ABSTRACT

Technological innovation has changed tourism management and practice, and tourism has become one of the largest industries in the world. As a result, tourism authorities must increasingly bet on the development of technology to accommodate tourists’ new image and make them feel included in their destination. In this respect, there is an important effective management of technological innovation in tourist destinations. Therefore, through theoretical methods and statistical committee previously conducted research on this issue, in these research methods are lacking, so this work aims to propose a technological innovation management method for tourist resorts. Thus, we have an approach to managing technological innovation in tourism destinations, expanding and integrating the indicators to be considered, and proposing the scale to measure the indicators. All of these provide the right tools for this purpose and facilitate the development of smart travel destinations.

Keywords: technological innovation; methodology; smart destinations

1. Introduction

Tourism is a highly competitive and constantly evolving global industry, both on the supply side and on the demand side. New proposals are continually appearing to attract the attention of tourists, while at the same time they have more information and tools to select destinations.

Information and communication technologies are modifying the knowledge and the way of planning, organizing and managing trips, and the way in which tourists interact with the destination and share their experiences. The tourist, increasingly demanding, seeks and finds the best value for money, services and experiences more personalized and adapted to their tastes and needs, values the most environmentally friendly options and, particularly, demands to be permanently connected and to be able to make use of new technologies throughout the entire life cycle of the trip[1].

The changes in the environment have forced tourist destinations to adopt new forms of management focused on an intelligent model that involves
“an innovative tourist space, accessible to all, consolidated on a cutting-edge technological infrastructure that guarantees the sustainable development of the territory, facilitating the interaction and integration of the visitor with the environment and increasing the quality of their experience in the destination, as well as the quality of life of the residents.”

Smart destination management encompasses a set of dimensions, addressed by different authors. According to the analysis made by Labrada et al., there is agreement in the scientific community that the most common dimensions to consider in the management of smart destinations are: technology, innovation, sustainability, accessibility and governance.

Given the new trends in tourism and the new profile of potential tourists, technology has become a fundamental factor in the success of tourist destinations. So much so, that technology, besides being an axis of action, is transversal to all other axes. In other words, the aim is not technology, it is not to turn tourist destinations into territories equipped with technological elements that do not add value, but to use ICTs as fundamental tools to improve their management and development and to add value to the destinations or resources. In short, technology must be the bridge to achieve the objectives set out in all the lines of action of a Smart Tourism Destination (ITD). Hence the importance of the promotion and development of technological innovation in destinations.

In the technological field, innovation is the invention or development of new technologies, which usually translates into more sophisticated tools, previously impossible capabilities and new knowledge. It is a concept specific to the contemporary approach to science and technology, the result of the great scientific-technological revolution that has occurred since the second half of the nineteenth century and continues to accelerate its progress to this day.

Since the management of technological innovation makes a significant contribution to the management of smart destinations and also has a cross-cutting effect on the other axes or dimensions, we proceeded to review previous studies that allow the management of this variable, finding that there are several authors who have proposed methodologies and indicators in this regard. Twenty-one proposals from different authors were analyzed using IBM SPSS (Statistical Package for the Social Sciences) software, and it was found that there is a great diversity of criteria regarding the indicators for managing technological innovation, as well as the scope of the aspects to be evaluated in each one of them; on the other hand, there is no consensus among the elements to be considered in the different indicators and they are not included with the relevance that another group of indicators should have given the current environment in which tourism organizations operate. In this context, the need arises for a methodological proposal to manage technological innovation in tourist destinations in order to contribute to their development as intelligent tourist destinations. Therefore, the objective of this paper is to propose a methodology for the management of technological innovation in a tourist destination.

2. Method

Theoretical and statistical methods were used for the elaboration of the methodology. Within the theoretical methods, the synthesis-analysis was used, since methodologies and previous works of 21 authors were analyzed, which allowed the analysis of previous proposals.

To determine the correlations between these authors, the IBM SPSS (Statistical Package for the Social Sciences) software was used for cluster analysis, Ward method and Chi-square measurement, resulting in the dendrogram shown in Figure 1.
From the results obtained, it can be seen how at a distance of 10 there are four groups, which are the most closely related to each other because they work with indicators in common. The first group of authors formed by Hernández and Baute[4], Muñoz and Sánchez[6], and Júnior et al.[7]; Espinosa[8] and García[9] worked five indicators in common. The second group formed by Baidal et al.[10]; (Baidal et al.[11], Invat.tur[12] and González and López[13] worked two indicators in common. The third group formed by Ruiz et al.[14]; Gascó[15]; Gil et al.[16]; Gidumal[17]. Galende and Ruiz et al.[18,19] agreed not to consider 12 indicators of the study conducted. Finally, the fourth group formed by Medina et al.[20]; Bueti[21]; SEGITTUR[22]; Cruz et al.[23]; Cebrián et al.[24] and Burgos[25] worked on a common indicator.

Within these groups, in turn, there are authors who are more closely related because the less distance there is between them, the more indicators they propose in common. This is the case of (Munoz and Sánchez[6], Hernández and Baute[4], who, of the 10 indicators proposed by each, coincide in nine. The same occurs with Gil et al. and Gidumal[16,17], who of the four indicators they propose, only differ in one. On the other hand, Burgos[25] and González and López[13] propose eight and nine indicators, respectively, and of these, they only coincide in two, so they can be seen in different groups in the dendrogram (Figure 1), with a greater distance between them.

To determine the coincidences between the criteria of the authors, a statistical method was used again with the UCINET software, based on a correlation analysis using the Statistical Package for the Social Sciences (SPSS) considering the similarity of a binary scale and the Jaccard method. As a result, there is an analysis of centrality between variables, as shown in Figure 2, which shows that the authors agree that, of the 24 indicators proposed in total, there are 18 fundamentals to evaluate technological
innovation in a tourist destination.

Figure 2. Centrality analysis.
Source: Own elaboration based on UCINET software outputs.

These indicators, as shown in Figure 2, present greater centrality and connection with the rest and are reflected as: Specialized web; ICT presence; Social networks; online marketing; online marketing; digitized information service; promotion and information systems; marketing system; mobile applications; geolocation systems; free access Wi-Fi; QR codes; audio guides; Big Data; Open Data; video-mapping techniques; holography technique; augmented reality and destination sensitization.

The following are further away from the central network: tourism knowledge system, digital advertising material, technological modernization, virtual currencies, Internet of Things and collaborative platforms on the Internet, which are the least correlated variables in the research.

From this analysis, the authors of this paper considered that despite the fact that the indicator: “technological modernization” was mentioned by only two authors, it will be taken into account in the new methodological proposal because of its importance for the management of technological innovation in a tourist destination and also it includes: presence of ICT and free access wifi, which complement in a more complete way the definition of the items to be evaluated in this indicator. On the other hand, the indicators: online marketing, promotion and information system and commercialization system will be analyzed jointly in the indicator: online commercialization of the destination due to the direct relationship between them.

For the analysis of the indicators: “Big Data” and “Open Data” the term will be used: “Data Management”; they will be evaluated jointly and, finally, the indicators: “video-mapping techniques, holography technique and augmented reality” were grouped together using the term: “use of intelligent techniques”, which brings together the three elements.

In summary, in order to make a proposal that
takes advantage of previous experience regarding the indicators to be used and covers the new variables demanded by the current context, the 18 most common indicators should be included, according to the opinion of authors who have previously addressed the subject, grouped in a more convenient way according to the definition and scope of each one; as well as a new indicator, proposing in all cases the scale of measurement of each indicator and item.

3. Results and discussion

Based on the above analysis, a methodology consisting of six stages is proposed with the objective of ordering the necessary steps to manage technological innovation in a tourist destination. Its graphic representation can be seen in Figure 3.

![Figure 3](image-url)

**Figure 3.** Graphical representation of the methodology for the management of technological innovation in a tourist destination.

The following is a description of the stages, steps and techniques and tools to be used for the development of the methodology.

Step 1: Analysis of the environment.

Description: In this first stage, a characterization of the destination's environment is carried out, determining the strengths, weaknesses, threats and opportunities in relation to the elements of technological innovation. Techniques such as documentary analysis, observation, interviews and the SWOT matrix (Strengths, Weaknesses, Threats, Opportunities and Threats) should be used for the development of this stage.

Stage 2: Application of the information gathering instrument

In this second stage, the instrument is applied using the “Checklist” shown in Annex 1 to determine the degree of compliance with the indicators and items. In cases where the status of the indicator cannot be precisely determined, specialist judgment should be used.

Stage 3: Diagnosis of technological innovation.

This stage is developed from the execution of three steps.

Step 1: The calculation of the evaluation of the indicators is carried out individually from the score
obtained in each item according to the scale applied in the previous stage. The following equation will be used for this purpose:

\[
\text{Evaluación Indicador} = \frac{\sum_{i=1}^{n} W_i}{n \times 3}
\]

Where:
- \( W_i \): value given according to the evaluation of the items (Optimal=3; Average=2; Worst=1)
- \( n \): number of items.

Step 2: The calculation of the evaluation of technological innovation is made in a general way in the destination using the data obtained in the previous step and using the following equation:

\[
\text{Evaluación de la Innovación tecnológica} = \frac{\sum_{i=1}^{n} \text{Evaluación del Indicador}_i}{n}
\]

Where:
- \( n \): number of items

Step 3: The result of the calculation obtained in the previous step is calculated as a percentage and the current degree of development of technological innovation in the destination is determined from the use of Table 1, where the range to be taken into account for such classification is specified.

| Degree of development | Range |
|-----------------------|-------|
| 1                     | Deficient = 0%-40% |
| 2                     | Medium = 41%-80% 3 |
| 3                     | Optimal= 81%-100% |

Stage 4: Strategy selection.

This stage is developed from the execution of two steps.

Step 4: Taking into account the deficiencies identified in the diagnosis of the destination's technological innovation, strategies that need to be developed to contribute to the improvement of the indicators that were most affected are proposed. These strategies should take into account the objectives to be pursued, as well as the resources needed to achieve them.

From the strategies formulated, a selection is made of those that can be implemented at the destination. The criteria for evaluation and selection of strategies are used for this purpose. These are:

- Adequacy and consistency criteria: assessing whether the strategy is compatible with what is happening in the environment, whether it is capable of addressing its weaknesses and exploiting its strengths.
- Feasibility criteria: assesses the possibilities of implementation, i.e. whether the strategy can be undertaken with the physical, human and financial resources available.
- Acceptability criteria: assesses whether the consequences of adopting a given strategy are acceptable or not.

Step 5: An action plan is drawn up for the proposed strategies where the deficiencies detected, strategies to be carried out, costs of the strategies, who will execute them, period and those responsible for monitoring their implementation are defined.

Stage 5: Implementation of the strategies

In this stage, the solutions are implemented based on the action plan defined in the previous stage. This stage is executed according to the possibilities of realization of the same from the variations that may exist in the destination.

Stage 6: Control and evaluation of results.

In this stage, the development of the strategies implemented in the previous stage is controlled, as well as the evaluation of the results from the follow-up of their execution and the effects they have produced in the destination. In this way, the causes of any deviation from the established plan are established and the results are used to continue perfecting the actions to be carried out for the development of technological innovation in the tourist destination.
Among the most important authors who have addressed technological innovation are: (Garcia, 2015) and Espinosa[8,9]. García) conducts a study of this dimension in conjunction with others with the aim of exemplifying the degree of adaptation of the Smart Tourism Destination (ITD) concept in the cities of Malaga and Zaragoza[9]. For his part, Espinosa[9] performs a diagnosis of Quito as a DTI with emphasis on technological innovation. Both methodologies propose a set of indicators to evaluate it in a tourist destination, coinciding in a group of them and showing dispersion in others, but no specific proposals were found that addressed methodologies for innovation management. The present research proposes a specific methodology for the management of technological innovation, also proposes an expansion of the indicators to be measured, defines the items to be considered in each of them and formulates a scale for the measurement of these indicators and items. These results allow to broaden the theoretical support for a better management of technological innovation in an intelligent tourist destination.

4. Conclusions

The use of technologies has become very important in the management of Smart Tourist Destinations and within this concept, technological innovation plays a significant and transversal role, making it essential to apply methodologies that facilitate the management of technological innovation in tourist destinations. The bibliographic review of 21 previous studies shows the diversity of criteria on the indicators to be used and methodological shortcomings for the management of technological innovation. The proposed methodology for the management of technological innovation in a tourist destination, carried out in this research, includes the expansion and integration of the indicators to be considered according to the definitions and current context, as well as the measurement scale to be used in each case. All this makes it possible to have an appropriate tool that favors the development of intelligent tourist destinations.

Conflict of interest

The authors declare no conflict of interest.

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## Annexes

### Annex 1: Instrument to evaluate technological innovation in the destination.

| Indicators                                      | Items                                                                 | Scale                                                                                     |
|------------------------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| **Specialized website**                        |                                                                       |                                                                                           |
| Existence of the website of the destination    | Does not have its own website                                        | Has its own website but it works with insufficiencies                                     |
| Promotion of an attractive corporate image of the destination | Does not promote an attractive corporate image of the destination | Promotes an insufficiently attractive insufficiently attractive                           |
| Availability of updated content                | The website does not have information about the destination          | The website has outdated destination information                                          |
| Interactivity with clients                     | Website does not allow interactivity with customers                  | Website allows limited interactivity with customers                                       |
| Existence of a blog on the site                | No blog is included on the site                                      | A blog is included and is not managed adequately                                          |
| Content management on the page or site         | No content is managed on the page or site related to the destination | Some content is managed on the page or site but it is not updated frequently              |
| Active presence of the destination in social networks (Facebook, Twitter, Instagram, YouTube) | The destination does not use social networks to interact with tourists before, during and after their trip | The destination moderately uses social networks to interact with tourists before, during and after their trip |
| Existence and execution of a long-term destination strategy on social networks | The destination does not have a long-term social media strategy | The destination has a strategy in place but does not execute it properly                   |
| Leverage user-generated content in destination marketing campaigns on social networks | User-generated content is not leveraged and analyzed to create marketing campaigns based on customer needs | User-generated content is leveraged but this information is not used for marketing campaigns |
| Analysis of customer reviews on social networks | Customer reviews on social networks are not analyzed.                | Customer reviews on social networks are occasionally analyzed                             |
| Existence of a virtual space for visitors to interact with the destination and with other users | No virtual space developed for visitors to interact with the destination and other users | A virtual space has been developed for visitors to interact with the destination and with other users but it works with shortcomings |
| Monitoring of brands and media by the destination | No analysis of what is said about the destination and what the visitor's motivations are. | What is said about the destination and what are the visitor's motivations are analyzed irregularly |
| Design of innovative innovative campaigns, sending of videos, animations, etc. | Not done                                                             | Occasionally                                                                              |
| Publication of guides and unique, attractive promotional material | No guides or promotional material are published, properly structured and segmented in accordance to current tourist profiles | Promotional material is occasionally published without taking into account tourist segment profiles |
| **Social Networking**                          |                                                                       |                                                                                           |
| **Online marketing of the destination**        |                                                                       |                                                                                           |
| Publication of guides and unique, attractive promotional material | No guides or promotional material are published, properly structured and segmented in structured and segmented according to according to current tourist profiles | Promotional material is occasionally published without taking into account tourist profile segments |
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Annex 1. (continued)

| Information services | Mobile applications | Geolocation systems | QR codes |
|----------------------|---------------------|--------------------|---------|
| Establish annual promotional plans, including an aligned Social Media Plan. | There are no interactive platforms in the destination through which customers can customize their experience and contract and pay for products and services. | The destination’s facilities do not have their own websites. | There are no QR codes in the destination. |
| Existence of independent websites, independent websites for the destination’s destination facilities with updated information on offerings | There are no interactive platforms in the destination through which customers can customize their experience and contract and pay for products and services. | The destination’s facilities have their own websites but they do not have updated information on their offers. | QR codes are available on some tourist services. |
| Availability of mobile applications available at the destination for information and promotion of the tourism offer | There are no mobile applications available at the destination for purchasing and consuming services, but they are not purchase and consume services. | There is availability in the destination of mobile applications for geolocation of tourism offerings. | There are QR codes on interpretive panels, promotional material, check-in/out processes. |
| Availability of mobile applications mobile applications at the destination for purchase and consume services | Mobile applications are available at the destination for purchasing and consuming services. | Mobile applications for geolocation of tourism offerings are available at the destination. | Mobile applications for geolocation of the tourist offer and cover the destination's products and services. |
| Availability of mobile applications mobile applications are available in the destination for sharing experiences | Mobile applications for sharing experiences are not available in the destination. | Mobile applications for geolocation of tourism offerings are available at the destination. | Mobile applications for geolocation of the tourist offer and cover the destination's products and services. |
| Implementation of an integrated tourism information system. | The destination does not have an integrated tourism information system that allows for decision-making, creation and improvement of the offer. | An Integrated Tourism Information System exists but is managed with difficulties to enable decision making, creation and improvement of the offer. | Mobile applications are available at the destination to buy and consume services and covers all services. |
| Develop an informative platform platform for national and foreign and foreign tourists | The destination does not have an information platform for domestic and foreign tourists in the destination but it is not properly managed. | There is an information platform for domestic and foreign tourists in the destination but it is not properly managed. | Mobile applications are available at the destination to buy and consume services and cover all services. |
| Online catalogs | Not published | Occasionally published and updated | Published and updated frequently |
| Establish annual promotional plans, including an aligned Social Media Plan. | No annual promotion plans are established | Annual promotion plans are established but do not include a Social Media Plan aligned with objectives and strategies | Annual promotion plans are established including a Social Media Plan aligned with objectives and strategies |
| Existence of interactive platforms interactive platforms through which customers can customize their experience and purchase and pay for products and services. | There are no interactive platforms in the destination through which customers can customize their experience and contract and pay for products and services, but they function with shortcomings. | There are interactive platforms in the destination through which customers can customize their experience and purchase and pay for products and services, but they function with shortcomings. | There are interactive platforms in the destination interactive platforms through which customers can customize their experience and purchase and pay for products and services are functioning adequately. |
### Annex 1. (continued)

| Data management | techniques | Data management from customer feedback on social networks | Use of mechanisms to capture tourist's online actions automatically | Use of intelligent techniques |
|-----------------|------------|----------------------------------------------------------|---------------------------------------------------------------|-------------------------------|
| Audio guides    | Existence of audio guides in attractions | There are no audio guides in the destination's attractions | Audio guides exist in some of the destination's attractions and are used infrequently. | The augmented reality technique is not used in the |
| Use of Big data and Open data in destination management | Use of Big data and Open data are not used in destination management | Big data is used for information processing but Open data is not used because destination data is not published, there is no free access to it. | Optimal use of Big data and Open data in destination management | |
| Publication of destination data on publicly accessible websites | Destination data is not published on publicly accessible websites | Limited publication of destination data on publicly accessible websites | Data are published on publicly accessible websites with interactive dashboard with key indicators for consultation and use of destination data | |
| Data management from customer feedback on social networks | No data is managed from customer information on social media. | Occasional data is managed from customer information on social media | Constant monitoring of the official website and social networks is carried out to enable data analysis and management. | |
| Data analysis for the detection of market trends | No market trend studies are carried out | Market trend studies are conducted through data analysis with limitations | Market trend studies are conducted through data analysis with effectiveness. | |
| Data management destination organizations | Data in the destination organizations are managed in an unstable manner and no actions are taken with the results obtained | Data in the destination organizations are managed for periods of time and actions taken with the results obtained are made only on occasion | Data in the destination organizations are constantly managed, which enables real-time decision making. | |
| Use of mechanisms to capture the logs (actions that a user performs while browsing the destination's website or its social networks) automatically | No mechanisms are used to capture the logs (actions that a user performs while browsing the destination's attractions) | Mechanisms to capture logs automatically are occasionally used. | Mechanisms are frequently used to capture logs automatically, for example, through Google Analytics. | |
| Have a platform to collect and analyze sensor data, and analyze sensor data, process it and upload it to a real-time database in order to provide an accurate view of the events at the destination. events at the destination | There is no platform for collecting and analyzing sensor data at the destination. | A platform is in place to collect and analyze data from destination sensors, process it and upload it to a real-time database to analyze indicators and make decisions, but it is not frequently used. | A platform is in place to collect data from destination sensors, process it and upload it to a real-time database to analyze indicators and make decisions to provide an accurate view of destination developments. | |
| Use of 3D (video mapping) | No use of video mapping at the destination. | Video mapping is occasionally used at the destination. | 3D videos are frequently projected to simulate that the building in front of the tourists is actually changing and modifying in an attractive way. | |
| Use of holography | Holography is not used at the destination. | Occasional use of holography at destination | Holography technique is frequently used in which a hologram is formed that sends light waves to the viewer identical to those that would be reflected by the real object and thus creates the optical illusion of its presence | |
| Use of augmented reality in the | The augmented reality technique is not used in the | The augmented reality technique | The augmented reality technique is frequently used in the |
| Destination sensing | Methodology for the management technological innovation in tourist destinations | Technological modernization |
|---------------------|---------------------------------------------------------------------------------|---------------------------|
| Information and promotion of the tourist offer. | Use of sensors within the destination for monitoring public transport | Electronic commerce (ecommerce) |
| Information and promotion of the tourist offer. | Sensors are not used within the destination for public transport monitoring. | Tools for the computerized management of check in and check out. |
| is occasionally used in the information and promotion of the tourist offer, identifying and locating the attractions that surround the visitor. | In-destination sensors are occasionally used for public transport monitoring. | The destination does not have in its facilities tools for the computerized management of check in and check out, but with limitations. |
| information and promotion of the tourist offer. | Public transport monitoring | The destination has tools for computerized check-in and check-out management with a high level of development. |

**Annex 1. (continued)**

| Use of sensors within the destination for monitoring public transport | Sensors are not used within the destination for public transport monitoring. | In-destination sensors are occasionally used for public transport monitoring. |
| Use of sensors within the destination for water and energy use by tourists | Sensors within the destination are not used for water and energy use by the customer in tourist establishments. | In-destination sensors are occasionally used for water and energy use by the customer in tourist establishments. |
| Use of sensors within the destination for waste and carbon footprint of a tourist | Sensors within the destination are not used for waste and carbon footprint monitoring of a tourist | In-destination sensors are frequently used for public transport monitoring and energy use in tourism establishments. |
| Use of sensors in other processes | No use of in-destination sensors in other processes | Sensors within the destination are frequently used in other processes. |
| Occasional use of sensors within the destination for the control of a tourist's waste and carbon footprint | Occasional use of sensors within the destination for the control of a tourist's waste and carbon footprint. | The destination has a state-of-the-art property infrastructure that guarantees the sustainable development of the tourist territory and facilitates the interaction and integration of visitors with the environment. |
| Existence of adequate computerization and telecommunications infrastructures | The destination does not have an adequate computerization and telecommunication infrastructure. | The destination has a state-of-the-art technological infrastructure that guarantees the sustainable development of the tourist territory and facilitates the interaction and integration of visitors with the environment. |
| Telecommunications infrastructures | The destination has a technological infrastructure with a medium level of development that facilitates the interaction and integration of visitors with the environment, but still has shortcomings. | The destination has a state-of-the-art technological infrastructure that guarantees the sustainable development of the tourist territory and facilitates the interaction and integration of visitors with the environment. |
| Ease of connection to the Internet by the tourist demand. | There is no Internet connection facility for the tourist demand. | Tourist demand has access to the Internet and can access it from anywhere in the destination. |
| Implementation of an open, powerful, free and fast-registration WiFi network in the places with the greatest influx of visitors. | An open, powerful, free and fast-registration WiFi network has not been implemented in the places with the highest number of visitors. | An open, powerful (100 Kbps and low latency), free, fast-log-

**Conditions have been created for the development of e-commerce in the destination e-commerce in the destination whereby the consumer can make online purchases when buying tourism packages, tourism services, tourism services, etc., in the destination, tourism packages, transportation, accommodation, etc.**
Annex 1. (continued)

| Automation of processes related to tourist information. | There is no system for automate the collection of tourist tourist information of the destination (information requests by type, number of users, etc.) | A system to automate the collection of tourist information about the destination (information requests by type, number of users, etc.) is in place but not implemented. | A system is in place to automate the collection of tourist information about the destination (requests for information by type, number of users, etc.). |