

## Tourism education and data analytics: creating synergy for competitive human capital

### Educación turística y analítica de datos: creando sinergia para un capital humano competitivo

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#### Abstract:

This article explores the synergy between higher education and data analytics as a strategic axis for the professionalization of human talent in the tourism sector. In a global context of digital transformation, tourism increasingly demands competencies related to the collection, interpretation, and application of data for decision-making, innovation, experience design, sustainability, and the formulation of effective public policies. Through a systematic documentary analysis of recent scientific literature with emphasis on authors from Mexico and Latin America, as well as international comparative studies, this study identifies key trends, educational gaps, and curricular proposals that align tourism education with the requirements of a highly competitive and digitalized environment. The study proposes a content structure for tourism programs based on analytical, digital, and strategic skills, aimed at strengthening employability, evidence-based decision-making, and responsiveness to emerging challenges. It concludes that mastering data analysis tools is now an essential condition for the development of smart and sustainable tourism destinations, as well as for ensuring the relevance of university-level training in this field.

#### Keywords:

Tourism, data analytics, education, professionalization, competitiveness, digital transformation

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#### Resumen:

El presente artículo explora la sinergia entre la educación superior y la analítica de datos como un eje estratégico para la profesionalización del talento humano en el sector turístico. En un contexto global de transformación digital, el turismo demanda cada vez más competencias relacionadas con la recolección, interpretación y aplicación de datos para la toma de decisiones, la innovación, el diseño de experiencias, la sostenibilidad y la formulación de políticas públicas efectivas. A través de un análisis documental y sistemático de literatura científica reciente, con énfasis en autores de México y América Latina, así como estudios comparativos internacionales se identificaron las principales tendencias, brechas formativas y propuestas curriculares que permiten alinear la educación turística con los requerimientos de un entorno altamente competitivo y digitalizado. El estudio propone una estructura de contenidos formativos para los programas de turismo basada en habilidades analíticas, digitales y estratégicas, con el fin de fortalecer la empleabilidad, la toma de decisiones basada en evidencia y la capacidad de respuesta ante desafíos emergentes. Se concluye que el dominio de herramientas de análisis de datos es hoy una condición indispensable para el desarrollo de destinos turísticos inteligentes y sostenibles, así como para garantizar la pertinencia de la formación universitaria en este campo.

#### Palabras Clave:

Turismo, análisis de datos, educación, profesionalización, competitividad, transformación digital.

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## Introduction

The tourism industry has undergone a significant transformation in the last decade due to the incorporation of digital technologies, particularly related to data analytics. The evolution toward smart tourism has forced both companies and educational institutions to rethink their training and professionalization strategies. In this context, human talent becomes a fundamental axis to achieve sector competitiveness, provided that it has skills aligned with digital transformation, especially in the strategic use of data for decision-making [1].

In this regard, the growing availability of tourism information from social media, booking platforms, mobile devices, and sensors has given rise to new forms of analysis such as data mining, sentiment analysis, and the use of artificial intelligence to predict consumer behaviors and optimize destination management [2]. However, this digital revolution has not been accompanied at the same pace by educational institutions, many of which still maintain traditional training approaches that do not systematically integrate analytical and digital competencies [3].

Thus, the development of competitive human talent now implies not only knowledge about hospitality, culture, or management but also capacities to interpret data, build visualizations, and propose evidence-based strategies. According to Loureiro et al. [4], higher education in tourism must adopt a holistic and multidisciplinary vision that incorporates technological tools and analytical skills as an essential part of study programs. The lack of training in these areas could represent an obstacle to the development of sustainable and innovative destinations, as well as to the employability of future tourism professionals.

This article aims to analyse how the integration of data analytics in educational and training processes strengthens the competitiveness of human talent in the tourism sector. The findings show that although there are significant advances in digitization and in the use of data in smart tourism destinations, there remains a significant gap in academic training related to analytical, digital, and strategic skills. It is demonstrated that higher education aligned with technological trends not only improves the quality of tourism services but also enhances innovation capacity, facilitates evidence-based decision-making, and enables destinations to proactively adapt to the challenges of the global environment.

## Methodology

The development of this work was based on a qualitative methodology with an exploratory and descriptive approach. A systematic documentary analysis was conducted, which included the review of scientific articles indexed in databases such as Scopus, Web of Science, Redalyc, SciELO, and Dialnet, published between 2018 and 2024. The selection of sources was guided by criteria of thematic relevance, currency, academic impact, and geographic diversity, with special emphasis on Mexican and Latin American authors, as well as comparisons with studies from Europe and Asia. The analysis process was structured into five phases (see Figure 1).

Figure 1. Study methodology

|             |                                                                                                                                              |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| Methodology | Phase 1. Review of trends in tourism education and digital transformation to define the core question.                                       |
|             | Phase 2. Thematic organization of findings around key categories: global trends, training needs, curricular innovation, and public policies. |
|             | Phase 3. Comparative review between educational models in Mexico and other regions.                                                          |
|             | Phase 4. Synthesis and critical analysis of theoretical and practical contributions, identifying gaps and opportunities.                     |
|             | Phase 5. Design of a curricular proposal for tourism programs based on analytical and digital competencies.                                  |

Source: own elaboration

This methodology enabled a rigorous and contextualized construction of arguments, as well as the development of practical recommendations for educational institutions, public policy makers, and stakeholders in the tourism sector.

## Tourism in the era of data

Digital transformation has redefined the structure of the tourism sector, establishing a new paradigm based on the collection, analysis, and interpretation of large volumes of information. In the so-called "data era," tourism leverages emerging technologies such as Big Data, artificial intelligence (AI), the Internet of Things (IoT), and geographic information systems (GIS) to optimize its processes, offer personalized experiences, and make evidence-based strategic decisions [5].

The multiplication of information sources—such as social media, online booking platforms, mobile apps, sensors in smart destinations, and visitor management systems—has turned tourism into a data-intensive ecosystem.

According to Del Vecchio et al. [6], Big Data allows for a better understanding of tourist behavior, more precise market segmentation, management of tourist flows, and anticipation of demand changes. This analytical capability has become essential not only for business competitiveness but also for designing more efficient and sustainable public policies.

Along the same lines, the concept of Smart Tourism gains relevance by integrating digital technologies to enhance traveller experience and destination management. Gretzel et al. [7] highlight that smart destinations use data as a primary input to innovate their services, promoting more collaborative governance, environmental sustainability, and local economic development. This approach cannot be fully developed without professionals capable of interpreting data and translating it into concrete strategies. Additionally, techniques such as sentiment analysis enable the extraction of qualitative information from digital platforms, offering tourism managers a detailed view of visitor perceptions. Recent studies have demonstrated its usefulness in evaluating service quality and improving the digital reputation of destinations [8]. The ability to leverage these data in real-time represents a significant competitive advantage in an environment characterized by uncertainty and high demands from digital consumers.

However, for tourism to fully harness the potential of data analysis, the gap between technology and human talent must be bridged. The shortage of professionals trained in digital and analytical skills limits the sector's ability to adapt to new market conditions. This underscores the urgency of integrating these topics into educational programs and continuous training.

### **Education and training in tourism: current challenges**

In the context of digital transformation, tourism education faces the challenge of integrating new competencies focused on data analysis, the use of emerging technologies, and strategic information management. However, many higher education institutions in Latin America, and particularly in Mexico, continue to prioritize traditional content centered on operations, culture, and hospitality, without updating their curricula to meet the demands of the digital environment [9].

Curricular relevance is a key challenge. Several studies have pointed out the disconnect between academic training and the skills required by the labor market in tourism. Rivas et al [10] highlight that graduates of tourism programs in Mexico often face difficulties securing higher value-added jobs due to insufficient training in digital skills, critical thinking, and information management. This gap is further aggravated in regions where tourism is a primary source of employment, limiting its potential to contribute to sustainable local development.

Thus, the development of analytical and digital skills is not only an economic imperative but also a pedagogical one. According to López [11], higher education in tourism must adopt a more comprehensive training vision, promoting transversal competencies such as autonomous learning, problem-solving, and digital literacy. This requires rethinking teaching methods toward active models that involve the use of real data, simulations, and case analyses related to the tourism environment.

In Mexico, some institutional efforts have begun to respond to this need by incorporating courses related to innovation, sustainability, and business intelligence into the curricula of public and private universities [12]. However, these changes are often isolated and poorly coordinated at the national level. In the absence of an educational policy oriented toward the sector's digital transformation, the development of human talent with an analytical vision remains limited.

Therefore, advancing toward tourism education aligned with the digital era requires both content updates and ongoing faculty training, as well as stronger links with the productive sector. Only then will it be possible to train professionals capable of interpreting data as strategic tools and actively contributing to the competitiveness of tourism destinations and organizations.

### **Synergy between analytics and education: towards a competitive human talent in tourism**

The transformation of tourism into a knowledge-intensive sector has created the need to train professionals capable of integrating technological, analytical, and strategic skills. This synergy between education and data analytics emerges as a key pathway for developing competitive human talent, able to adapt to dynamic, digitalized, and sustainable environments [13].

In countries like Finland and Singapore, the incorporation of data analysis into tourism training programs has been driven by education policies focused on innovation. In Finland, university centers have integrated Data-Driven Tourism modules at undergraduate and graduate levels, focusing on predictive analytics, market intelligence, and digital destination management [14]. This strategy has helped position the country as a benchmark in education based on digital competencies applied to tourism.

Australia, meanwhile, has promoted partnerships between universities and businesses to design curricula with a strong emphasis on learning analytics, the use of interactive dashboards, and data mining applied to tourism experiences [15]. This dual approach allows students to gain practical experience solving real-world problems using technological tools, thereby increasing their employability and capacity for innovation.

In contrast, in Latin American countries (including Mexico), progress in this integration has been more fragmented. Although notable cases exist where active methodologies and technologies have been incorporated into tourism classrooms—such as sentiment analysis on social media or data visualization on tourist maps [16] these practices have not become widespread in curricula. Lack of resources, faculty training, and institutional coordination remain structural obstacles.

Nonetheless, some efforts are showing promising results. In Colombia, for example, universities like Externado have begun to include analytics as a transversal axis for studying tourist behavior and destination planning, promoting an interdisciplinary approach [17]. These experiences offer valuable lessons for countries seeking to transition toward evidence-based professionalization in tourism.

Based on these comparisons, it is clear that building an effective synergy between education and analytics requires a student-centered pedagogical redesign, oriented around competency-based training and supported by key stakeholders in the productive sector. Only then can the gap between the potential of data and the real capacities of human talent in tourism be closed.

### Systematic analysis of data use in tourism: trends, needs, and opportunities

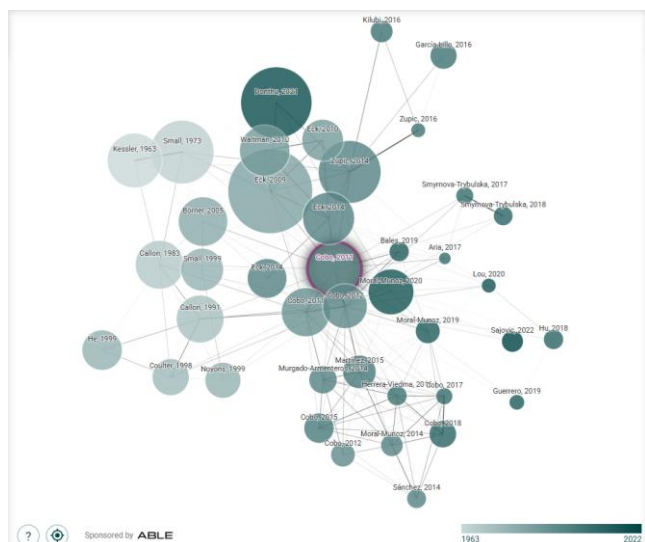
Over the past two decades, tourism has evolved from a model focused on direct experience to a data-driven one, where information is positioned as a strategic input for planning, territorial management, product innovation, and public policy evaluation. This trend fits within a broader context of digital transformation that has impacted not only private sector actors but also governments and international organizations [18].

A systematic review of recent literature reveals five major trends in the use of data for tourism development:

- *Big data and artificial intelligence*: The volume and variety of data generated through digital platforms, social networks, sensors, and geolocation systems have fostered new ways to understand tourist behavior, forecast visitor flows, segment markets, and design personalized experiences [19]. These technologies are being adopted more rapidly in European and Asian countries, where robust smart tourism destination models already exist.
- *Evidence-based governance*: local and national governments have begun integrating tourism information systems that allow them to evaluate impacts, identify gaps, and make informed decisions on investments, promotion, regulation, and resource conservation. Spain, for example, has developed the Tourism Intelligence System that links economic, environmental, and social indicators to guide its national strategy [20].
- *Linking data and public policy*: There is growing consensus on the need to incorporate data analysis in all phases of the tourism public policy cycle: from diagnosis to evaluation. However, in Latin America, institutional capacity, data interoperability, and political will to create open, integrated, and useful systems remain scarce [21].
- *Data-driven innovation*: data has enabled the creation of new business models based on digital platforms, personalized tourism, smart mobility, and real-time management. In this context, data analytics not only improves the efficiency of tourism organizations but also acts as a catalyst for innovation in products, services, and governance models [22].
- *Education for a data culture*: The transition to smarter and more resilient tourism requires that all ecosystem actors' authorities, businesses, academics, and citizens develop skills to understand, analyze, and apply data in decision-making. This implies a profound renewal in educational processes, as noted in previous sections.

An example of integrating data and public policy can be seen in Portugal, which through its TravelBI platform connects official, business, and digital tourist behavior data to design knowledge-based strategies and foster innovation in less favored regions [23]. This contrasts with the Mexican experience, where despite having tools like Datatur, updating, in-depth analysis, and strategic data visualization still represent pending challenges for consolidating more effective policies oriented toward sustainable development [24] (see graphic 1).

Graphic 1. Bibliometric **Technological competencies in tourism**.



Source: Connected papers.

Given this scenario, it is essential to promote data literacy policies at all levels of the tourism ecosystem. The systematization of information, its multidimensional analysis, and ethical interpretation will enable the generation of more inclusive, monitorable, and sustainable public policies, while also strengthening innovation as a competitive advantage for destinations.

# Curricular proposal for tourism professionalization based on digital and analytical competencies

In light of the advances in digital transformation in tourism, the intensive use of data, and the constant demand for innovation, tourism educational programs must urgently adapt to ensure the relevance and competitiveness of their graduates. Current training shows a disconnect between traditional content and the real needs of the labor market, resulting in low employability, insufficient digital skills, and limited preparation for evidence-based decision making [25].

According to recent studies by international organizations such as OAS, Segittur, and IESALC-UNESCO [26, 27, 28], there is consensus that universities must move toward flexible, multidisciplinary educational models focused on solving real-world problems through the use of technology and data. This involves not only updating curricula but also transforming pedagogical approaches, strengthening ties with the industry, and promoting digital literacy as a cross-cutting axis.

The following table summarizes a proposed set of contents and competencies to be integrated into tourism degree programs:

*Table 1. Proposed Content for the Professionalization of Human Talent in Tourism*

| Field of Study                          | Proposed content                                                                              | Competencies to develop                                                        |
|-----------------------------------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| Tourism data analysis                   | Fundamentals of statistical analysis, data mining, and data visualization (Power BI, Tableau) | Interpret and communicate findings for data-driven decision making             |
| Tourism market intelligence             | Consumer analysis, market segmentation, sentiment analysis, and trends                        | Formulate strategies based on data intelligence and digital behavior           |
| Digital transformation of tourism       | Digital platforms, emerging technologies (AI, IoT, Blockchain) in tourism                     | Implement technologies for innovation in tourism products and services         |
| Smart destination management            | Governance, sustainability, ICTs, competitiveness indicators                                  | Participate in tourism development projects with a smart destination approach  |
| Information management and ethics       | Digital literacy, data processing, cybersecurity, ethics of information use                   | Use data in a critical, ethical, and secure manner                             |
| Tourism innovation and entrepreneurship | Innovation labs, digital business models, collaborative economy                               | Design creative and sustainable proposals based on market opportunity analysis |
| Public policy evaluation                | Evaluation methodologies, indicator systems, visualization for public management              | Evaluate tourism impacts and propose improvements based on evidence            |
| Continuing education and certifications | Open courses (MOOCs), software certifications, and data analysis certifications               | Stay updated and competitive in a changing environment                         |

Source: own elaboration

This curriculum proposal addresses the challenges faced by the tourism sector at a global level, as well as the specific needs of countries like Mexico, where tourism represents a strategic activity for economic, social, and environmental development. Therefore, the university must assume an active role not only in technical training but also in fostering a culture of innovation, ethics, and lifelong learning [29].

The curriculum redesign must also consider active methodologies such as problem-based learning, case studies, tourism management simulators, and professional internships related to data management and technologies. This will enable graduates not only to be familiar with the tools but also to apply them effectively to solve real challenges in contemporary tourism.

### Conclusions

This research allows us to conclude that tourism, as a complex and multifactorial activity, requires a profound transformation in the training processes of the human talent that supports it. In an environment where digitalization constantly redefines economic, social, and cultural practices, the ability to collect, interpret, and use data has become a key competence for strategic decision-making, designing meaningful tourist experiences, and formulating efficient public policies.

Tourism data, understood not only as quantitative figures but as inputs to generate market intelligence, represent a critical resource for sustainable development, innovation, and continuous improvement in the sector. The use of data enables the detection of behavioral patterns, demand anticipation, impact measurement, and, above all, reduction of improvisation in tourism management, favoring informed and contextualized decisions. Considering the above, digitalization is not merely a technological trend but a new operational logic involving connectivity, automation, hyper-personalization, and evidence-based governance. Countries that have invested in smart tourism destination strategies (Spain, South Korea, Colombia) have succeeded in articulating data platforms, qualified talent, and digital-focused public policies, creating more resilient, sustainable, and competitive tourism environments.

In light of this scenario, the professionalization of tourism actors stands as an imperative. Academic programs must stop being conceived as rigid structures centered on traditional content and evolve towards training models based on digital, analytical, and ethical competencies, where learning is continuous, multidisciplinary, and connected to the needs of the territory and the labor market. Curricular innovation is indispensable to avoid human capital obsolescence and strengthen the capacity to respond to global crises or technological disruptions.

Likewise, implementing content related to data analysis, market intelligence, digital transformation, and public policy evaluation not only improves graduates' employability but also equips them with tools to actively participate in building more sustainable and inclusive destinations. This reinforces the need for constant linkage among academia, the productive sector, and governments to train profiles that understand the strategic value of data at all levels of the tourism chain.

In light of the foregoing, the future of tourism is intrinsically linked to the intelligent management of information and the capacity of its professionals to integrate into digital dynamics that demand innovation, critical thinking, and a global vision. Therefore, higher education in tourism cannot remain on the sidelines: it must lead this process through updated, critical, and committed training aligned with the challenges of the 21st century.

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