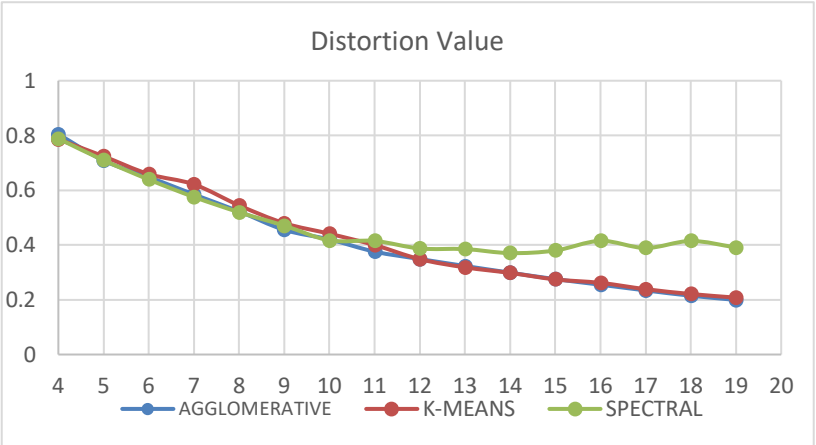


*Figure 5. Distortion Value of k*

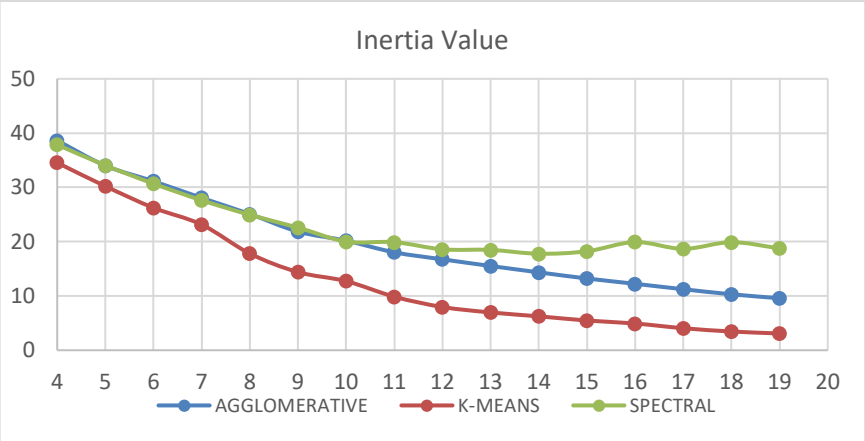


*Figure 6. Inertia Value of k*

TABLE 8. OPTIMAL K VALUES DETERMINED BY EVALUATION METRICS

| | Kneedl – Inertia | Kneedl – Distortion | K of Maximum Silhouette Score | Elbow Method based on Inertia | Elbow Method based on Distortion |
|---|---|---|---|---|---|
| **K-Means** | 11 | 12 | 13 | 12 | 12 |
| **Agglomerative** | 11 | 11 | 12 | 11 | 11 |
| **Spectral** | 10 | 10 | 10 | 10 | 10 |

Based on Table 8, the consistency between methods is evaluated to identify the most frequently occurring optimal k for each clustering algorithm. The K-Means algorithm shows consistency of 3 out of 5 methods (60%) at k=12, Agglomerative shows 4 out of 5 (80%) at k=11, while Spectral Clustering shows consistency with all methods (100%) at k=10. Considering the highest consistency, the optimal number of clusters is determined to be k=10, based on the results from the spectral clustering algorithm.

### 3) RESULTS OF THE QUALITATIVE PHASE

As explained in the overview, the qualitative phase aims to validate the results of dimension grouping at the optimal $k$ ($k$ = 10) obtained from the quantitative phase. This phase is executed using expert interviews analyzed through thematic analysis along with the second data validation, where the results from the first validation are then mapped against the IT governance components of COBIT 2019 and ITIL 4.

#### 1. RESULTS OF THEMATIC ANALYSIS OF EXPERT INTERVIEW: DATA VALIDATION 1

Considering the best clustering results using the k-means algorithm with optimal $k$ = 10, each cluster represented a candidate dimension, a factor influencing smart tourism destinations' readiness. This led to the adoption of a qualitative process to validate the cluster results by interviewing the experts. Thematic analysis was then used to examine the interview results to identify the factors influencing smart tourism readiness from the experts' perspectives based on the dimension grouping in the quantitative phase.

According to each expert's established criteria, the three sources were the president director of an agency under Indonesia's Ministry of Tourism and Creative Economy; the head of the Tourism Destination Working Team at the Department of Culture, Youth, and Sports; the Tourism Office of City Government *'Y'*, which serves as the area's regulator, facilitator, and coordinator; and the general manager of a tourist destination owned by a company under the Ministry of State-Owned Enterprises. These individuals were identified as Experts 1, 2, and 3.

In the interview session, we provided the experts with the optimal dimension grouping, and we asked them to assess whether each dimension group accurately represented a factor influencing smart tourism destination readiness. The experts could reorganize the clusters to ensure accuracy and were also responsible for proposing names for each suggested dimension grouping.

The interview results were processed using the thematic analysis method with the Atlas.ti application. Based on the discussion of the 10 clusters within the dimension groups, seven dominant factors were frequently cited by experts and recognized as dimensions influencing the readiness dimensions of smart tourism destinations, as shown in Figure 7: (1) governance, (2) sustainability, (3) online tourism service, (4) smart technology, (5) accessibility, (6) innovation culture, and (7) socioeconomic conditions. The dimension grouping performed by experts based on clustering results shows conformities. There are four clusters generated by text clustering that were identified by experts as conforming to the proposed dimensions, as

shown in Table 9. The data in the table indicates that the text clustering process helps experts identify dimension groupings that represent the dominant factors of smart tourism destination readiness.

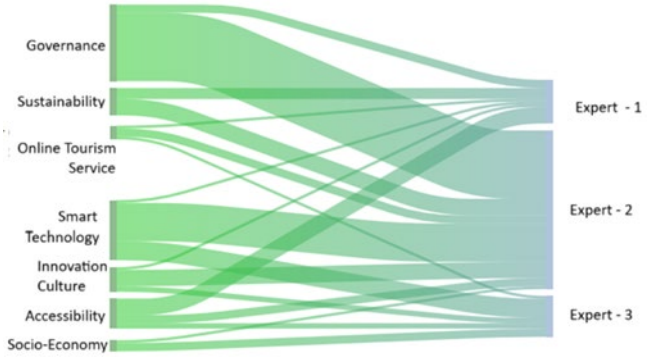


*Figure 7. Sankey Diagram of Frequently Cited Terms by Experts*

TABLE 9. CLUSTER VALIDATION RESULT

| Proposed Dimension by Expert | Dimension Clustering Number by Algorithm | Percentage of Conformity |
|---|---|---|
| **Governance** | **4** | **100%** |
| **Online Tourism Service** | **5** | **100%** |
| **Sustainability** | 6 | 50% |
| | 3 | 50% |
| **Accessibility** | 0 | 11% |
| | 2 | 34% |
| | 7 | 22% |
| | 8 | 11% |
| | 9 | 22% |
| **Smart Technology** | **8** | **100%** |
| **Sosio Economy** | 0 | 31% |
| | 1 | 38% |
| | 3 | 15% |
| | 6 | 8% |
| | 8 | 8% |
| **Innovation Culture** | **2** | **100%** |

The following presents an operational definition of smart tourism destination dimensions according to the results of the thematic analysis.

**Dimension 1: Governance**

The governance dimension is defined as a destination's readiness to achieve its objective by leveraging the support of smart technology. Ideally, a smart tourism destination has a responsible organization to oversee strategic planning policies, monitor financial resources [2], [11], [12], [47], and collaborate and coordinate with smart city authorities, which are essential for strategic development [14], [47], [88]. This organization also promotes collaboration between the public and private sectors. Governance refers to the efficient, transparent, and participatory management of tourist destinations using technology and data[5], [11], [12]. Therefore, IT management support [14] is also required to enable optimal planning and usage in the governance and operations of smart tourism destinations. Regarding TOE theory, establishing a governing body signifies organizational readiness to become a smart tourism destination.

**Dimension 2: Sustainability**

A major factor in sustainability readiness is the use of technology to balance the demands of local communities and the tourism industry. We achieved this objective by minimizing negative environmental impacts and preserving local culture for communities [11], [12], [47]. Utilizing technology and innovation to conserve the environment and culture, adapt to climate change, and manage natural resources through urban planning and waste reduction are key aspects of this dimension [11]. According to TOE theory, destinations must prepare these environmental aspects to become smart tourism destinations.

**Dimension 3: Online Tourism Service**

This dimension outlines a destination's readiness to offer tourism services using technology that benefits tourists and local residents. This category encompasses information and transaction services, promotional activities, communication strategies, and tourism product offerings. All these factors aim to enhance the visibility of the destination [12], [13]. Communication activities involve building strong customer relationships, understanding their needs and preferences, and utilizing technology to provide a seamless and personalized experience throughout their journey [13]. Additionally, this dimension requires integrated tourism product sales with dynamic pricing strategies [13] and general social services [74]. Furthermore, these objectives can be achieved through collaboration among stakeholders and full government support [14], [82], reflecting TOE theory's environmental aspect.

**Dimension 4: Smart Technology**

Smart technology refers to a destination's readiness to implement a three-stage technology-related process, comprising instrumentation, interconnection, and intelligence [8]. The instrumentation stage involves connecting real-world data sources through sensors, personal devices, social networks, and urban elements to facilitate meaningful usage [8]. Interconnection entails integrating data from various sources, systems, or organizations to create a collectively utilized database or information service [8]. The intelligence dimension involves collecting, evaluating, and interpreting data to generate valuable information that supports decision-making and destination performance [5], [8]. The ability to effectively manage tourism data aids in decision-making and planning, while data analysis allows for trend identification and service personalization [5], [12]. As part of the preparation for implementing smart technology, establishing measures to ensure data security and privacy

[17], along with the government's commitment to investing in IT [14], is essential. This dimension illustrates the technological readiness aspect of TOE theory.

**Dimension 5: Accessibility**
This dimension describes a destination's readiness to be easily accessible for all tourists, including those with physical, sensory, cognitive, or situational disabilities, ensuring an inclusive and barrier-free experience [11], [12], [73], [89], [90]. It encompasses the ability to provide and manage physical and technology-based infrastructure, as well as information, transportation, accommodation, destination, health, and security throughout all phases of tourism, including before, during, and after travel [91]. This dimension reflects TOE theory's environmental aspect.

**Dimension 6: Innovation Culture**
This dimension describes a destination's readiness. Smart tourism destinations encourage the involvement of digital experts as leaders in collaborative initiatives to develop business strategies and new ways to enhance efficiency and tourism experiences [12]. The presence of high-quality information technology education at the targeted destination [7], [12], [88], the successful scaling of startup businesses [88], and the availability of IT professional consultants [14] reflect this. The dimension also encompasses the environmental aspect of the theory of economic evolution.

**Dimension 7: Socioeconomic Conditions**
This dimension addresses the readiness and socioeconomic conditions of a destination in facing the implementation of smart tourism, as evidenced by interviews with informants who serve as tourism regulators [10]. Economic welfare tends to impact the development of human resources [22]. Various studies have indicated that the success of information technology-based programs, such as smart cities and tourism, largely depends on the quality of human resources [92], [93]. We assessed this social welfare from the perspectives of education, health, income, low unemployment rates, and high labor productivity [22], [7]. Additionally, social conditions such as environmental safety factors related to tourist safety [82], levels of hygiene and health [2], and quality of service [82] were also considered. This dimension represents the environmental aspect of TOE theory.

## 2. RESULTS OF IT GOVERNANCE COMPONENTS MAPPING USING CONDENSED DATA: DATA VALIDATION II

The smart tourism concept depends heavily on information technology to deliver high-quality IT services to stakeholders [22]. This aligns with the objectives of IT governance in ensuring the company's needs and IT implementation align to achieve its goals. To ensure governance, certain IT components must be fulfilled [76].

In Data Validation II, based on the data condensation process illustrated in Figure 3, the seven proposed dimensions are mapped onto the components of IT governance as outlined in ITIL 4 and COBIT 2019, ensuring the effective provision of related services in smart tourism destinations. The data condensation process involved identifying keywords from three groups of definitions. The first group was based on the seven operational definitions of the proposed dimensions. The second group was taken from the definitions of IT governance components in COBIT 2019, and the third group was derived from the definitions of IT governance components in ITIL 4. The mapping process involved looking at the keywords of the suggested dimensions and comparing them first with the IT governance components from COBIT 2019, and then with those from ITIL 4, which led to two sets of mappings shown in Table 10 and Table 11. An IT governance component was considered related to a spesific readiness dimension if they shared similar keyword.

TABLE 10. MAPPING RELATIONSHIP BETWEEN ITIL 4 IT GOVERNANCE COMPONENTS AND SMART TOURISM DESTINATION DIMENSIONS

| IT Governance Components VS STD Dimension | Organization and People | Information Technology | Partner and Supplier | Value Streams and Processes |
|---|---|---|---|---|
| Governance | √ | | √ | |
| Sustainability | | | | √ |
| Online Tourism Service | | | | √ |
| Smart Technology | | √ | | |
| Accessibility | | | | √ |
| Innovation Culture | | √ | | |
| Socioeconomy Condition | | | | √ |

TABLE 11. MAPPING RELATIONSHIP BETWEEN COBIT 2019 IT GOVERNANCE COMPONENTS AND SMART TOURISM DESTINATION DIMENSIONS

| IT Governance Components VS STD Dimension | Process | Organization Structure | Principles and Policies | Information | Culture and Behavior | People, Skills and Competencies | Service, Infrastructure, and Application |
|---|---|---|---|---|---|---|---|
| **Gover-nance** | √ | √ | √ | | | √ | |
| **Sustainability** | | | √ | √ | | | |
| **Online Tourism Service** | | | | √ | | | |
| **Smart Technology** | | | | √ | | | √ |
| **Accessibility** | | | | √ | | | √ |
| **Innovation Culture** | | | | | √ | | |
| **Socioeconomy Condition** | | | | | | √ | |

### *Mapping with ITIL 4*

- Organizations and People
  The organization is responsible for operationalizing smart tourism destinations through appropriate managerial processes. It adopts strategic planning for related projects and facilitates stakeholder collaboration in the managerial process [11], [12], [94].
- Information Technology
  Smart tourism is defined as the use of IT to assist management in enhancing the tourist experience [11], [13], [94], [95].
- Partners and Suppliers
  Stakeholder collaboration in providing relevant information and services contributes significantly to the success of smart tourism implementation [5], [12], [94]. The smart tourism destination ecosystem shapes this stakeholder collaboration.
- Value Streams and Processes
  Stakeholders provide exceptional experiences and business value to customers through co-creation activities. [96], [97].

### *Mapping with COBIT*

- Process
  Standard operating procedures are required for all business processes, from development initiatives to operational governance. This is especially true for implementing IT in all aspects of these destinations [11], [12], [98]. Utilizing IT to enhance the smart tourism environment leads to effective and systematic progress toward achieving the destination's objective.
- Structure Organization
  A formal institution responsible for coordinating the interests of different stakeholders within the tourist area is required [5], [11], [12]. This institution is represented by the presence of a destination management organization (DMO), which administers several functions, including mobilizing, matching, managing, sensing, shape-shifting, and stewardship [99].
- Principles, Policies, and Procedures
  To ensure the success of IT implementation, certain laws and regulations are enforced to monitor the management and governance process [76], [100]
- Information
  Various sources provide data, including all open data shared by stakeholders. Additionally, business intelligence implementation is essential for increasing information value and supporting operational and strategic decision-making [11], [12], [73].
- Culture, Ethics, and Behavior
  Culture involves the relationship between digital innovation and the skills present in tourism destinations [43]. This includes a destination's readiness and acceptance to adopt innovation and digitalization, as well as the presence of a strategic plan, budget allocation, resource distribution, and recruitment and training initiatives [11], [12], [13].
- People, Skills, and Competencies
  IT consultants or professionals must have strong ICT literacy [2], [12], [14]. Various studies have found that the success of information technology-based programs, such as smart cities and tourism, largely depends on the quality of human resources [92], [93]. Education, health, income, a low unemployment rate, and high worker productivity are key indicators of social welfare [7], [22].
- Service, Infrastructure, and Applications
  This refers to a destination's ability to provide and manage infrastructure digitally through applications that enhance tourism services in various ways [5], [11], [12]. This includes providing information, transportation, accommodation, destinations, health, and safety throughout all stages of the travel experience [91].

## V. DISCUSSION

The study of readiness dimensions highlights the multifaceted nature of smart tourism readiness. The findings underscore the need for an integrated approach that addresses both technical and non-technical factors, ensuring that smart tourism initiatives are inclusive, sustainable, and globally scalable.

Identifying seven dimensions—governance, sustainability, online tourism services, smart technology, accessibility, innovation culture, and socio-economic conditions—provides a comprehensive factor for preparing smart tourism readiness. The following explanation delves deeper into each dimension, exploring its implications and challenges.

**1. Governance:** This dimension plays a pivotal role in ensuring the strategic alignment and coordination of stakeholders in smart tourism initiatives. Effective governance includes clear regulatory frameworks, stakeholder engagement, and accountability mechanisms. The absence of these components often results in fragmented implementation efforts and resource inefficiencies. A key challenge in implementing this dimension is establishing an organization for managing smart tourism destinations to ensure effective governance. This organization would develop strategic plans, regulate policies, foster stakeholder collaboration, and oversee other essential functions.

**2. Sustainability:** This dimension ensures the long-term viability of tourism by addressing its environmental, cultural, and socioeconomic impacts. Tourism destination managers have widely practiced sustainability. In the context of smart tourism, integrating smart technology to achieve sustainable tourism is a key challenge that requires careful preparation.

**3. Online Tourism Services:** The rise of digital platforms has revolutionized tourism services, enabling real-time communication, personalized experiences, and integrated solutions for travelers. This study highlights how digital platforms can enhance service delivery. However, several challenges must be addressed, including digital literacy readiness and infrastructure preparedness.

**4. Smart Technology:** Integrating IoT, Big Data, and AI technologies facilitates real-time monitoring, predictive analytics, and automation in smart tourism. The study highlights the potential of these technologies to improve infrastructure management, reduce operational expenses, and enhance customer experiences. In addition to preparing for smart technology implementation, which includes a three-stage technology-related process, data security and privacy are significant challenges that must be carefully addressed.

**5. Accessibility:** In the context of smart tourism destinations, accessibility refers to both physical and digital inclusivity, ensuring that tourism destinations are accessible to all users, including those with disabilities. Policies promoting universal design standards and inclusive digital platforms can significantly improve smart tourism destinations' accessibility.

**6. Innovation Culture:** An innovation culture is essential for fostering creativity and embracing technological change. This dimension highlights the importance of education, training, and organizational openness in creating an environment conducive to innovation. Establishing innovation hubs, funding programs, and IT education initiatives can nurture an innovation-driven mindset among tourism stakeholders. Fostering an innovation culture poses a significant challenge for developing countries.

**7. Socioeconomic Conditions:** Socioeconomic factors, such as education, income stability, and community engagement, strongly influence a destination's readiness to become a smart tourism destination. Income level, community participation, safety concerns, and health and hygiene conditions can either deter or attract tourists and investors. Meeting these socioeconomic conditions is a critical challenge that must be addressed for a destination to transition to smart tourism, as they influence the implementation of other readiness dimensions.

In addition to the previously discussed implications, the following section examines how these dimensions align with or differ from existing literature and highlights their significance in the broader context of smart tourism research.

### *A. Alignment with Existing Literature*

1. **Governance:** The governance dimension refers to the structures and processes facilitating stakeholder collaboration in achieving destination objectives. This collaboration aims to address the needs of the tourism ecosystem by leveraging smart technology [10]. Therefore, governance activities, including strategic planning, stakeholder collaboration, and resource management, are crucial and aligned with existing studies that highlight the significance of governance in smart tourism. This dimension aligns with the studies conducted by [5], [11], [12], who highlighted these aspects in the evaluation models they developed.

2. **Sustainability:** the identification of sustainability as a critical dimension is based on its essential role in maintaining and preserving destinations, as established and globally practiced by TTDI [2], [48] and GSTC [47]. This dimension reflects a destination's efforts to take responsibility for the environmental, social, economic, and cultural impacts of tourism activities within the destination [47], [101] by leveraging smart technology. Numerous studies on smart tourism destinations frequently address this dimension. However, much of the emphasis has primarily been placed on environmental aspects, as seen in the smart tourism evaluation model [11], [12].

3. **Accessibility:** The accessibility dimension describes a destination easily accessible to all tourists, including visitors with physical, sensory, cognitive, or situational disabilities, to enjoy an inclusive and barrier-free experience [11], [12], [73], [89], [90]. This dimension encompasses the capacity to provide and manage physical or technology-based infrastructure. The majority of the literature on smart tourism destination frameworks incorporates this dimension, as also emphasized by [5], [11], [12], [13]
4. **Innovation Culture:** Smart tourism studies frequently mention innovation culture. IT governance component strengthens its explicit identification as a readiness dimension. This study emphasizes the role of IT

education, startup ecosystems, and professional consultants, which are discussed in existing models [5], [12], [13].

### B. Differences from Existing Literature

The study created several new aspects by reviewing existing research related to the Technology-Organization-Environment (TOE) framework, talking to important people, and connecting it with the IT Governance Framework. This approach distinguishes the proposed model from existing ones. The following section provides a detailed explanation:

1. **Online Tourism Services:** Unlike traditional frameworks that focus on offline services and infrastructure, this study highlights the importance of integrated online services, including personalized digital marketing, real-time communication, and e-commerce capabilities. Online tourism services reflect tourism's growing digitalization and differentiate this framework from earlier models.

2. **Smart Technology:** Smart technology is a ubiquitous technology platform implemented within a smart tourism context, which all stakeholders in the tourism ecosystem can utilize. Smart technology is often mentioned as an initial component of smart tourism in various frameworks, but there is limited discussion on how to prepare for its implementation. This study emphasizes the readiness of smart technology, particularly focusing on the implementation phases within smart cities, which include instrumentation, interconnection, and intelligence [8]. Additionally, how data is collected and processed for analytical purposes to support decision-making, as well as how data security and privacy are maintained, are crucial aspects of this study [14], [15], [17], [79].

3. **Socioeconomic:** As previously discussed, although socioeconomic factors are a part of the sustainability dimension as addressed in conventional tourism, they are often not thoroughly explored in the context of smart tourism [2], [47], [101]. In the context of smart tourism destinations, sustainability has predominantly focused on environmental and cultural aspects. However, the socioeconomic aspect plays a crucial role in the successful governance and management of tourism [10]. Expert interviews validate this finding within the context of Indonesian tourism. Consequently, socioeconomic status is a crucial dimension in developing smart tourism destinations. Key factors considered within the socioeconomic dimension include social welfare, as examined by education, healthcare, income levels, low unemployment rates, and high labor productivity [22], [7]. Furthermore, social conditions, including environmental safety factors concerning tourist safety [82], levels of hygiene, and health [2] should also be considered as essential aspects.

4. **Mapping to IT Governance Frameworks:** This study is distinct in its alignment with IT governance components such as COBIT 2019 and ITIL 4. In a corporate context, the **IT governance component** plays a crucial role in ensuring that information and technology effectively support the achievement of organizational goals. This principle serves as the basis for aligning all aspects of IT governance with the readiness dimensions of smart tourism destinations. Such alignment ensures that the implementation of information technology in tourism systems contributes to achieving the objectives of a smart tourism destination.

In conclusion, this study emphasizes a balanced approach that integrates strategic and operational considerations. From the strategic integration perspective, the governance dimension's role aligns with COBIT's objective of linking IT goals with business objectives. This ensures that smart tourism initiatives are not isolated technological projects but are integrated into broader destination management strategies. From an operational perspective, IT governance components represent the essential elements that must be prepared to enable effective governance and management of IT adoption in tourism businesses. Combining IT governance components with the suggested areas is a strategic move to create management and governance systems for destinations that use smart technology. This integration greatly affects smart tourism destinations by making sure that the organizations involved are ready with the right rules and policies, skilled stakeholders, a culture of innovation, prepared services and infrastructure, and the use of smart technology. The proposed dimensions, which serve as key findings of this study, comprehensively cover these aspects.

## VI. CONCLUSION

In conclusion, this study aimed to determine the factors that influence its readiness to become a smart tourism destination. Indonesia was selected as a case study due to its significant tourism potential, rapidly developing IT infrastructure that drives digital transformation across various sectors, and a promising pool of digital talent. These characteristics present valuable opportunities for implementing smart tourism initiatives. However, Indonesia's overall IT literacy among its population remains relatively low, presenting unique challenges in preparing for the implementation of a smart tourism destination. The goal was to explore a context where such readiness evaluations are critically needed. However, with appropriate adaptations, we can extend the methodology and findings to other countries and regions. While this study uses Indonesia as a reference point, the readiness factors are derived from the tourism literature, particularly research on smart tourism destinations. Furthermore, the validation process was conducted by aligning with established IT

governance frameworks, such as COBIT 2019 and ITIL 4, which are widely implemented globally. This approach enhances the generalizability of the study's recommendations to a broad range of stakeholders.

We adopted an explanatory mixed-method approach, starting with establishing a dimensional model through comparative analysis. This phase involved using quantitative methods and NLP. We applied clustering methods to facilitate comparative analysis, grouping dimensions with similar definitions into clusters. This approach minimized the subjectivity of the research and sources while comparing the dimensions and providing guidance for validating the extracted dimensions. The qualitative phase verified the clusters, yielding the dimensions. This phase involved analyzing the interviews using a thematic framework. During this dimension extraction process, we also considered factors from TOE theory that had not yet been addressed, leading to the formulation of several dimensions influencing readiness to become a smart tourism destination: (1) governance, (2) sustainability, (3) online tourism service, (4) smart Technology, (5) accessibility, (6) innovation culture, and (7) socioeconomic conditions.

We connected the seven readiness dimensions to two popular frameworks—ITIL 4 and COBIT 2019—to make sure that IT governance successfully provided related services to smart tourism destinations. The results demonstrated a proper mapping of all smart tourism readiness dimensions.

This research made a scientific contribution by providing insights into applying machine learning, specifically NLP with clustering methods, to aid comparative analysis. This method minimized the subjectivity of the research when comparing dimensions. We also conducted a qualitative validation of the NLP results using competent sources. The study addressed some gaps by identifying factors affecting a destination's readiness to become a smart tourism destination. The study grounded these factors in TOE theory and aligned them with the widely accepted IT governance components of ITIL 4 and COBIT 2019. Their combination allowed smart tourism to represent the implementation of IT technology within the sector. The practical contribution of this research offered insights into several crucial aspects of developing smart tourism destinations.

## VII. RESEARCH LIMITATIONS AND DIRECTIONS FOR FURTHER WORK

Despite its scientific and practical contributions to addressing gaps in its readiness to become a smart tourism destination, this research faced several limitations. The first limitation concerns the selection of informants, who were individuals holding strategic positions in organizations in Indonesia and possessing substantial experience in tourism. Future research should address this limitation by including informants from a broader geographic context to enhance the generalizability of the findings. The second limitation is that the study represents a preliminary step toward developing a smart tourism destination readiness measurement tool. Future work should focus on refining the identified dimensions into measurement indicators and developing a comprehensive readiness evaluation system for smart tourism destinations. The final limitation concerns the use of machine learning in addressing text clustering tasks. Recently, people have begun applying deep learning methods to complete tasks. A new area of study in deep learning looks at using Neural Architecture Search (NAS) to automatically create models based on neural networks, which has been successful in completing certain tasks[102], [103], including solving NLP problems[104]. Future work should explore the application of NAS in NLP to potentially achieve better clustering results [105].

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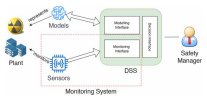


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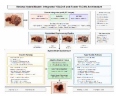

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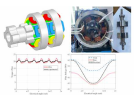

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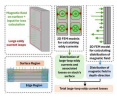

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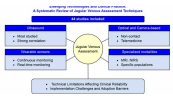

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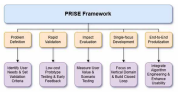


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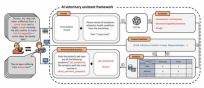

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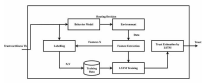

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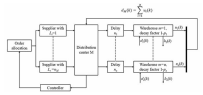

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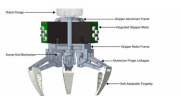

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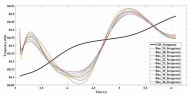

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Abstract HTML

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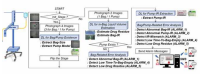

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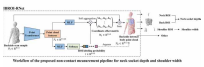

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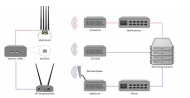

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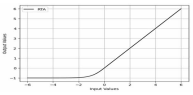

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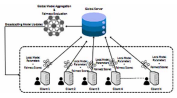

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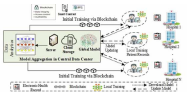

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**290**

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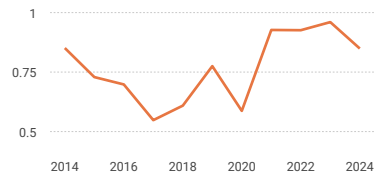
SJR

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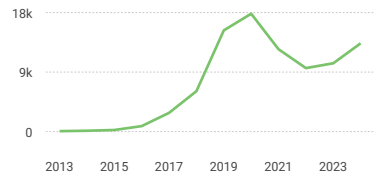


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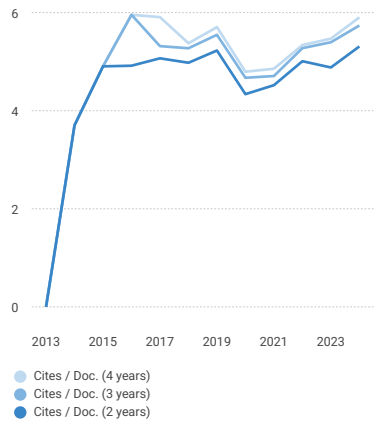


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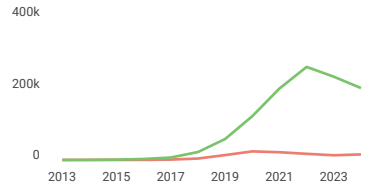


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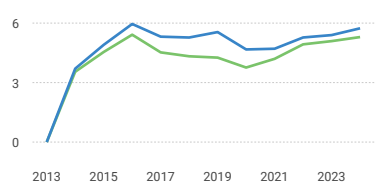
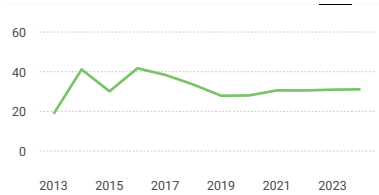



% International Collaboration

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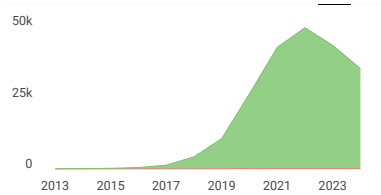


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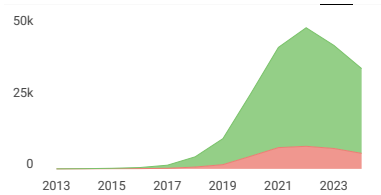


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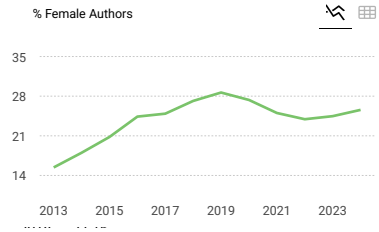
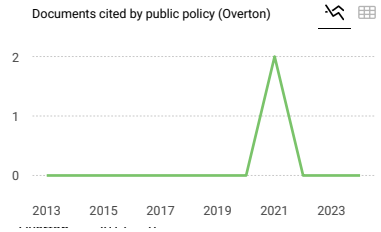
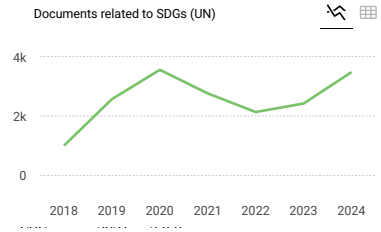



Documents cited by public policy (Overton)




Documents related to SDGs (UN)

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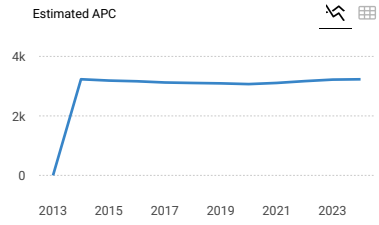


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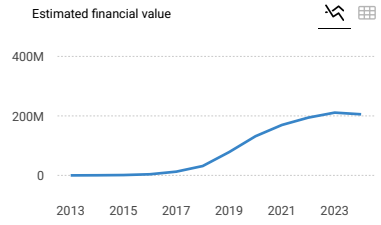



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M **Mohsen** 11 months ago

Greetings and respect
Is it possible for the author who is from Iran to print the article without paying the printing fee? It is almost impossible for us to pay this fee, but we would like the article to be published in Access Journal.

reply

SCImago Team

**Melanie Ortiz** 11 months ago

Dear Mohsen,
Thank you for contacting us.
We are sorry to tell you that SCImago Journal & Country Rank is not a journal. SJR is a portal with scientometric indicators of journals indexed in Elsevier/Scopus.
We suggest you visit the journal's homepage or contact the journal's editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

M **Mohammad Afzal** 11 months ago

Is IEEE Access is Q1 Journal?

reply

SCImago Team

**Melanie Ortiz** 11 months ago

Dear Mohammad, thank you very much for your request. You can consult that information just above. Best Regards, SCImago Team

F **Fadhil** 2 years ago

Is this Q1?

reply

J **Jaafar** 1 year ago

yes, it is Q1.

SCImago Team

**Melanie Ortiz** 2 years ago

Dear Fadhil, thank you very much for your request. You can consult that information just above. Best Regards, SCImago Team

M **MOUSSAID** 2 years ago

merci

reply

W **Wisal** 2 years ago

Dear Sir, good day
How much it cost publishing a paper in this journal? And is there a discount for authors from Iraq?

reply

SCImago Team

**Melanie Ortiz** 2 years ago

Dear Wisal,
Thank you for contacting us.
We suggest you visit the journal's homepage or contact the journal's editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

A **Ahmed** 3 years ago

Just i need to know the JIF

reply

SCImago Team

**Melanie Ortiz** 3 years ago

Dear Ahmed, thank you very much for your comment. SCImago Journal and Country Rank uses Scopus data, our impact indicator is the SJR. We suggest you consult the Journal Citation Report for other indicators (like Impact Factor) with a Web of Science data source. Best Regards, SCImago Team

M **Mostafa** 3 years ago

Hello,
I would like to kindly ask when the ranking of IEEE Access is available for 2021?
best regards,
Mostafa

reply

SCImago Team

**Melanie Ortiz** 3 years ago

Dear Mostafa,
Thank you for contacting us. Our data come from Scopus, they annually send us an update of the data. This update is sent to us around April / May every year. The SJR for 2020 was released on 17 May 2021. Therefore, the indicators for 2021 will be available in May/June 2022 and before that date we can´t know what will happen with this journal.
Best Regards, SCImago Team

U **Usama Khaled** 4 years ago

Dear Scopus team of IEEE Access journal
Regarding to our published paper:

Abderrahmane Beroual, Usama Khaled, Aassem AlGhamdi, "DC Breakdown Voltage of Synthetic

Ester Liquid-based Nanofluids", IEEE Access, vol. 8, pp. 125797-125805, July 2020.

You forgot to mention both affiliation of 2nd author in Scopus database while it's correct in Web of Science database.
Please add my second affiliation (Department of Electrical Engineering, Faculty of Energy Engineering, Aswan University, Sahary City 81528, Egypt) to correct this mistake as soon as possible.
Best regards
Usama Khaled

reply

SCImago Team

**Melanie Ortiz** 4 years ago

Dear Usama,
Thank you for contacting us.
We are sorry to tell you that SCImago Journal & Country Rank is not a journal. SJR is a portal with scientometric indicators of journals indexed in Elsevier/Scopus.
Unfortunately, we cannot help you with your request, we suggest you contact the journal's editorial staff , so they could inform you more deeply.
Best Regards, SCImago Team

M **MOHAMED** 4 years ago

Is any fees for publication in this journal?

reply

SCImago Team

**Melanie Ortiz** 4 years ago

Dear Mohamed,
Thank you for contacting us.
Unfortunately, we cannot help you with your request, we suggest you visit the journal's homepage.
Best Regards, SCImago Team

I **Imtithal** 5 years ago

Is it top 10

reply

SCImago Team

**Melanie Ortiz** 5 years ago

Dear Imtithal,
Thank you for contacting us.
We suggest you use the Journal Rankings Tool shown on our website.
Best Regards, SCImago Team

H **Hadiyanto** 5 years ago

How long, this journal had been included in scopus index? Is it ok a journal published thousand of pages in one issues?, I found some journal Q1 had been removed from scopus in short time. How can?. I am going to submit my article to this journal, but I am still doubt.

reply

SCImago Team

**Melanie Ortiz** 5 years ago

Dear Hadiyanto,
Thank you very much for your comment.
All the metadata have been provided by Scopus /Elsevier in their last update sent to SCImago, including the Coverage's period data. The SJR for 2019 was released on 11 June 2020. We suggest you consult the Scopus database directly to see the current index status as SJR is a static image of Scopus, which is changing every day.

For further information, please contact Scopus support: https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/
Best Regards, SCImago Team

G **Gimba Dogara** 5 years ago

Th request is not for publication.

reply

SCImago Team

**Melanie Ortiz** 5 years ago

Dear Gimba,
Could you please expand a little bit your comment? Best Regards, SCImago Team

D **Derek Abbott** 6 years ago

Dear Elena

Please add the subject category "Electrical

reply

SCImago Team

**Melanie Ortiz** 6 years ago

Dear Derek, SJR is a portal with scientometric indicators of journals indexed in Scopus. SJR has no authority over the data of the journals; they are the ones that Scopus sends us. The metadata are property of Scopus. SCImago has a signed agreement that limits our performance to the generation of scientometric indicators derived from the metadata sent in the last update. We suggest that you contact Scopus through this link to report the inconsistencies or modifications that you want to make in SCImago: https://service.elsevier.com/app/answers/detail/a_id/14883/kw/scimago/supporthub/scopus/. Best Regards, SCImago Team

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