Article

Sustainable and smart: Evaluating São Paulo's tourist resorts with the "DTI-BR Model"

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Abstract: This paper evaluates the Smart Tourism Destination indicators and Standards for Sustainable and Smart Cities applied in Tourist Resorts in São Paulo State, Brazil, through the "DTI-BR Model". This model selects the most suitable indicators for the Brazilian context, drawing on sources like SEGITTUR (the Spanish State-owned Company for the Management of Innovation and Tourism Technologies) and the Brazilian Technical Standards for Smart Cities. The study emphasizes the importance of using indicators to assess and standardize the evaluation of municipal tourism departments, highlighting their role in optimizing tourist resources, and underscores the necessity for tourist destinations to comprehend and integrate these indicators fully to improve service quality, environmental management, and the overall tourist experience. The process of standardizing these indicators not only allows for effective comparisons across various destinations but also aids in identifying and adopting best practices. This approach is poised to make significant contributions towards the sustainable development of tourism by promoting the conservation of both natural and cultural resources, alongside stimulating local economic growth. By understanding and implementing these indicators, tourist destinations can enhance the quality of their services, environmental management, and tourist experience. Moreover, standardizing indicators facilitates comparison across different destinations and the identification of best practices. This can significantly contribute to the sustainable development of tourism, promoting the conservation of natural and cultural resources, as well as boosting the local economy. Therefore, the adoption of Smart Tourism Destination indicators and standards for sustainable and smart cities is crucial for fostering responsible and high-quality tourism.

Keywords: smart tourism destinations; smart cities; DTI-BR model; indicators; SEGITTUR; sustainability

1. Introduction

The concept of a city has changed over time, with different terms and perspectives used to define urban evolution according to individual experiences. According to the number of inhabitants, a locality can be classified as a community with a population between 1000 and 2500 inhabitants; a city with a population between 10,000 and 1.5 million; and a mega-city with a population exceeding 1.5 million [1].

The Brazilian Institute of Geography and Statistics [2] uses a different classification for cities and municipalities: the municipality is an autonomous unit of the lower hierarchy within the political-administrative organization of Brazil. They are governed by organic laws and can create, organize, and suppress districts. The place where the town hall is located has the category of city, characterized by the urbanized part of the municipality.

A city is considered a complex system that includes physical and social components. These systems are evolving, using communication and data processing technologies that provide greater depth and scope to the innovation system, while at the same time making its functions more transparent and effective. As a result, the city gains greater capacity for innovation, which results in increased competitiveness and well-being [3].

The use of indicators helps public management to improve the efficiency of public services provided to the population, making it possible to evaluate Smart Cities (SC). Indicators can help make comparisons between cities, support integrated policies and decision-making, and monitor performance. In order to standardize, norms have been established for cities. The references in Brazil for these cities are the ABNT ISO 37120:2021 and ABNT ISO 37122:2020 standards [4,5].

These standards define and establish methodologies for a set of indicators related to sustainable development, with the aim of guiding and measuring the performance of urban services and quality of life [4]. In this context, tourist cities that include SC indicators integrate sustainability and technology into the phases of the tourism value chain as a strategy, create sustainable development based on local limitations and capacities, and enhance the insertion of technology into the entire value chain of the tourism destination [6,7].

The Ministry of Tourism defines a Smart Tourism Destination (STD) as an innovative and accessible tourist area, consolidated on a state-of-the-art technological infrastructure, which guarantees sustainable development and facilitates visitor interaction and integration with their surroundings, increasing the quality of their tourist experience at the destination. This concept was developed by the Spanish Sociedad Mercantil Estatal para la Gestión de la Innovación y las Tecnologías Turísticas (SEGITTUR) in 2013 and adapted by the Argentine Institute Ciudades Del Futuro [8].

The "DTI-BR Model" was created to help transform Brazilian tourism destinations, using the adaptation of the international STD indicators defined by SEGITTUR for Brazil and the ABNT standards related to smart and resilient cities [9].

For a municipality to be classified as a tourist resort it needs to have a consolidated tourism destination, have a permanent flow of visitors, have an emergency medical service, accommodation, and tourist information, and have less than two hundred thousand inhabitants. The resorts have infrastructure and services geared towards tourism, following specific legislation and prerequisites for qualification. There are 70 municipalities with this classification in São Paulo and they can be highlighted as tourist attractions. The tourism attraction needs to be for public use and of a permanent nature. Tourist resorts in the state of São Paulo are characterized by Law No. 1457/1977 and its Complementary Law No. 1261/2015 [10,11].

Tourist resorts, established by Law No. 1457/1977, must have historical, artistic, and religious attractions, as well as natural and scenic resources. The law also states that the guidelines for the process of verifying the requirements for the creation of tourist resorts will be defined in a regulation. The first resort to be established, according to this classification, was the municipality of Aparecida, in 1978. Due to the diverse landscapes and historical-cultural riches found throughout most of the state of

São Paulo, many municipalities have sought to achieve this designation together with the bodies responsible for evaluating them, becoming resorts [12].

According to Complementary Law No. 1261/2015 [11], art. 2, the conditions for a municipality to be classified as a Tourist Resort are: (i) it must be a consolidated tourism destination, with effective tourism that generates permanent flows of visitors; (ii) it must have significant natural, cultural or artificial tourist attractions for public use on a permanent basis that identify its vocation; it must have at least the following tourist facilities and services: means of lodging, food services, tourist information and reception services; (iii) have tourist support infrastructure, such as adequate access to attractions, transportation, communication, security and emergency medical care services, as well as signs indicating tourist attractions that are up to international standards; (iv) have basic infrastructure capable of serving fixed and floating populations in terms of drinking water supply, sanitary sewage collection and treatment and solid waste management; (v) have a tourism master plan, approved and reviewed every three years; and (vi) maintain a duly constituted and active Municipal Tourism Council.

This work aimed to analyze 11 resorts in the state of São Paulo as tourist cities with the potential to be transformed into a smart tourism destination by applying the "DTI-BR Model".

2. Concepts of smart cities

The concept of Smart Cities (SC) has gone through a historical evolutionary process, which began in 1994 with the use of technology and innovation in urban areas, in the digital city of Amsterdam. In 1997, virtual urban areas appeared. After the introduction of the virtual city, the concept of the virtual community came into existence in 1998, allowing communication between individuals through shared communication norms. This virtual community network had a narrow scope for digitizing services because it was associated with a community, and people outside the community had no direct access to the community network [13].

In 1999, the first definition of SC was considered in Dubai, where residents and local governments created communities using Information and Communication Technology (ICT) and sensors to share information. With the start of the 2000s, types of SC evolved into more sophisticated ecosystems, whose level of integration expanded from the simple delivery of information embedded in social systems to the delivery of intelligent services (EcoCity) [1].

In 2012, the concept of a Strategic Digital City emerged, which can be understood as the application of information technology resources to municipal management and the provision of information and public services to citizens [14]. A Strategic Digital City does not have the same conventional concept as a digital city or a smart city; it is a project that goes beyond just offering internet to citizens through telecommunications resources. That same year, Smart Tourism Destinations (STD) were conceptualized, meeting specific government and tourism demands for cities [15].

To create a reference point for Sustainable Cities in Brazil, the first technical standard for cities was published in 2014, NBR ISO 37120:2021 [4]. This standard considers sustainability as a general principle and the smart city as a guiding concept

in the development of cities. NBR ISO 37122:2020 defines a smart city as one that: " ... increases the pace at which it delivers social, economic and environmental sustainability outcomes and responds to challenges such as climate change, rapid population growth and political and economic instability by fundamentally improving the way it engages society, applies collaborative leadership methods, works across municipal disciplines and systems, using data information and modern technologies to provide better services and quality of life for those who live there (residents, businesses and visitors), without unfair disadvantage or degradation of the natural environment" [5].

In 2022, a national STD promotion strategy was presented for the first time in Brazil, establishing guidelines and a methodological manual for transforming tourism destinations into more connected and inclusive spaces, implemented by digital means and innovation actions [16].

The search for solutions to meet the challenges of increasing information availability and the growth of cities has led to the emergence of the concept of Smart Cities. This concept implies the presence of Information and Communication Technology (ICT) to offer public products and services, minimizing urban problems and developing a more sustainable city [17].

Cities that use ICT aim for efficient management in the use of resources and greater citizen participation, where sustainability is one of their objectives, and use indicators to direct public policies and investments. They are considered smart and sustainable cities. SCs have provided different experiences for their residents with the help of the available technological infrastructure, contributing to improved quality of life and sustainable economic growth through a participatory government management model, in order to boost local economic growth [7,18].

These concepts of technological, sustainable, and intelligent cities are attributions aimed at improving operational and administrative processes using ICT. De Freitas Paulo Rampazzo and Vasconcelos [19] state that smart cities are those that develop policies, strategies, and approaches to planning, finance, construction, governance, and the operation of urban infrastructures and services, which use ICT as a central element.

To deal with the growth in the availability of information, coherent modeling is needed of the information generated in urban centers, related to mobility, structures (bus stops, squares), and the cities they cover. Information modeling provides several benefits, such as structured and documented information systems, capable of presenting higher quality results; in-depth knowledge of the market; and a reduction in costs, risks, and project failures, by helping to manage the complexity of the growth of Smart Cities [17].

For Komminos [3], SC emerges from the convergence of two main currents in the contemporary approach to the city and urban development. On the one hand, there is a redefinition of the city through the prism of communications technologies, the digital interconnection of their representation, and, on the other hand, through the perception of the city as a space for creativity and innovation.

A city can be categorized as smart when sustainable economic growth and high quality of life are achieved through investments in human capital, an adequate level of government participation, and infrastructure that supports the proper dissemination of

information throughout the city [20]. Thus, SCs should base their intelligence on three main pillars, namely: human capital, infrastructure, and information.

The construction of a smart city must be based on a harmonious relationship with the environment through the rational use and reuse of local and regional environmental resources for the benefit of the population. The transformation of a digital city into a smart city requires the inclusion of the human factor, and the existence of a technological structure alone is insufficient [21].

In their work, Buhalis and Amaranggana [22] conceptualized aspects related to each of the intelligence indicators, using the Smart City Wheel framework developed in 2012 by Boyd Cohen, an urban strategist and expert in urban innovation and smart cities (**Figure 1**).
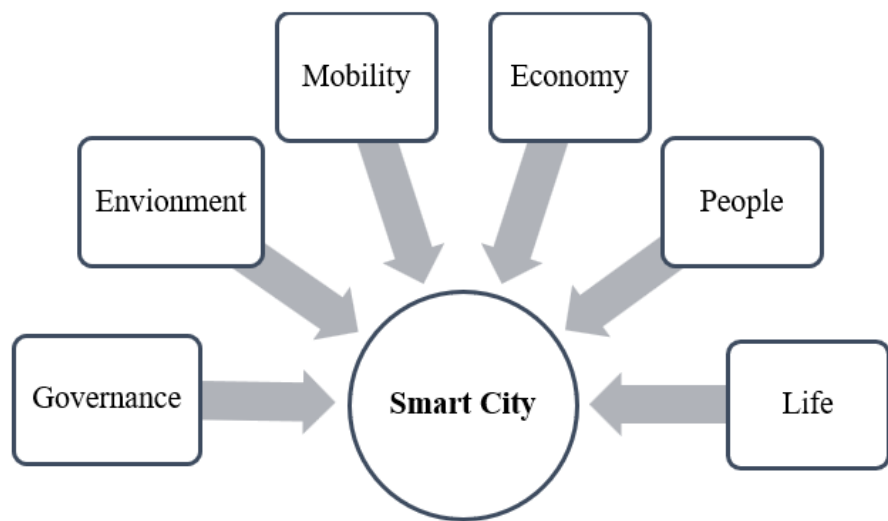
Figure 1. Smart city wheel structure.

The Smart City concept of the Smart City Wheel structure consists of six components:

(1) Smart governance, which relates to the aspect of transparency within governance systems by modernizing city administration, supporting open data and public involvement;

(2) Intelligent Environment, which is related to energy optimization, leading to sustainable management of available resources;

(3) Smart Mobility, which refers to accessibility inside and outside the city and the availability of modern transport systems;

(4) Smart Economy, which is related to the implementation of economic strategies based on digital technology;

(5) Smart People, related to the level of qualification of the city's human capital; and

(6) Smart Living, involves the quality of life measured in terms of a healthy environment, social cohesion, tourist attraction, and the availability of cultural and educational services.

Cohen [23] introduced 18 indicators and 46 sub-indicators based on these six key elements: (1) Environment; (2) Mobility; (3) Governance; (4) Economy; (5) People; and (6) Life. These indicators contribute to the transformation of a city into a SC, as it is based on them that standards are created to help manage and implement good

practices in Smart Cities. As well as helping to make comparisons between cities, the indicators can support integrated policies that help decision-making by monitoring their performance. The Brazilian references are NBR ISO 37120:2021, NBR ISO 37122:2020, and NBR ISO 37123:2021.

The Brazilian concept of SC by the Brazilian Charter for Smart Cities consists of: "Cities committed to sustainable urban development and digital transformation, in their economic, environmental and sociocultural aspects, that act in a planned, innovative, inclusive and networked way, promote digital literacy, collaborative governance and management and use technologies to solve concrete problems, create opportunities, offer services efficiently, reduce inequalities, increase resilience and improve the quality of life of all people, guaranteeing the safe and responsible use of data and information and communication technologies" [24].

The Brazilian Smart Cities Charter is organized into eight strategic objectives and is linked to the National Regional Development Policy and the National Urban Development Policy [24]. They are:

(1) Integrate digital transformation into sustainable urban development policies, programs, and actions, respecting diversity and considering the inequalities present in Brazilian cities;

(2) Provide equitable access to quality internet for all;

(3) Establish data and technology governance systems with transparency, security, and privacy;

(4) Adopting innovative and inclusive models of urban governance and strengthening the role of public authorities as managers of the impacts of digital transformation in cities;

(5) Fostering local economic development in the context of digital transformation;

(6) Stimulating financing models and instruments for sustainable urban development in the context of digital transformation;

(7) Fostering a massive and innovative public education and communication movement for greater engagement of society in the process of digital transformation and sustainable urban development; and

(8) To build the means to understand and evaluate, continuously and systemically, the impacts of digital transformation on cities.

The Brazilian Charter for Smart Cities takes a broad view of digital transformation in cities. Therefore, it is necessary to understand the changes imposed on urban space by digitization and how urban space responds to these changes.

Kumar et al. [25] prepared a study for the transformation of a city into an SC, describing in phases the activities needed to reach the level of maturity and indicators considered in the various SC evaluation systems. The results suggest a multidimensional service classification along with the development of the necessary infrastructure.

The method has four main areas (planning, physical infrastructure, ICT infrastructure, and deployment of smart solutions) to illustrate the transformation of the city. Three methodological approaches were adopted to suggest smart city solutions: (1st) crowdsourcing to collect ideas related to smart service solutions; (2nd) content analysis to analyze and categorize the ideas received; and (3rd) mind mapping

technique to illustrate the transformation, resulting in the Smart City Transformations Framework (SCTF) for SC transformation [25].

The SCTF method makes it possible to help urban managers and developers, government officials, and service providers in terms of understanding and extracting more insights from the smart solutions suggested for SC development. To develop SC services, there must be collaboration between the different levels of government, effective distribution of funds, planning of adequate housing facilities, and formation of appropriate rules and regulations for the various domains of a city. When designing public services, the government's focus should be on cost-effective, innovative, and timely service provision [25].

The SCTF, proposed by Kumar et al. [25], contains four main areas and is based on 24 categories divided into planning, ICT infrastructure, physical infrastructure, and deployment of intelligent solutions, as shown in **Figure 2**.
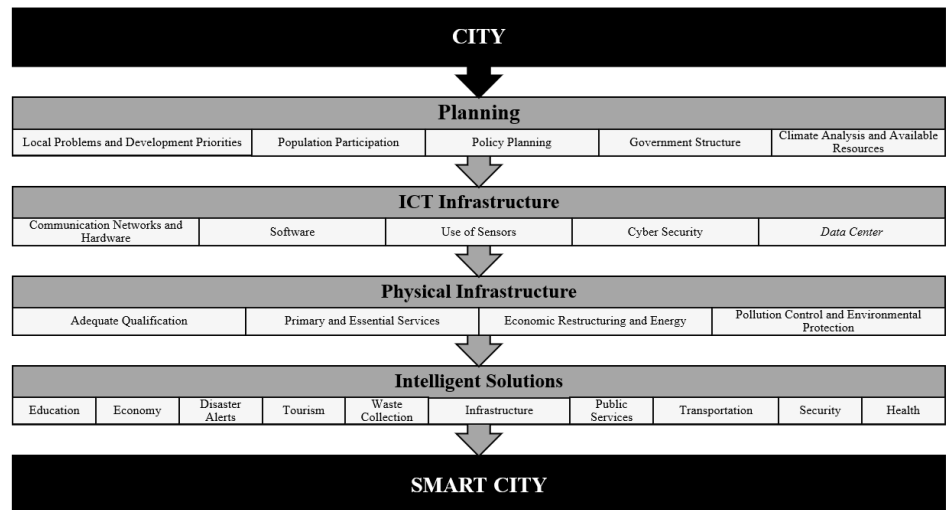
Figure 2. Phases of planning, physical infrastructure, ICT, and implementation of intelligent solutions.
Source: Adapted from Kumar et al. [25].

Understanding the needs and expectations of the users of a service presupposes knowledge and interaction between managers and the various players involved. This highlights a change in the position of traditional public managers and the techniques conventionally used to design services. In order to improve services and create SC, rather than defining rules and controlling their application or building services in isolation, it is up to municipalities to encourage interactions around common interests, so that, together, it is possible to identify what actually constitutes the public interest or problem and build the public service to be offered [26].

Municipal strategic planning (multi-annual planning and the master plan) must be integrated with the planning of information and knowledge systems, and information technology [27]. ICTs inserted into city strategies and urban planning have the potential to be tools for building more sustainable, healthy, inclusive, and emancipatory cities. However, these are not inherent attributes of technologies, which must be politically oriented, as they also have the potential to aggravate power tensions [28].

Advances in wireless communication technologies and ICT in general offer opportunities for the creation of crowdsourcing models to record and update a city's resources, with the aim of increasing the independence of people who need city resources and improving quality of life [29].

3. Smart tourism destinations

With technology integrated into all organizations and entities, tourism destinations take advantage of the synergies between technology and its social components to support the enrichment of experiences. By applying the concept of intelligence to meet the needs of travelers before, during, and after their trip, destinations can increase their level of competitiveness. This is one of the main challenges for urban tourism management [30].

Jovicic [15] defines, in his work, three concepts of tourism destinations that have significantly contributed to the development of theoretical thinking in tourism and reflected in the evolution of destinations in practice: the classical-traditional view, the systemic approach to tourism destinations, and the concept of Smart Tourism Destinations (STD), presented in **Table 1**.

Table 1. The evolution of tourism destination concepts.

Type of Approach	Approach		Smart Tourism destinations
	Classic	Systemic	
Definition	It focuses on the importance of geographical characteristics for the occurrence and development of destinations.	Caused by the dynamic development of tourism practice and the significant improvement of theoretical tourism.	They represent complex systems in which the digital revolution allows for better collaboration between tourism businesses and tourists, who share information and knowledge.
Features	Clusters of attractions and services; Neglect of cooperation within the destination; The role of tourists as actors in the destination.	Interaction between tourists, companies that provide services, and destination residents; Constant contact with the macro environment; Non-linear connections between stakeholders.	The intertwining of digital and real tourism; Public-private consumer collaboration; Participatory governance; Creative and knowledgeable people; Co-creation of destination value; and Personalized services.

Source: Adapted from Jovicic [15].

Tourism, under the systems approach, must be considered in the context of other systems that interact with it. The tourism destination is treated as an open and flexible system, characterized by high interaction between its constituent elements, such as companies providing tourist services, destination residents, local authorities, and tourists [15].

Smart Tourism Destinations make intensive use of ICT to improve the tourist experience. STD's are therefore first and foremost Smart Cities that enable the sustainable development of tourism while maintaining the quality of life of residents. These destinations (The main difference between a city and a tourist destination is that a city is a place where people live and work, while a tourist destination is a place that people visit for the specific purpose of tourism. However, many cities are also popular tourist destinations, as they offer a wide range of tourist attractions for visitors.) serve visitors in a way that resembles meeting the needs of their residents, in the way they support mobility, allocate resources, and increase sustainability and quality of life [30].

For Buhalis and Amaranggana [22], the concept of STD arose from the development of the characteristics of SC. With the use of technology in all organizations and entities, destinations are exploiting the synergies between ubiquitous technology and its social components to support the enrichment of tourist experiences.

This link between the tourist and the tourism destination can be made with different types of technological resources. The real-time collection of information by sensors scattered around the city, with its processing, can provide accurate information about the city via end-user devices. These reflect the use of ICT as a predictive tool to implement a more intelligent way of managing tourism destinations [22].

The changes caused by the application of ICT in tourism destinations result in different characteristics for each stakeholder, as shown in **Table 2**.

Table 2. Characteristics of stakeholders at STD.

STD Stakeholders	Features
Residents	Constantly connected Creative and capable enough Knowledge of technology Actively involved in the development of smart heritage/electronic culture
Tourists	Well-connected and well-informed They demand a highly personalized service Socially and technologically engaged Discuss dynamically via social media Create experiences They contribute to the content They use end-user devices at various points of contact
Government	Information governance that supports open data Regulating data privacy

Source: Adapted from Buhalis and Amaranggana [22].
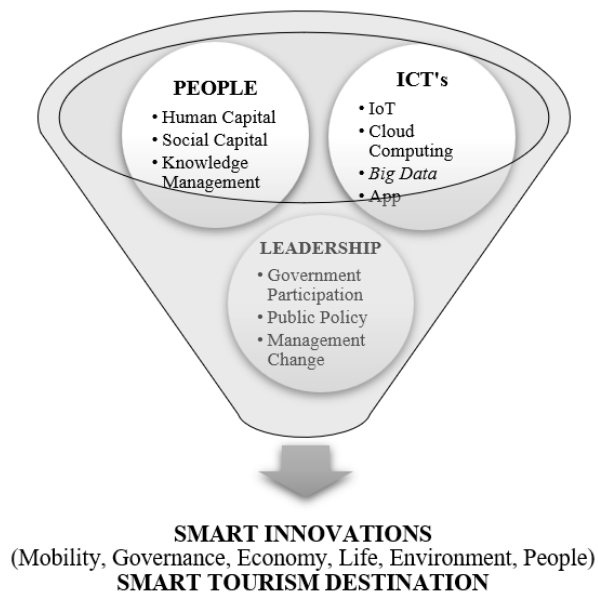
Figure 3. Framework for the development of STD.

Source: Adapted from Boes et al. [31].

To develop an STD, Boes et al. [31] present a framework in which three axes contribute: people, ICT, and leadership. However, separately, they are only individual

concepts and, only when intertwined and interconnected within the ecosystem, they do become significant contributors, as illustrated in **Figure 3**.

The use of technology is revolutionizing the tourism industry and determining the strategy and competitiveness of tourism organizations and destinations. Connecting stakeholders supports fluidity between physical and digital interactions, enabling dynamic networks, and imposing disruptions on the established tourism industry [32].

A common aspect in places identified as smart is the reintroduction of the socio-technical paradigm. This emphasizes the connection between society and technology, in which people and technology are connected and perceived as equal actors, interconnected in an ecosystem [31].

"DTI Brasil Project" by the ministry of tourism

The concept of STD, created by Spain's State Mercantile Society for the Management of Innovation and Tourism Technologies (SEGITTUR), has been adopted as a conceptual basis and strategic tool that seeks to create tourism experiences and improve destination management through knowledge [33]. STD was defined in 2012 as: "An innovative tourist area, accessible to all, consolidated on a state-of-the-art technological infrastructure that guarantees the sustainable development of the territory, which facilitates the interaction and integration of visitors with their surroundings and increases the quality of their experience at the destination and the quality of life of residents" [33].

The Spanish community has remodeled its tourism management, seeking to improve the quality and sustainability of its destinations and provide differentiated tourist experiences. These actions have been based on the use of ICT to increase its competitiveness. The main aim of the STD concept is to provide services to tourists in real time, interacting with them and other stakeholders to create an environment of cooperation and sharing of data, information, and knowledge to generate innovation [34].

Following the same theme, in 2022 Brazil presented a public policy for STD, designed by the Ministry of Tourism (MTur) in partnership with the Ciudades del Futuro Institute (Argentina). The Brazilian methodology is an adaptation of the methodology developed by SEGITTUR, with adjustments for the specific characteristics found in Brazil, starting with its territorial size, based on nine methodological axes that serve to organize the requirements applicable to an STD [16]:

(1) Governance;
(2) Innovation;
(3) Technology;
(4) Accessibility;
(5) Creativity;
(6) Sustainability;
(7) Security;
(8) Mobility and Transportation; and
(9) Promotion and Marketing.

Each axis is based on pillars that detail the areas of assessment and action and the requirements to be met. It can be said that these pillars are the guidelines for the

methodology to be applied in each destination. Below are the definitions corresponding to each one:

- Governance: local government must be able to generate trust, manage public goods legitimately, and govern with the effective participation of strategic players;

- Innovation: the adoption of new services, processes, marketing, or organizational methods to improve benefits and competitiveness;

- Technology: cross-cutting in nature, it enables the training and analysis of information in real time, contributing to sustainability and improved access to public data;

- Accessibility: the destination must work as an integrated whole, ensuring that any visitor is free to travel to the destination without any problems, to choose the leisure activity of their interest, and enjoy it in complete autonomy;

- Creativity: the destination must make a commitment to incorporating creativity into the development of public policies, with a view to strengthening creative ecosystems and developing culture and tourism through the creative economy;

- Sustainability: protecting the economic activity of tourism, respecting the environment, preserving and valuing the sociocultural aspect, and guaranteeing the quality of life of current and future generations;

- Safety: identifying and promoting risk control and mitigation measures, as well as providing tourists with information on preventive safety measures and self-care for a safe visit;

- Mobility and Transportation: work focused on improving mobility and air and road connectivity connecting the destination, identifying the availability of existing infrastructure and means of transportation; and,

- Promotion and Marketing: The strategy focused on improving the relationship between the destination and the tourist by offering valuable experiences and actions that strengthen the image of the destination and promote it to its public.

This methodology also used the normative references NBR ISO 9000:2015 (Quality Management Systems. Fundamentals and Vocabulary), NBR ISO 9001:2015 (Quality Management System - Requirements), UNE 178.501 (Sistema de Gestión de los Destinos Turísticos) and UNE 178.502 (Indicadores y Herramientas de los Destinos Turísticos Inteligentes) [17].

The method was developed in 2 stages: (1) diagnosis and planning; and (2) execution and follow-up. Stage 1 consists of 3 phases. Phase 1 involves incorporation, where the destination signs its letter of commitment with the Ministry of Tourism and becomes part of the project as a pilot destination. In phase 2, the diagnosis is made, with a territorial analysis of structural and data aspects. In phase 3, strategy and planning, the destination defines its transformation plan according to the 9 axes of the methodology.

In stage 2, two more phases are carried out. Phase 4 corresponds to the implementation of the program, in which the actions proposed in the transformation plan are put into practice. In the last phase, the entire planning and execution process carried out by the destination is evaluated to see if there is a need to renew or implement any changes to the actions.

The entire methodology is based on the continuous improvement cycle called "Plan → Do → Check → Act" or PDCA Cycle. In the context of STD management, the PDCA approach can be summarized as follows:

1) Planning: establishing the indicators, objectives, targets, and action plans needed to achieve the results that will improve STD management.
2) Do: implement the STD management action plans.
3) Verify: monitor and measure the processes and the main characteristics of the operations that determine the management of the STD, in relation to the policies and objectives, and report the results.
4) Act: take action to continuously improve the STD's management system and the Municipality's performance (results).

The "DTI Brasil project" benefits both tourism service entrepreneurs, by increasing visitation and consequently generating more income and development for the destination, and tourists, whose experience is improved from the moment they plan their trip.

4. Development

With technology integrated into all organizations and entities, tourism destinations take advantage of the synergies between technology and its social components to support the enrichment of experiences. By applying the concept of intelligence to meet the needs of travelers before, during, and after their trip, destinations can increase their level of competitiveness. This is one of the main challenges for urban tourism management [30].

The link between the tourist and the tourism destination can be made with different types of technological resources. The real-time collection of information by sensors scattered around the city, with its processing, can provide accurate information about the city via end-user devices. These reflect the use of Information and Communication Technologies (ICT) as a predictive tool to implement a more intelligent way of managing tourism destinations [31].

Based on SC research and methodologies, it can be seen that an STD successfully implements intelligence that is fostered by open innovation, supported by investments in human and social capital, and sustained by participatory governance. These characteristics develop the collective competitiveness of tourism destinations to improve social, economic, and environmental prosperity for all stakeholders, creating an ideal habitat for the Smart Tourism Destination [31].

dos Santos and Gonçalves Gândara [7] define an STD as a tourist area with a defined project and objective, with the ability to create sustainable development based on local limitations and capacities. It enhances the integration of technology throughout the destination's value-creating relationship, as well as reinforcing and incorporating actions between public and private managers in order to promote greater competitiveness for the destination. For Gretzel et al. [35], the term "smart" is the new jargon in tourism, which describes and integrates concepts about technology, economics, and social development, fueled by communication and information technologies, promoting connectivity and the exchange of information.

For Buhalis and Amaranggana [22], the concept of STD arose from the

development of SC characteristics, and in their study, they present aspects of a city's intelligence indicators. With the use of technology in all organizations and entities, destinations are exploiting the synergies between ubiquitous technology and its social components to support the enrichment of tourist experiences.

These intelligence indicators of a SC are defined as:

- Intelligent Governance: related to the aspect of transparency within governance systems by modernizing the city's administration, supporting open data and public involvement;
- Intelligent Environment: related to energy optimization that leads to sustainable management of available resources;
- Smart Mobility: refers to accessibility inside and outside the city and the availability of modern transport systems;
- Smart Economy: related to the implementation of economic strategies based on digital technology;
- Smart People: corresponds to the level of qualification of the city's human capital; and
- Smart Living: involves the quality of life measured in terms of a healthy environment, social cohesion, tourist attraction, and the availability of cultural and educational services.

Following this theme, Bussador et al. [36] based their STD model, called the "DTI-BR Model", on the set of indicators from the ABNT standards for Smart Cities and Resilient Cities, and the Smart Tourism destination standards defined by SEGITTUR, adapted for Brazilian cities, to create a decision tree, using the multi-criteria "Analytic Hierarchy Process" (AHP) method to assess the priorities of these indicators. The "DTI-BR Model" quantifies the degree of STD compliance of each criterion, sub-criterion, and indicator and creates a hierarchical decision tree prioritizing these criteria.

Table 3. Criteria and sub-criteria of the "DTI-BR Model".

Criteria	Sub-criteria	SEGITTUR	ABNT ISO 37122:2020	ABNT ISO 37123:2021	"Model DTI-BR"
Sustainable Development	Sustainability	10	11	5	16
Mobility and Telecommunications	Telecommunications and Sensors	5	3	0	7
	Transport and Accessibility	5	12	1	17
	Economics and Finance	2	4	3	9
Economics and Finance	Online Marketing	8	0	0	8
	Smart Tourism	16	1	0	16
Governance and Urban Planning	Governance	11	0	1	9
	Urban Planning	0	16	1	14
Health, Safety and Quality of Life	Information Systems	8	0	0	8
	Public and Social Services	0	10	4	13
Education, Culture, and Social Development	Innovation	6	0	0	6
	Population and Education	1	8	2	11
Total		72	65	17	134

The criteria adopted for the "DTI-BR Model" are: Sustainable Development; Mobility and Telecommunication; Economy and Finance; Governance and Urbanism; Health, Safety, and Quality of Life; and Education, Culture, and Social Development, listed in **Table 3**, with the corresponding sub-criteria and the number of indicators [36].

5. Methodology

The set of 134 indicators for the "DTI-BR Model" is made up of 48% Smart Tourism Destination indicators defined by SEGITTUR, 42% indicators from the Brazilian Smart Cities standard, and 10% from the Brazilian Resilient Cities standard.

The "DTI-BR Model" is carried out in two stages to validate the STD indicators. Both are applied concurrently to specialists working in municipal public administration.

In Stage 1, the Decision Tree is created to assess how important one item is in relation to another. Questionnaire 01 is applied and the AHP method is used to design the hierarchical decision tree with the priority percentages generated for the criteria and sub-criteria. The AHP hierarchy of criteria and weights is defined by the decision-makers as they build the model. The criteria are compared pair by pair, which introduces a subjective component into the model. In other words, the criteria and weights are the result of human judgment, not simply mathematical information.

In Stage 2, the degree of compliance with the STD indicators is measured. Questionnaire 02 quantifies the "DTI-BR Model" indicators, generating information about the municipality and checking whether it satisfactorily meets the model's criteria and sub-criteria. The most relevant alternatives for each of the sub-criteria are defined, and each one is measured individually by the experts. With this information, the degree of compliance is calculated, taking into account the percentage of Medium and Large responses in the questionnaire, with more than 50% of the responses per indicator.

The "DTI-BR Model" is an authorial project. For more details on the model used and the questionnaires applied in this research, read Bussador [9].

The application of the "DTI-BR Model" to a location generates a comparison of the hierarchy of indicators present in the decision tree and the degree to which the destination's indicators are met. **Figure 4** shows the application phases of the "DTI-BR Model" [9].

Figure 4. Application of the "DTI-BR Model".

With the generation of the decision tree and the degree of compliance, a comparative analysis is made, which serves as a subsidy to identify how the municipal resources that were defined as a priority in the decision tree are applied, even if the degree of compliance suggests a different order of priority. The analysis can be redone at each change of government or after the application of public policies created for the

development of STDs, in order to reassess their priorities and the degree to which they are being met.

Each of these phases shown in the flowchart corresponds to specific and linked activities for building the decision tree and assessing the degree of compliance with the STD indicators.

6. Results and discussion

Given these characteristics, 11 resorts in the state of São Paulo (Aparecida, Atibaia, Bragança Paulista, Campos do Jordão, Itanhaém, Morungaba, Paraibuna, Ribeirão Pires, Santos, São José do Barreiro and São Sebastião) were chosen as the population of interest for Questionnaire 01. As a result, a representative from the municipal tourism office of each resort was interviewed (three had two people involved in the process), giving a total sample of 14 people.

The data is validated using the AHP method, which provides a comprehensive and rational procedure for modeling a decision problem, representing and quantifying the variables involved in a hierarchy of criteria weighted by preferences (weights).

The application of the questionnaires makes it possible to prioritize the indicators to be applied in an STD since the criteria and sub-criteria are evaluated pair by pair according to their importance. The weighting of the criteria and sub-criteria shows which of the aspects evaluated are most important to the group of decision-makers.

In this study, for the São Paulo resorts, the objective was to define the quantitative coefficients of significance of the criteria and sub-criteria and to create the decision tree, based on the application of Questionnaire 01, resulting in the weights illustrated in the decision tree in **Figure 5**.
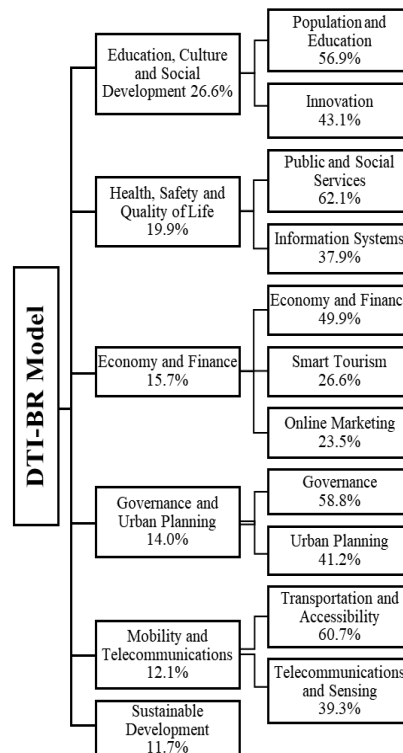
Figure 5. Decision tree for the tourist resorts of São Paulo.

7. Conclusion

The "DTI-BR Model" helps transform tourist cities by adapting international STD indicators (SEGITTUR) to Brazil using ABNT standards related to smart cities and resilient cities.

An interpretation of the results obtained indicates that the resorts in the state of São Paulo could improve their STD indicators in order to be considered a smart tourism destination. The criterion with the highest priority in the evaluation was Education, Culture, and Social Development, with 26.2% importance, while Sustainable Development had the lowest priority rating, with 11.7%.

Having said that, the prioritization of the criteria resulting from the application of the model in the tourism destination could help to improve the planning and management of tourist activity, allowing it to be transformed into an intelligent tourism destination.

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