


# Analysis of the tourism sector of the city of Barranquilla applying Machine Learning

## Análisis del sector turístico de la ciudad de Barranquilla aplicando técnicas de aprendizaje automático

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**Leidy Perez-Coronell**   
Universidad Simón Bolívar. Barranquilla (Colombia)  
[leidy.perez@unisimonbolivar.edu.co](mailto:leidy.perez@unisimonbolivar.edu.co)

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### Abstract

**Introduction**— Annually more than 6.5 million people arrive in Colombia from other countries, as indicated by the Ministry of Commerce, Industry and Tourism, demonstrating that the country is a key tourist destination in the region. It should take advantage of the boom in the sector and enter the market as an innovative, diverse and high-value destination.

**Objective**— The objective of this research is to present in a general way the tourism sector in Colombia and to introduce the concept of machine learning applied to this sector.

**Methodology**— For the documentation of this study, a methodology of exploration of secondary sources was used, through the exploration of databases such as Scopus, Science Direct, Ebsco-Host, IEEE, among others.

**Results**— In the conceptual review, it was found that Colombia has great tourism potential in different areas and in its various regions. However, there are limitations in the management and organization of the sectors and in the implementation of new technologies to improve their competitiveness.

**Conclusions**— The tourism sector seeks more realistic and satisfactory solutions because of ICT innovation and the use of computer systems and telecommunications equipment in information processing, which allows better responses to customers and improve production systems.

**Keywords**— TIC; tourism; Machine Learning; market; innovation; consumer

### Resumen

**Introducción**— Anualmente llegan a Colombia más de 6.5 millones de personas provenientes de otros países, según lo indicado por el Ministerio de Comercio, Industria y Turismo, demostrando que el país es un destino turístico clave en la región. Se debe aprovechar el auge que vive el sector e insertarse en el mercado como un destino innovador, diverso y de alto valor.

**Objetivo**— El objetivo de esta investigación es presentar de manera general el sector turístico en Colombia e introducir el concepto de aprendizaje automático aplicado a dicho sector.

**Metodología**— Para la documentación de este estudio, se utilizó una metodología de exploración de fuentes secundarias, a través de la exploración de bases de datos como Scopus, Science Direct, EbscoHost, IEEE, entre otras.

**Resultado**— En la revisión conceptual se encontró que Colombia tiene un gran potencial turístico en diferentes áreas y en sus diversas regiones. Sin embargo, existen limitaciones en la gestión y organización de los sectores y en la implementación de nuevas tecnologías para mejorar su competitividad.

**Conclusión**— El sector turístico busca soluciones más realistas y satisfactorias como resultado de la innovación de las TIC y el uso de sistemas informáticos y equipos de telecomunicaciones en el procesamiento de la información lo que permite dar mejores respuestas a los clientes y mejorar los sistemas productivos.

**Palabras clave**— TIC; turismo; Machine Learning; mercado; innovación; consumidor



## I. INTRODUCTION

Colombia's immense diversity in tourism is due to its unique geographical and cultural conditions. Coupled with steady advances in healthcare, business, and urban development, these factors have positioned Colombia as a versatile destination for various types of tourism. UNESCO defines ideal tourism as one that simultaneously respects the traveler, the heritage, the local population, and the environment. This approach not only ensures enriching vacations but also promotes a robust influx of tourists, thus boosting the local economy [1].

Annually, more than 6.5 million international visitors arrive in Colombia, as reported by the Ministry of Commerce, Industry, and Tourism. This influx underscores Colombia's status as a premier tourist destination in the region. However, it also presents challenges in terms of responsible tourism. Increased tourism can lead to pollution in natural reserves, potentially causing adverse effects [1].

Furthermore, the National Development Plan emphasizes Colombia's need to capitalize on the current global upswing in tourism. The goal is to establish itself in the market as an innovative, diverse, and high value destination, as illustrated in Fig. 1.

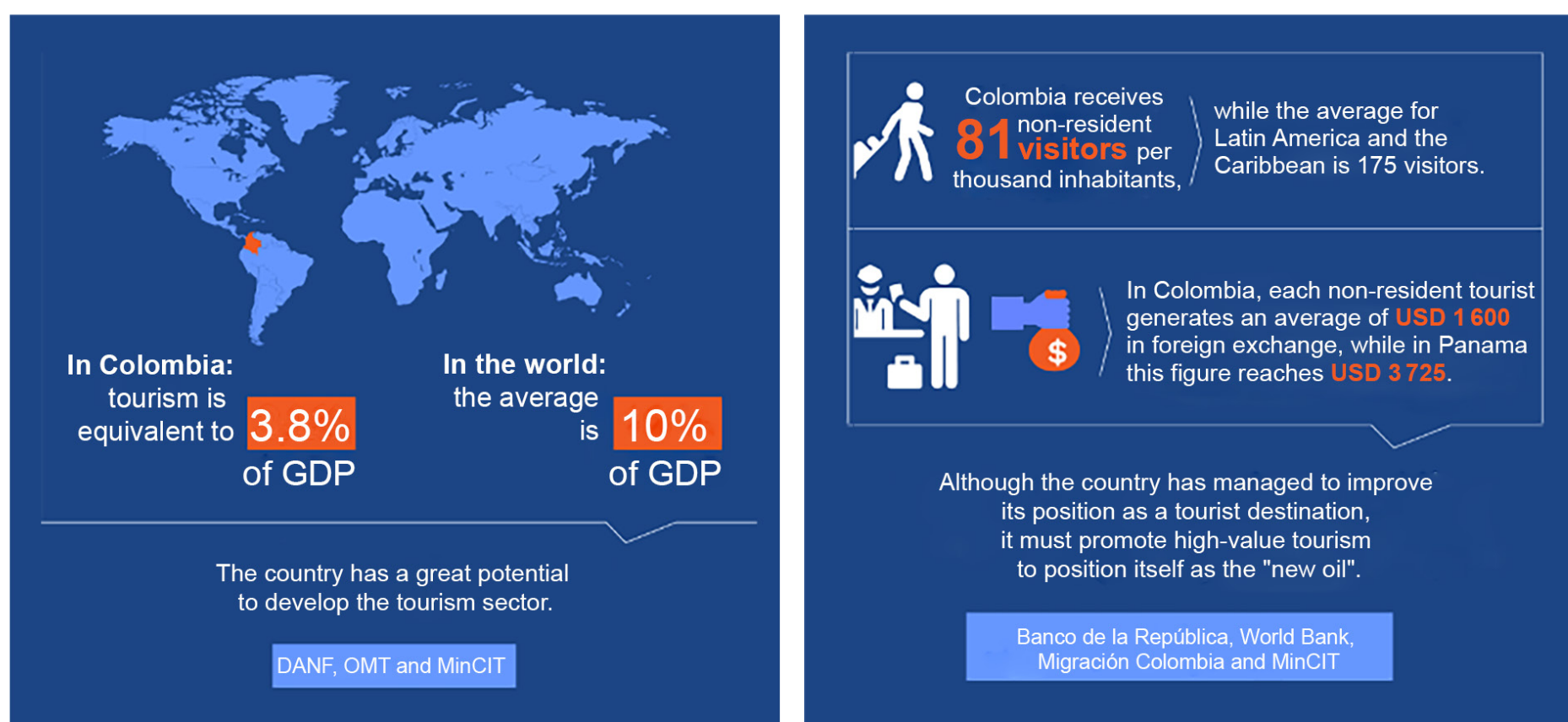


Fig. 1. Tourism sector in Colombia.  
Source: [2].

For all these reasons, Colombia must focus its efforts on achieving the following objectives [2]:

- Promote conditions that improve the tourism sector.
- Strengthen the range of tourist offerings.
- Improve infrastructure, connectivity, and investment opportunities.
- Promote business development and innovation.
- Strengthen human capital in the tourism industry.
- Ensure an inclusive and equitable tourism sector.
- Enhance the tourism experience by developing what can be termed the "tourism rainbow".

Colombia should set its sights on achieving the following goals in its tourism sector [2]:

- Improve the regulatory framework for tourism to better align with the evolving dynamics of the sector and various regional contexts.
- Designate special tourist zones in harmony with the Land Management Plan (POT).
- Develop different high-impact tourism products, including ecotourism, cultural tourism, business tourism, and health and wellness tourism.
- Establish sustainable and world-class tourism infrastructure.
- Streamline the processes associated with the National Tourism Registry (RNT).
- Elevate the level of education, training, and competencies within the tourism sector, focusing on superior personnel training.
- Modernize and refine the practices of tourist guides.

## II. TOPIC REVIEW

### A. Nature tourism

Nature tourism in Colombia encompasses a diverse range of activities, including cycling, bird watching, diving, community tourism, equestrian tourism, sport fishing and agrotourism. Recognized worldwide for its hospitality, Colombia's immense biological diversity makes it an ideal destination for nature enthusiasts. The country boasts two seas, three mountain ranges, a snow-capped mountain range, verdant jungles, and unique rivers. Its location in the equatorial zone, combined with varied geological conditions, fosters a multitude of ecosystems and landscapes. These natural settings are perfect for experiences that foster understanding and conservation of Colombia's rich natural heritage [1].

### B. Business and event tourism grows in Colombia

According to the latest ICCA ranking, Colombia is among the top 30 global destinations for hosting a significant number of events annually. In Latin America, three Colombian cities are particularly notable, ranked in the top 10 for organizing meetings [1]:

- *Bogota*: As the capital of Colombia, Bogota offers more than 50 venues suitable for a wide range of meetings. It is renowned for its modern infrastructure capable of accommodating high-impact events [1].
- *Cartagena*: Known for its delightful Caribbean climate, Cartagena provides a warm welcome to attendees and guests of corporate events [1].
- *Medellin*: Famous for the hospitality of the "paisas", locals from the regions of Antioquia, Caldas, Risaralda, and Quindio. Medellin is celebrated as one of the most welcoming cities in Colombia. It is also called the 'City of Eternal Spring' due to its pleasant climate throughout the year [1].

### C. Gastronomic tourism

Colombian gastronomy is exceptionally diverse, reflecting the country's rich cultural heritage and varied climate. This diversity is evident in the cultivation of exotic products like potatoes and chontaduro, found in great variety throughout the country. The addition of skilled chefs and culinary experts further enrich this culinary landscape. This unique combination attracts more than 4 million foreign visitors annually, who often begin their gastronomic journey in Colombia at various key locations: a) Bogotá, b) Boyacá, c) Eastern Colombia, d) Caribbean Coast, e) Antioquia, f) Eje Cafetero (Coffee Axis), g) Tolima Grande-Huila and Tolima, h) Valle, i) Nariño, and j) Llanos [1].

#### D. Machine Learning

Machine Learning (ML) is a specialized branch of Artificial Intelligence (AI). It is distinguished by its ability to comprehend and adapt data structures using consumer insights and predictive models. Unlike traditional computing methods prevalent in the IT industry, which rely on explicit instructions for problem solving, machine learning takes a different approach. It employs sophisticated algorithms that allow computers to process and analyze data input for empirical research. This process enables the generation of output within a defined range. Furthermore, computer frameworks leverage these ML methods to construct models based on test data, thereby facilitating automated decision making driven by the input data [3], [4], [5], [6].

#### E. Machine Learning's role in the tourism sector

In the modern era, Information and Communication Technology (ICT) is one of the most environmentally conscious and people-friendly industries. The tourism sector, in particular, is increasingly turning to ICT for more effective and satisfying solutions, thanks to ongoing technological innovations. ICT encompasses the utilization of computer systems and telecommunication equipment to process information. Notable examples include Cell Phone Applications (like Short Message Service-SMS), Digital Cameras, the Internet, Wireless networks (Wi-Fi), Voice over Internet Protocol (VOIP), Global Positioning System (GPS), Geographic Information System (GIS), Convergence, and Digital Radio. These technologies are revolutionizing the global marketplace, making it more innovative and sustainable [3], [7], [8], [9], [10].

Furthermore, machine learning applications in tourism are transforming the industry in several ways, including:

- Enhanced Customer Service and Automatic Messaging.
- Streamlined Check-In and Check-Out processes using Facial Recognition.
- Automation of services through robotics.
- Effective use of Social Networks for engagement and marketing.

The importance of social networks in influencing travel decisions and marketing has increased in recent years. The global travel industry, a pioneer in the adoption of advanced information technology, has witnessed a paradigm shift due to the Internet. This transformation has democratized the access to technology for a wide range of customers and tourism companies, regardless of their size. Today, travelers around the world depend on social networking sites and online travel agencies to plan their trips. IT-enabled tourism encompasses various functions, including direct booking, simplified payment processes for end-users, and business-to-business commerce for product producers, travel agencies, and resellers.

ICT has emerged as an indispensable component in the tourism sector. A prime example of IT in tourism is the Automated Reservation System used in railways and airlines. Additionally, IT solutions are increasingly being utilized in hotels, motels, hospitals, travel, entertainment, and tourism intermediaries. These solutions are designed to streamline business processes, improve customer relationships and ensure efficient operations [3], [11], [12], [13].

### III. CONCLUSIONS

The tourism sector is a key component of the global economy, encompassing a wide range of businesses that are directly or indirectly linked to tourism. This includes entities in the hospitality industry, such as hotels and restaurants, transportation services, and any other activities related to the tourism realm. In particular, the tourism sector holds the fourth position in the world economy, only behind fuels, chemicals, and food products. This prominence is underscored by its exponential growth over the past decade. According to the WTO in 2022 [15], tourism is one of the most significant contributors to the global economy. This is largely attributed to the widespread enthusiasm for travel and cultural exploration among people worldwide. Factors such as the income level of the populations and the policies of different countries greatly influence the sector.

Tourism is regarded as one of the largest and most dynamic productive activities worldwide, characterized by its rapid growth rate. For entrepreneurs who are starting a tourism business, one of the primary motivations is the potential to generate positive impacts, as outlined in the following points [14]:

- Creation of employment and income.
- Enhanced price control mechanisms.
- Potential to attract foreign investment.
- Expansion and improvement of infrastructure.
- Diversification of the economy through substitution of traditional exports
- Stimulating overall economic growth.

One of the significant challenges in the tourism sector is managing diverse demands, with some tourists preferring rural tourism, while others opt for more traditional forms. This varying demand can lead to excessive reliance on tourism, potentially causing economic imbalances. Such a dependence might result in incompatibilities within the sector and could lead to speculative activities that improve or adversely affect inflation [14].

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This research has been conducted independently, utilizing our own resources. This approach has ensured that the study remains unbiased and purely driven by our investigative objectives, without any external influence or sponsorship.

#### AUTHORS' CONTRIBUTION

The authors' contributions to this article are as follows:

Leidy Pérez Coronell was responsible for the conceptualization, methodology, conducting the research, and writing the initial draft.

All authors have participated in reviewing the results and have given their approval for the final version of the manuscript.

#### CONFLICT OF INTERESTS

The authors hereby declare that there are no conflicts of interest pertaining to the reporting of this study. This declaration encompasses any potential financial, personal, or professional interests that could be construed as influencing the research process, its outcomes, or the interpretation of its findings.

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**Leidy Pérez Coronell.** Industrial engineer. She is currently a full-time lecturer at the Universidad Simón Bolívar (Colombia). Her research interests are focused on recommender systems, intelligent systems, logistics and tourism. <https://orcid.org/0000-0001-5665-9910>