Evaluation of a nature-based tourism destination attractiveness - the case of Madeira

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Abstract

This study evaluates the overall attractiveness of Madeira as a nature-based tourism destination, by utilising a comprehensive approach that integrates both the perspectives of Polish tourists and expert opinions. To achieve this, the study employed a combination of the Analytic Hierarchy Process (AHP) and the Fuzzy Comprehensive Evaluation Method (FCEM), referred to as the Fuzzy-AHP approach. Data were collected through two questionnaires: one directed to experts with extensive knowledge of Madeira and another to Polish tourists, who have visited the island. The findings from the expert pairwise comparisons indicate that tourist attractions are the most significant dimension of Madeira's nature-based tourism attractiveness, with natural attractions, cultural attractions and external access being the most important factors and special events, historical relics, and folk customs ranking as the top attributes. Attributes such as road signs, tour guide interpretation, and interpretation boards were rated the lowest. From the tourist perspective, climatic phenomena was identified as the most important attribute, followed by topography and geology and the eco-environment. In contrast, marine transportation, sports facilities, and car parks were considered the least important. The study concludes that Madeira is evaluated as an "excellent" nature-based tourism destination, reflecting very high attractiveness.

Keywords

nature-based tourism, destination attractiveness, analytic hierarchy process, fuzzy comprehensive evaluation method, Madeira

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1. Introduction

Destination attractiveness is a crucial concept in tourism research, acknowledged as the driving force behind tourism and a significant factor in destination choice (Ariya et al., 2017). The "pull factors" influence tourists to choose one destination over another, making the attractiveness of a destination a critical factor in the success of any tourism location (Lee et al., 2009). Given its importance, destination attractiveness has received considerable attention in recent years from tourism researchers, professionals, and policymakers (Lee et al., 2010; Medina-Muñoz & Medina-Muñoz, 2014). Due to its significant impact on visitor behaviour, destination attractiveness is a relevant topic in tourism research (Lee et al., 2010b) that has been explored in many contexts, including but not limited to, visits to national forests and parks (An et al., 2019; Ariya et al., 2017), camping experiences (Lee, 2020), industrial sites (Lee, 2016), honeymoon destinations (Lee et al., 2010a), ski resorts (Kim & Perdue, 2011), railway tourism (Lee & Chen, 2016), senior-friendly destinations (Lee & King, 2016) and recreational biking (Lee & Huang, 2012; Lee et al., 2014).

Among the various forms of tourism included in the destination attractiveness discussion, nature-based tourism (NBT) has gathered significant attention in recent years due to its growing importance in the global tourism landscape. Nature-based tourism is considered to include a variety of related categories, such as nature tourism, wilderness and wildlife tourism, adventure tourism, environmental tourism, geo-tourism, outdoor tourism, and ecotourism (Fredman & Margaryan, 2021) and it plays a crucial role in promoting sustainable development and conservation efforts (Silva et al., 2023). It can also be viewed as a potential driver for community and regional development, aiming to benefit local populations while preserving natural and cultural heritage (Roxana, 2012). The motivations for NBT often include the desire to escape urban environments, experience pristine landscapes, observe wildlife in natural habitats, and engage in outdoor recreational activities (Majdak et al., 2021). The shift toward nature-based recreation suddenly accelerated after the COVID-19 outbreak in the spring of 2020 (Fredman & Margaryan, 2021) and nowadays continues to be a major trend, as it often aligns with sustainable practices with destinations focusing on preserving their natural assets and promoting responsible tourism initiatives (Dume, 2024).

One of the destinations in particular stands out as a remarkable example of a nature-based tourism destination. Madeira is the largest island forming part of the Madeira Archipelago within the Macaronesian Region, located on the Atlantic Ocean about 700 km off the coast of Africa and 900 km from mainland Portugal. The archipelago consists of three

other islands: Porto Santo and two uninhabited islands being nature reserves - Desertas and Selvagens (Rivera & Obón, 1995; Chojnacka-Ożga & Ożga, 2023). Nowadays, Madeira is one of the most significant regions for leisure tourism in Portugal, with its popularity increasing yearly. This is evidenced by the fact that since the 1990s tourism to the island has tripled from over 500,000 visitors in 1991 to 1.8 million in 2022 (Chojnacka-Ożga & Ożga, 2023). The latest figures show that more than 2 million tourists visited Madeira in 2023, an increase of 17.8% compared to 2022. (Direção Regional de Estatística da Madeira, 2024). Madeira island is distinguished by its exceptional natural features, including a mild climate, tropical-Mediterranean vegetation, a steep basalt coastline, varied terrain, lush river valleys, and terraced hillsides covered with vineyards (Chojnacka-Ożga & Ożga, 2023). All of these features, along with many others, make Madeira a destination rich with opportunities for nature-based tourism experiences. However, there is very little research about the attractiveness of Madeira, especially in the view of a nature-based tourism destination.

In recent years, Polish tourists have emerged as a significant demographic for Madeira's tourism sector. Direção Regional de Estatística da Madeira (2024) lists Poland as one of the main source markets for tourism in Madeira, ranking fourth among the top foreign markets behind Germany, the United Kingdom and France. The report states that in 2023 Madeira experienced a 39.5% increase in Polish tourist arrivals compared to the previous year, with the number of Polish visitors rising from 74,465 to 103,883. Polish visitors account for 6.5% of all foreign tourists arriving in Madeira.

Polish tourists have shown a marked increase in interest in destinations that provide not only leisure activities but also opportunities to explore the natural and cultural environments of the location (Chojnacka-Ożga & Ożga, 2023). This trend is supported by the growing popularity of NBT among Polish travellers, who seek immersive experiences in diverse landscapes and ecosystems. Among Polish visitors who travelled in 2015, nature (mountain, lake, landscape etc.) was one of the main reasons for going on holiday for 49% of them. Moreover, for 58% of Polish tourists, natural features were the main reason for returning to the same destination for holidays (European Commission, 2016). In a more recent study, the natural environment of the destination is ranked as the third most important factor when choosing a destination amongst Polish tourists (European Commission, 2021). The abovementioned factors and statistics demonstrate the growing importance of Polish tourists in Madeira's tourism landscape, making them a compelling group for further study in understanding the tourism attractiveness of the region.

Evaluating the attractiveness of a destination, especially a nature-based destination, helps to identify the unique features and resources that draw tourists, allowing destination managers to improve and market these attributes effectively. It also provides insights into visitor satisfaction and expectations, which are essential for enhancing the overall tourist experience and encouraging recurring visits (Gu et al., 2022). Moreover, understanding destination attractiveness contributes to sustainable tourism planning by balancing visitor inflow with the conservation of natural resources. It also supports economic development by identifying opportunities for local businesses and communities to benefit from tourism activities (Wang et al., 2024). Ultimately, a comprehensive evaluation of destination attractiveness ensures that tourism development aligns with environmental, social, and economic goals, promoting long-term sustainability (Tse et al., 2018). Although, until now, no universal method for measuring destination attractiveness has been developed. The attractiveness of nature-based destinations has been discussed in literature from the demand-side perspective by analysing the perceptions of tourists visiting destinations (Kim et al., 2003; Lee et al., 2009; Vengesayi et al., 2009; Islam et al., 2017; Aryia et al., 2019; Nasa et al., 2020), and the supply-side by evaluating the availability and perceived importance of attributes offered by destinations in the eyes of stakeholders with extended knowledge of the destination (Deng et al., 2002; Lee et al., 2010; An et al., 2019; Lee, 2020). However, the overall attractiveness depends on the relationship between demand and supply (Vengesayi et al., 2009). There is a lack of current research on both sides of nature-based tourism being evaluated simultaneously, as only Gu et al. (2022) proposed a model to achieve a more comprehensive evaluation of destination attractiveness.

The purpose of this study is to assess the overall nature-based tourism destination attractiveness of Madeira. The research aims to provide a comprehensive assessment of Madeira's attractiveness as a nature-based tourism destination, from both, the perspective of Polish tourists and the opinions of an expert panel. The objectives include identifying key factors that contribute to Madeira's attractiveness, determining their relative importance through expert opinions, and gauging tourist perceptions to create a holistic evaluation of the destination's attractiveness. The following research questions were set:

- According to experts, what are the most and the least important attributes contributing to nature-based tourism destination attractiveness?
- According to Polish tourists, what are the highest and lowest-ranked attributes of Madeira’s attractiveness?

- How is Madeira's attractiveness rated when comprehensively assessed as a nature-based tourism destination?

To answer these questions, the combination of the Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation Method (FCEM) called Fuzzy-AHP approach was utilised, which has been proven to successfully combine the evaluation of existing resources or attractions and their perceived attractiveness by the tourists (Gu et al., 2022). The data needed for the evaluation was collected from two questionnaires designed for this study: one conducted amongst 5 experts having extensive knowledge about the destination, and a second survey collecting data from 329 Polish tourists who have visited Madeira in the past.

The structure of this document is as follows: chapter two discusses the literature on the subject. Chapter three describes the methodology of the study and presents the data used. The results of the study are presented in chapter four, with further discussion covered in chapter five. The thesis concludes with a summary.

2. Literature review

2.1. The concept of destination attractiveness

Destination attractiveness can be described as a reflection of an individual's thoughts, beliefs, feelings, and perceptions regarding how well the destination satisfies their specific vacation needs (Hu & Ritchie, 1993). According to this concept, a destination becomes more attractive if it can better fulfil tourists' expectations and requirements (Ma et al., 2018). This aligns with Medina-Muñoz & Medina-Muñoz's (2014, p. 1) definition of attractiveness as "the ability of a destination to attract and satisfy potential tourists". The more a destination satisfies the tourists and meets their needs, the more likely this destination is to be selected as a final destination in preference to others and be perceived as more attractive (Vengesayi et al., 2009). Thus, the attractiveness of a country is the most influential element for destination choice, especially for foreign visitors (Kurihara & Okamoto, 2010). Besides destination choice, it also influences intentions to revisit, the duration of stay and the amount of money spent during the trip (Henkel et al., 2006). Therefore, it can be said that the success of a destination's tourism industry relies on its attractiveness.

Even though the tourists' opinions and perceptions of the destination's attractiveness are the demand side of tourism attractiveness, and some scholars claim that is what drives tourism, some argue that tourism cannot exist without attractions (supply). The reality is found in the mutual interaction between the two, which is necessary for tourism to exist (Formica & Uysal, 2006). According to a behavioural viewpoint on the interaction between supply and demand in the tourist industry, individuals participate in any tourism-related activities either because they are "pulled" by the destination attributes or "pushed" by tourism motivations (Gu et al., 2022). It can be said that destination attractiveness is a function of the natural resource base (attraction) and of demand (those who are attracted) and based on that, Formica and Uysal (2006) proposed a model that uses supply-and-demand indicators to measure and explain the factors that influence a destination's tourism attractiveness. It allows objective comparison and observation of the interaction between both viewpoints to determine how desirable the destination is for tourists. Since the competition among similar destinations is a significant concern for destination marketers and academics, by employing an integrated approach, tourist areas may use this strategy to build and implement planning, development, and marketing initiatives that are more successful (Henkel et al., 2006; Formica & Uysal, 2006). The guiding principle for all stakeholders should be that the overall tourism

attractiveness of a destination should always integrate the assessment of existing resources or attractions and their perceived attractiveness (Formica & Uysal, 2006; Gu et al., 2022)

As previously mentioned, a destination's overall attractiveness is partially determined by what it has to offer, or in other words, its attributes. The researchers found it necessary to identify all factors that may lead travellers to choose one location or engage in a particular type of tourism over another (Lee et al., 2010b). Travellers will likely consult various information sources and evaluate these characteristics for each potential destination during their decision-making process. From a list of possible destinations, they will select the one that maximises benefits within their travel constraints (Henkel et al., 2006). Understanding the factors contributing to a destination's attractiveness is vital for stakeholders aiming to enhance that attractiveness and ensure long-term success.

2.2. Attributes influencing destination attractiveness

Numerous studies on tourism attractiveness highlight the factors that travellers value when assessing a destination's attractiveness, however, there is no widely accepted set of attributes within the literature that would define the destination attractiveness. On the contrary, it has been embraced that a wide variety of such attributes exists, including many specific characteristics applicable only to some destinations and tourism products (Kim, 1998; Lee et al., 2010a; Medina-Muñoz & Medina-Muñoz, 2014). It is generally believed that a destination's attractiveness increases with the number of attributes it possesses (Vengesayi et al., 2009).

One of the most recognised structural frameworks was proposed by Gearing et al. (1974) when assessing the attractiveness of Turkey as a tourist destination, which included five dimensions of destination attractiveness: historical factors, social factors, natural factors, shopping and recreation facilities, and food, shelter and infrastructure. Van Raaij (1986) introduced a different approach and categorised destination attributes into two types: "given", which includes natural features like climate, scenery, and historic-cultural buildings, and "manmade", such as hotels, transportation facilities, package tours, and sports and recreation facilities. While natural features are inherent, the manmade attributes can be tailored to meet customer preferences within budgetary constraints (Van Raaij, 1986). Laws (1995) grouped the features of a destination into two different categories: the primary, which includes attributes that are embedded in the place, such as its natural resources, climate, ecology and culture, and the secondary, which are features that are mostly added for visitors, including lodging, transport, catering, entertainment and activities

Meinung (1989) claimed that some of the most crucial factors in attracting visitors to a place are the landscape, its natural environment, and its similarity to or difference from the demography of travellers. Moreover, cultural factors are becoming more significant in the worldwide tourism market because regions with strong historical legacies create a lot of demand just for their rich past, reflected either in living environments or museums (Meinung 1989; Kim, 1998). Several past studies also mentioned that safety, accessibility, and climate are crucial attributes for tourists. Middleton (1989) highlighted the significance of accessibility, which refers to how easily or not tourists can reach their chosen destination, as the overall access to the area is a crucial factor in destination choice. Davidoff and Davidoff (1994) pointed out that people would not travel to a location viewed as unsafe. In his study, Elwin (1989) argued that climate is a key component to enjoying a range of outdoor tourism activities. Hu and Ritchie (1993) attempted to assess the significance of destination attractiveness attributes, using several top international destinations. They concluded that scenery, climate, availability, quality of accommodation, local people's unique way of life, historical attractions and locals' attitudes toward tourists were the most significant factors influencing people's perceptions of destination attractiveness. In a study of five Korean destinations, Kim (1998) developed a review framework for outlining the important attributes of tourism destinations and listed several other factors affecting the attractiveness of a destination, such as seasonal and cultural attractiveness, a clean and peaceful environment, quality of accommodation and relaxing facilities, family-oriented amenities and safety, accessibility and reputation, entertainment, and recreational opportunities.

Another division was presented by Hsu et al. (2009), who identified the factors that influence the tourists' choice of Taiwan as a destination as belonging to two categories: internal force and external force. Internal force includes factors such as psychological factors (escape, and self-actualisation), physical factors (relaxation, medical treatment, health and fitness), social interaction (visiting friends or family and meeting new people) and exploration (novelty seeking, culture exploration, adventure seeking, and enjoying nightlife and shopping). Tangible factors (transportation facilities, friendliness of people, quality and variety of food, accommodation facilities, personal safety, price, culture and historical resources, good shopping, and environmental safety and quality) and intangible factors (destination image, and benefits expectations) make up the external force. Thus, only external force includes the characteristics of a destination and internal force refers to tourists' motivations, which makes it a vastly different approach from its predecessors that has not been further echoed in the literature.

Morachat (2003) conducted research focusing on investigating the overall attractiveness of a localised area from the demand-side perspective and identified 8 factors contributing to destination attractiveness. Natural factors included natural beauty, climate, water, wildlife, and vegetation, and cultural features contained attributes such as architectural and artistic features, historical and ancient ruins, carnivals and festivals, distinctive local features, religion, and food. Outdoor activities, facilities pursuing health, rest, serenity, nighttime recreation, and shopping facilities form the factor of recreational and shopping facilities. By infrastructure, the Author means the quality and availability of different means of transportation, and accommodation. Accessibility includes attributes of the physical distance to, and the time involved in reaching the vacation destination. Reception is the information centres, interpretation and language services, pedestrian signposts, display maps, tour-local guides and tour operators, and community attitudes towards tourists. Banks and cash machines, currency exchange, police and security, medical services, communications, energy supply, water supply, and sewerage services are considered services. Lastly, the price factor includes the value received for money spent on major services, food, lodging, and transportation.

On the contrary, Formica and Uysal (2006) identified the variables that supply tourism attractiveness as various elements, including tourism services and facilities, dining and drinking establishments, retail outlets, souvenir shops, travel agencies, accommodations, golf courses, cultural and historical sites (such as historic buildings, museums, historic districts, and civil war sites), festivals, wineries, campsites, cottages, recreational vehicle parks, and outdoor activities like horseback riding, waterfalls, hiking, and biking. These elements fall into four primary factors: tourism services and facilities, cultural/historical factors, rural lodging, and outdoor recreation opportunities. As tourists engage with these local businesses, they encounter a range of background tourism elements, such as natural landscapes, socio-cultural sites, and manmade attractions that often serve as the primary motivations for their travel (Formica & Uysal, 2006).

Some other researchers, like Krešić and Prebežac (2011), by connecting tourism attractions with destination competitiveness set a theoretical framework for destination attractiveness and identified nineteen destination attributes: image of the country, feeling of personal safety, quality of the country’s promotion, climate, scenic beauty, accessibility, quality of information in destination, urban and architectural harmony of the place, environmental preservation, tidiness of the place, friendliness, quality of accommodation, quality of restaurants, presentation of cultural heritage, entertainment opportunities, sport and recreation opportunities, shopping opportunities, and value for money. On the other hand,

Tam (2012) in her research with the use of a contextual approach categorised seventeen destination attributes as follows: safety and security, scenery, price levels, cultural attractions, attitude towards tourists, uniqueness of local people's life, food, availability/quality of local transportation, historical attractions, entertainment activities, festivals special events, communication difficulties, availability/quality of accommodations, weather and climate, shopping, accessibility, and sports/recreational opportunities and proved that different attributes of a tourism destination can be perceived and evaluated differently depending on the context in which the judgment is made. Both authors agree that safety and security should be considered in the research of destination attractiveness, following the previous work of Davidoff and Davidoff (1994).

In a study of international students' perceptions of Australia, Ma et al. (2018) identified five factors of the attractiveness of tourism destinations as follows:

- quality of tourism products: smooth travel to and from a destination, favourable weather/climate, unique tourism resources, high-quality tourism infrastructure, a good variety of activities offered for tourists at the destination, the hospitality of the local people, and high-quality of services;
- destination image: commitment to a safe environment, commitment to promote a positive image, good value for money, and overall favourable image;
- government support: easy access to meaningful information, policies/regulations favourable to tourists, and commitment to tourists satisfaction;
- competitive advantage: problem-free vacation arrangements, commitment to preserve the environment, competitive price of the destination, and commitment to continued improvement;
- convenience: ease and convenience at destination, and alliance with intermediates in the tourism sector.

The authors mentioned the importance of overall access, which was previously stressed by Middleton (1989). Also, similar to Krešić and Prebežac (2011) and Tam (2012), they also emphasized the role of perceived value for money.

Ding et al. (2021) reviewed the factors affecting tourism attractiveness based on the literature and collected four evaluation dimensions and sixteen important evaluation factors affecting the attractiveness of Taiwan's offshore islands tourism. The dimensions are as follows: substantial aspect (reputation and familiarity of attractions, natural resources of regional attractions, cultural heritage and cultural resources, specialities, souvenirs, and food),

social aspect (local festival activities, diversified itinerary designs and activities, well-established and convenient transportation, night tours and attractions), environmental aspect (completeness of recreational facilities, quality tourism consulting services and indexes, accommodation and public facilities, completeness of the tourist environment space) and perceived aspect (tourist atmosphere, tourism friendliness degree, travel pay expense amount, travel safety).

In a more recent study, Yevloyeva (2024) also comprehensively reviews the components forming tourism attractiveness based on existing literature, such as nature, culture and heritage, tourist infrastructure, sustainability, digitalisation and general development of tourism, sports and entertainment, and hospitality and local communities. The nature category includes attributes of landscapes, wildlife and climate. By culture and heritage, the author not only means historical attractions such as museums, architecture and monuments, but also cultural events, heritage sites, cultural exchange and interaction, and lore. Well-established transport networks, modern accommodation facilities and efficient services form the basis of tourist infrastructure. Under sustainability lies the balance between economic development and environmental conservation ensuring that tourism remains a force for good, leaving a minimal ecological footprint. The digitalisation of destinations, like technological advancements or virtual opportunities and the development of a variety of services, seems to be crucial to creating an environment convenient for tourism growth. Sports and entertainment can be anything from wellness programs to adrenaline adventures, including hiking, sports, and participating in events. Lastly, the hospitality and local communities category includes service quality, safety, education and awareness, and community involvement as key factors for destination attractiveness.

Among more focused studies on different destinations or tourism types, the categorisation of various attributes may differ even more. For instance, Brida et al. (2012), separated the wide range of variables influencing the attractiveness of urban tourism destinations into three essential categories: primary, secondary and additional. The primary components are physical and socioeconomic features, cultural amenities, such as museums and art galleries, entertainment venues, and sports facilities, which reflect the main reason visitors come to the city. Even if they are not the primary pulls for tourists, secondary factors like lodging and shopping, as well as additional elements like transportation and tourist information are crucial to the success of urban tourism. Signs, travel guides, information desks, and parking spots are also considered additional elements. The urban destination's lack

of natural features or hiking trails makes nature-related attributes less significant for this type of destination.

Mohanty et al. (2021) identified twenty-nine factors influencing destination attractiveness in the temple city of Bhubaneswar. They are as follows: perception regarding heritage tourism, opinion regarding the natural landscapes, opinion regarding the tourist's facilities, monuments and historical buildings, culture, history and art, customs and religious activities, behaviour of the host population, value for money, civic sense of people, standard of transportation, quality of infrastructure, climatic condition, political stability, unique tourists' attractions, quality of local food and cuisine, availability of special events and fairs, availability of local items, handicrafts and souvenirs, safety and security of tourists, availability of lavatories, availability of guide services, availability of urban sight-seeing, cleanliness in the tourist sites, availability of various transportation options, procedure of customs and immigration in airports, quality of sound and light show, availability of entertainment activities, availability of signs and signages, availability of tourism information centres, and availability of accommodation facilities. Das et al. (2007) when studying another destination in India, Varanasi, came up with a set of 7 factors perceived as important when assessing the attractiveness of a destination. Factor 1, ease of accessibility, consisted of four items measuring information, accessibility, connectivity and reservation facilities. Factor 2, touristic infrastructure, also represented four items covering basic infrastructure, infrastructure of hotels, food and hygiene. Factor 3, support services, included five items namely postal and banking services, travel arrangements, tourist information centre, proper display of fares and inexpensive tourist destination. Factor 4 was named as the ancient flavour of the city, which consisted of three items namely Indian spiritualism, the oldest surviving city and museum. Factor 5, distinctive local features, also represented three items specific to the location - Ganges and Ghats (riverbank), river cruise in Ganges and Ganga Aarti. Factor 6 was labelled as psychological and physical environment, which combined the safety of tourists, the attitude of the local people and the visible physical environment. Finally, Factor 7 covered only two items measuring music and handicrafts, which were named as cultural attributes. Both of the authors place substantial importance on cultural features unique to the destinations, echoing the works of Kim (1998), Mocharat (2003) and Tam (2012).

When evaluating long-haul destinations, four dimensions are considered important, according to a study done by Vigolo (2015) on Italian tourists choosing South Africa as a travel destination. Facilities include good infrastructure (e.g. roads, airports), good cleanliness/hygiene, good restaurants, good tourist information points and services, good

means of communication (e.g. mobile phone, internet), and good accommodation facilities. Badwill involves political stability, social crisis, and economic crisis. Wildlife is beautiful natural scenery, great wildlife, and the possibility to practice exciting outdoor activities. Attributes of untamed, authentic, and adventurous are considered part of exoticness.

Medina-Muñoz & Medina-Muñoz (2014) proposed a list of twenty-four possible determinants of wellness destination attractiveness, divided into six categories: the attractiveness of the offer of wellness treatments and centers, the natural conditions of the destination and the relaxing environment of the hotel, the business offer complimentary to wellness treatments, price competitiveness, the offer of sports activities, and differentiation based on personalised and professional attention. In the first category attributes such as thermal treatments, water treatments, the wide offer of wellness treatments, the attraction and uniqueness of wellness treatments, the chance to visit various wellness centers, treatments for relaxation and well-being, the attraction and uniqueness of wellness centers and hotels with wellness facilities, and the offer of treatments and services to relax and reduce stress are included. The natural conditions of the destination and the relaxing environment of the hotel consist of the attractiveness of the location and surroundings of the hotel, the peace of the hotel, the scenery and natural conditions, and the climatic conditions. The business offers complementary wellness treatments including treatment programs, medical services, cultural leisure, wellness advice, beauty and body care, and a balanced and healthy diet. The quality-price ratio of the trip and the low cost of the trip make up the price competitiveness category. The offer of sports activities includes attributes of gymnasia and other sports facilities, and the chance to practice sports while in touch with nature. Differentiation based on personalised and professional attention considers personalised attention and qualified staff. Since these attributes proposed by the authors are unique for wellness-oriented destinations, they cannot be universally used for all other types of destinations.

Even though much research on destination attractiveness identifies Taiwan as the chosen study site, the determinants seen as important differ depending on the studied tourism type. The attributes that determine the attractiveness of Taiwanese honeymoon destinations were presented by Lee et al (2010a) and include reasonable travel cost, excellent quality of accommodation, beautiful scenery, safety, romantic place, good place for shopping, good weather, cultural and historical assets, nightlife entertainment, and accessibility. When it comes to bicycle tourism in Taiwan, Lee et al. (2014), by reviewing relevant literature, selected thirteen determinants of destination attractiveness: beautiful scenery, nearby attractions, comfortable climate, connection-oriented transport services (e.g., rail, bus),

variety of bicycle route alternatives, smooth pavement surface, low traffic flow and density, provision of lodging facilities, provision of catering services (grocery and convenience stores), bicycle route signs, interpretation and information signage, lighting systems, and public rest areas and restroom facilities. For senior-friendly destinations, another set of twenty attributes are important, as mentioned by Lee and King (2016): unique natural and scenic resources, rare species flora and fauna, comfortable climate, year-round festivals and events, abundant cultural and historical sites, variety of seniors-friendly tour types, variety of seniors-friendly leisure facilities, variety of customised travel routes, barrier-free facilities along customised travel routes, variety of public transportation, barrier-free facilities of public transportation, seniors-only accommodation options, barrier-free accommodation facilities, quality of catering services, health-oriented cuisine, emergency medical service system, cleanness of tourism attractions, safety of tourism attractions, quality of seniors-only travel agencies, and quality of seniors-only tour guides.

The attributes determining industrial tourism attractiveness in Taiwan have been divided by Lee (2016) into the following groups: on-site attractions (do-it-yourself experience, exhibition space, observation of production process, events and performances, and on-site souvenir shops), nearby attractions (cultural attractions, natural attractions and eco sites, man-made attractions, and other tourism factories nearby), external access (accessibility by private vehicles, accessibility by public transport services, and connection to nearby attractions), internal access (opening days and hours. parking lot, carrying capacity, entry fee, and internal transport facilities), provision of lodging facilities (on-site overnight accommodation, off-site overnight accommodation, and rest areas), provision of catering facilities (on-site restaurants, restaurants nearby, shopping area nearby), communication & information services (visitor center/reception, professional guides, guidebooks, information displays, signposting, interactive information panels), and safety & security systems (site cleanliness and tidiness, reservation rules and restriction, elevated walkways behind the glass window, theft and industrial espionage, and medical emergency and first-aid service). On the other hand, the attributes relevant to railway tourism have been studied by Lee and Chen (2016) and include four categories:

- tourism attractions, including scenery along the route, a variety of rural branch lines, a variety of tour trains/chartered trains, railway museums, the architecture of railway stations, railway-related souvenirs, and sights and attractions near the station;

- accessibility, including train frequency, train punctuality, number of stops along the route, ease of access to the station, frequency of transit connectivity, and types of transit transports;
- amenities, including the comfort of the seating, on-train dining service, sleeping carriages, on-train entertainment equipment, station-waiting area, and lodging and catering services nearby the station;
- complementary services, including announcing systems, information/service centers, railroad-supplied electronic devices, railway police, emergency service, and on-train service staff.

In a study of Portugal as a holiday destination as perceived by Czech tour operators, Tomigová et al. (2016) presented attributes like scenery, historical attractions, accessibility, climate, price levels, festivals/special events, food, sports/recreational opportunities, cultural attractions, uniqueness of local people's way of life, availability and quality of accommodation, safety and security, attitude toward tourists, entertainment activities, shopping, availability/quality of local transportation, communication difficulties. Then again, when analysing the different ways in which seasonal tourists assess the attributes of the Algarve region in Portugal, Barreira and Cesario (2018) considered attributes of lodgings, landscape, urban design, urban planning, urban cleanliness, noise levels, food and drink, friendliness of locals, natural parks, culture and entertainment, beaches, health services, safety for tourists, road safety, public transport, taxi services, and value for money as important. Focusing on more specific urban locations like the Algarve highlights different attributes compared to the study that examines Portugal as a whole, thus segmenting and researching smaller regions allows for more detailed findings. This suggests significant potential for further research in Portugal, specifically exploring different regions and types of tourism practised throughout the country.

It can be noticed that most authors universally recognise natural and cultural attributes as core elements of destination attractiveness. The role of accessibility and infrastructure, specifically transportation, accommodations, and basic services, has also been featured prominently across the board. However, a significant difference lies in the categorisation of the attributes. Over the years the frameworks became more detailed, and these expanded categorisations reflect the increasing complexity of tourism and the growing need to address diverse tourist expectations. There is also a vast difference in the importance of intangible attributes. While early studies focus predominantly on tangible, physical attributes, more recent research underscores the increasing significance of intangible elements, such as the

image of a destination (Hsu et al. 2009) and the perceived value of sustainability (Yevloyeva, 2024). These intangible aspects are becoming more critical as tourists increasingly value ethical, environmental, and psychological benefits alongside traditional tourism offerings. Overall, the trend in the literature moves from a focus on individual attributes to a holistic understanding of the tourist experience. Moreover, newer studies, such as Yevloyeva (2024), incorporate digitalisation and sustainability as essential attributes. The increasing relevance of technological advancements, virtual tourism opportunities, and sustainable practices reflects the growing importance of eco-friendly tourism and tech-enabled convenience. These considerations are largely absent from earlier studies and become now relevant in present times, especially the sustainability aspect, which needs to be further studied in terms of perceived destination attractiveness.

However, the variability in the attributes discussed by different authors also underscores the importance of context. The existing literature has proven that for every destination or tourism type, different attributes can be considered as important, depending on special characteristics. Since there is general agreement across the findings that desirable attributes are associated with particular categories of tourism sites and, thus, call for a site-specific assessment, it is important to understand the studied destination type better.

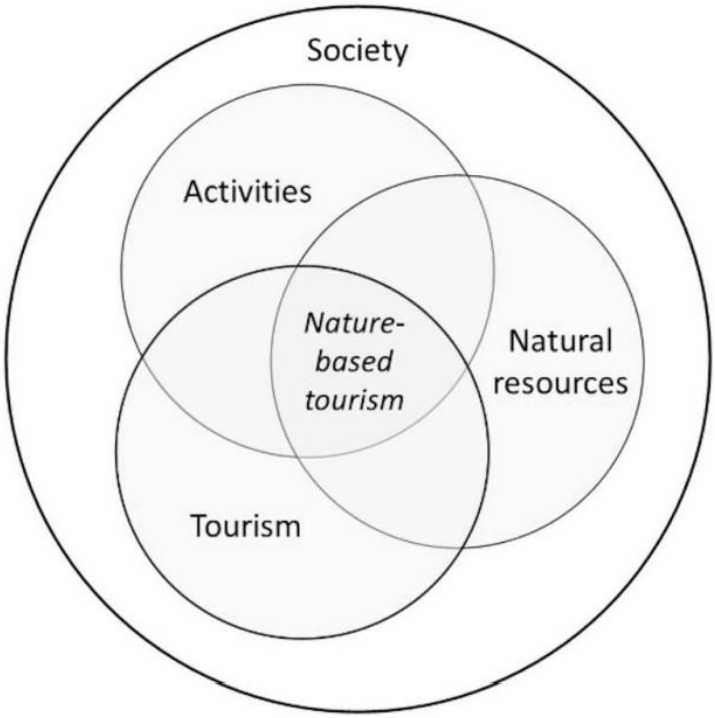
2.3. Characteristics of nature-based tourism

Nature-based tourism (NBT) is one of the fastest-growing tourism sectors that takes up a major segment of world tourism (Winter et al., 2019, Silva et al., 2023). Describing what nature-based tourism refers to in general may not be difficult, however, an agreement on its exact definition has not been reached yet. There has been a rise in interest and discussion on this topic in the last 15 years, as seen in a variety of literature examining nature-based tourism itself or as a part of wider tourism research (Donici & Dumitras, 2024).

The expression nature tourism or nature-based tourism refers to vacation activities that emphasise connecting with nature and typically involve an overnight stay, which usually involves going to and spending the night in areas near or in national parks, woods, lakes, the sea, or the countryside, and engaging in activities that make use of these environments and are consistent with their inherent traits (Bell et al., 2007). This type of tourism includes all forms where the primary attraction or setting is the relatively undisturbed natural environment (Buckley & Coghlan, 2012). The relationship between humans and nature was elaborated by Valentine (1992), who proposed three types of tourist activities: experiences dependent on nature, experiences enhanced by nature, and experiences where nature has a subordinate role

(nature is not necessary to achieve satisfaction). Wolf et al. (2019, p. 2) have broadly defined NBT as "visitation to a natural destination which may be the venue for recreational activity where interaction with the plants and animals is incidental, or the object of the visit to gain an understanding of the natural history of the destination and to interact with the plants and animals. Interactions with wildlife (usually animals, but in some definitions plants and animals) can be nonconsumptive (e.g., wildlife viewing) or consumptive (e.g., recreational hunting)". A simpler definition of nature-based tourism is to view it as an activity that occurs when visiting a natural area outside of the ordinary place of residence (Fredman & Tyrväinen, 2010). Fossgard and Fredman (2019) defined NBT as the intersection of tourism, outdoor recreational activities, and natural areas, as presented in Figure 1 below.

Figure 1. A nature-based tourism framework.



Source: Fossgard, K., & Fredman, P. (2019). Dimensions in the nature-based tourism experiencescape: An explorative analysis. *Journal of Outdoor Recreation and Tourism*, *28*, 100219.

According to Nyaupane (2007), many authors in past literature use the terms NBT and ecotourism as synonyms, whilst others use the term NBT as a synonym for rural, sustainable, responsible, or adventure tourism (Roberts & Hall, 2004, Higgins, 1996, Silva et al., 2023). To highlight the difficulty in agreeing on one uniform definition, Fredman and Tyrväinen (2010) mentioned that 42 recognised definitions of ecotourism have been identified in one paper alone. However, over time, nature-based tourism came to refer to a wide range of

outdoor recreational-based travel experiences, not exactly as synonyms but more as sub-categories of NBT (Fennell, 2000, Fredman & Tyrväinen, 2010).

Nature-based tourism is a very diverse sector, that should recognise the variety and diversity both in the supplied products and in customers who buy and demand these products (Buckley & Coghlan, 2012). Based on existing literature, Donici and Dumitras (2024) have identified the following forms of nature-based tourism: eco-tourism, wildlife tourism, geo-tourism, rural tourism, adventure tourism mountain tourism, outdoor tourism/outdoor recreation, active tourism, wilderness tourism, dark sky tourism, and botanical and garden tourism. They have also identified some usual nature-based activities as hiking, trekking, birdwatching, photography, camping, hunting, fishing, park touring, skiing, mountain biking, safaris, and stargazing. All of those require a specific natural environment to be performed. Therefore, natural resources at a destination are crucial for providing tourist experiences in natural settings, making it essential to identify and manage these resources effectively within the NBT system (Fredman & Tyrväinen, 2010).

Protected areas are important and popular parts of nature-based destinations. On one hand, these areas were created to protect and conserve nature, however, on the other hand, they bring profit by attracting visitors (Silva et al., 2023). With nature-based tourism, there is a potential for a symbiotic relationship between tourism and natural area conservation which is required to maintain sustainability (Wolf et al., 2019). People take pleasure in visiting natural areas and interacting with wildlife. Spending time in natural environments and engaging in outdoor activities is widely acknowledged as essential for boosting human health and well-being, strengthening social bonds, reconnecting individuals with their natural and cultural heritage, supporting local economies, and cultivating a conservation mindset (Winter et al., 2019). Land managers aim to attract these visitors to gain government and community backing, generate goodwill, and secure financial resources. These funds can then be reinvested in preserving natural areas, protecting them from potentially harmful land uses. When travellers have meaningful experiences in nature, they may extend their support to conservation efforts and such experiences are also crucial for encouraging future visits or recommendations of the destination to others. This generates additional financial revenue and strengthens the case for conserving the tourism site (Wolf et al., 2019). However, promoting visitation rather than designating an area as untouched wilderness has its drawbacks. Nature-based tourism can lead to resource degradation, increased roadkill, disruption of animals from crucial feeding and breeding areas, and inappropriate feeding, whether intentional or accidental, among other issues documented in studies on the impacts of outdoor recreation,

ecotourism, and wildlife tourism (Green & Higginbottom, 2002, Steven et al., 2011, Wolf et al., 2019). Ironically, the more attractive a site is, the greater the risk of its degradation. Nevertheless, conserving natural resources is crucial, as without it, the unique qualities of ecosystems that form the foundation of nature-based tourism would diminish, change, and eventually vanish (Donici & Dumitras, 2024).

The key to balancing conservation efforts with the development and promotion of tourism is ensuring that the natural beauty and resources of a destination are both protected and appreciated. Effectively assessing a nature-based destination's attractiveness not only enhances its potential to attract and satisfy visitors, helps with planning and marketing, assists destinations to allocate resources and prioritize the investment and development of their tourism areas, but also helps preserve its ecological integrity as proven above. To do so, understanding the attributes that contribute to nature-based destination attractiveness is crucial.

2.4. Attributes influencing nature-based destination attractiveness

Due to the unique character of nature-based destinations the attributes mentioned in nature-based tourism literature might slightly differ from factors perceived as important when assessing destination attractiveness in general. Deng, King, and Bauer (2002) highlighted five essential factors for assessing the attractiveness of national parks and forest reserves: local communities, accessibility, visitor amenities, tourism resources, and peripheral attractions. In their model, tourism resources include both natural and cultural elements, with cultural resources often playing a supportive role in nature-based tourism. The social, cultural, and economic characteristics of local communities influence resource management and the overall quality of leisure experiences, making it one of the five key factors. Tourism facilities are divided into infrastructure, recreational amenities, and educational resources. Accessibility refers to the ease of reaching a destination, both externally and internally. External accessibility is evaluated based on alternative routes, convenience, and distance, while internal accessibility relates to the connectivity within the park’s road and trail network.

When evaluating Korean national parks, Kim, Lee, and Klenosky (2003) concluded that the three main elements contributing to the attractiveness of visiting national forest parks are key tourism resources, information and facility convenience, and accessibility and transportation. A few of the most important tourist attractions include places where children may learn about the environment, rare fauna and flora (or aquatic life), peaceful rest areas, stunning scenery, historical and cultural sites, and carefully maintained environments. Well-

run tourist information networks, practical amenities (such as beverage stands and restrooms), easily accessible parking spaces, and tidy, pleasant accommodations make up information and convenience facilities. In their study, accessibility and transportation refer to easy accessibility and convenient transportation to and within a destination.

The factors affecting the attractiveness of forest recreation tourism have also been explored by Lee et al. (2010b), who presented twenty-two crucial attributes: forest landscapes and scenery, climatic phenomena, rare flora and fauna, special events, historical structures, road network, steam railway, charter buses, internal shuttle services, car parks, quality accommodation and cuisine, types of accommodation and cuisine, trails, museum exhibits, outdoor furniture, shopping, visitor centers, guided walks, interpretation boards, road signs, medical care system, emergency remedy system, and environment maintenance.

An et al. (2019), derived the criteria for the tourism attractiveness of protected areas from previous studies, which resulted in thirteen attributes: international importance, biodiversity of plants and animals, rare plants and animals, historical, cultural and spiritual structures, hotels and hostels, trails, information services, tourism cooperation, education and research cooperation, diversity of outdoor activities, external access, internal access, and the local community.

While evaluating Zimbabwe, where the tourism industry is mostly focused on its natural attractions, Vengesayi et al. (2009), pointed out that attributes include a wide range of natural and man-made resources, including culture, heritage, history, customs, architectural landmarks, traditional art, cuisine, music, and handicrafts that appeal to travellers. They divided these attributes into three categories: destination attractions, destination support services and people-related factors. Destination attractions include cultural and historical attractions, natural attractions, recreation facilities, unique attractions and created attractions (e.g. tours or special events). As destination support services authors describe accommodation facilities, destination utilities (e.g. clean water), communication facilities and destination accessibility. The people-related factors involve attitudes of locals to tourists, physical risk (e.g. political stability), health risk and customer service.

When it comes to national parks, Aryia et al. (2017) proposed four factors contributing to nature-based tourism destination attractiveness. Factor 1 is the pricing of attractions, which includes a guiding fee, park entry fee, and cost of meals and accommodation. Factor 2, wildlife resources, consists of attributes such as abundance of wildlife resources, unique wildlife resources, and variety of wildlife resources. Factor 3, named park image, includes park branding as a rhino sanctuary, park branding as a bird sanctuary, and safety and security

inside the park. Accessibility, quality of road systems, quality of park route signs, and proximity to attraction sites compose the last factor, the park itself. On the other hand, Nasa et al (2020) proposed a 5As framework to evaluate the attractiveness of Phu Kradueng National Park in Thailand, consisting of Attractions, Activities, Accessibility, Accommodations, and Amenities. Attractions include tourism resources such as cultural experiences, events, festivals, and the unique natural features of a destination. Accessibility involves the transportation options that enable tourists to reach and navigate their destination. Accommodations refer to the lodging options available for tourists during their visit. Amenities include the facilities and services provided for tourists at the destination, such as restaurants, public restrooms, tourist information centres, and communication networks. Finally, activities refer to recreational opportunities available for tourists to enjoy at the destination.

Camping tourism, as a form of nature-based special interest tourism, has been studied by Lee (2020), who highlighted sector-specific destination-level attributes, classified into tourism attractions, accessibility, amenities, and supplementary services categories. Tourism attractions are the key factors that define a destination's attractiveness and act as a significant draw for campers to a specific location. These attractions can be either natural or man-made. Accessibility pertains to the ease of reaching a campground, including the quality of the access infrastructure and the types of transportation used to get to and move within the campground. Accessibility is typically evaluated on two levels: external access and internal access. Amenities encompass a range of commercial services and facilities specifically designed to meet campers' basic needs and are divided into two categories: lodging facilities and catering facilities. Supplementary services include the efforts of various stakeholders to enhance the camping experience, focusing on both information services and safety and security services.

In their research, Islam et al. (2017) presented a set of the most important drivers for nature-based tourism in Bangladesh, that were described as follows: personal safety and security of the place, easy access to transportation services, variety of natural attractions, well-developed tourism markets and roads, natural scenic beauty and calmness of the place, well decorated and comfortable accommodations, availability of healthcare and emergency medical treatments, cleanness of the atmosphere, reasonable price of different products, quality of the overall tourism services, pleasant climate and good environment, availability of telecommunications with high speed internet and ATM, reputation of the place, access to information and easy communication with locals, good quality and taste of foods and

beverage, variety of historical attraction and places, availability of family oriented visited atmosphere, shopping and entertainment facility, friendliness and hospitality of the locals, outdoor recreational facilities, variety of cultural events and attractions, availability of discounted tour packages, similarity with the local lifestyle, and opportunity for visiting friends and relatives.

A demand-side perspective on the factors determining the attractiveness of Taiwan as a hot springs tourism destination proposed by Lee et al. (2009), revealed that attributes can be divided into three groups: core attractions, supporting infrastructure, and safety and security. The latter factor includes five items: safety of the bathing environment, hygiene standards for hot springs spa equipment, emergency medical care and the availability of ambulance services, personal safety and hygiene-basic rules and responsibility, and safety of the overall destination. The supporting infrastructure can be divided into transportation infrastructure, leisure and recreation, food, and accommodation. The first factor in this group, transportation infrastructure, included four items such as convenient access to a hot springs area, reliable public transport services, a sound local transportation network, and ample parking spaces. The second factor consisted of four items such as special events and festivals, seasonal recreation, outdoor adventure and souvenir shopping. The third factor, food, was composed of three items: authentic recipes using ethnic ingredients, seasonal menu offerings, and health-oriented gourmet. The fourth factor, accommodation, was concerned with adequate capacity of accommodation, and high quality of accommodation. The core attractions were represented by cultural assets measuring the importance of guided tours of local art and culture, notable historical landmarks nearby, and natural resources, which consisted of three items: high-grade natural hot springs, plentiful natural hot springs, and abundant natural scenery.

The most comprehensive set of attributes was presented by Gu et al. (2022), who proposed, in total, thirty-two attributes determining the nature-based tourism destination attractiveness of Changbai Mountain Biosphere Reserve. They have been divided as follows:

- Natural attractions: topography and geology, rare flora and fauna, forest landscape, climatic phenomena, water landscape, and eco-environment,
- Cultural attractions: historical relics, folk customs, and special events,
- External access: road network, aviation, and railway,
- Internal access: charter buses, internal shuttle service, and car parks,
- Tourism amenities: sports facilities, education-oriented facilities, shopping facilities, recreation facilities, catering facilities, and lodging facilities,

- Stakeholder's attitude: host government support, local residents' attitude, and tourism-engaged staffs' quality,
- Safety and sanitation: health care system, emergency rescue system, and environment maintenance
- Information services: visitor centers, interpretation boards, road signs, and tour guide interpretation.

The literature on nature-based destination attractiveness reveals both commonalities and distinct variations across different studies, reflecting the multifaceted nature of tourism attractiveness. The most commonly identified factors of nature-based destination attractiveness revolve around natural resources, accessibility, and tourism facilities. All of the authors place natural resources among the key determinants, however, the scope of what constitutes them varies. Kim, Lee, and Klenosky (2003), Lee et al. (2010b), An et al. (2019) and Gu et al. (2022) mentioned rare flora and fauna as one of the attributes, climate has been pointed out by Lee et al. (2010b), Islam et al. (2017) and Gu et al. (2022), stunning natural scenery was included by Kim, Lee, and Klenosky (2003), Islam et al. (2017) and Lee et al. (2009), however Lee et al. (2010b) and Gu et al. (2022) consider forest landscape as important. Some studies focus on wildlife and biodiversity (An et al., 2019; Aryia et al., 2017), while others include a broader range of natural assets, such as topography and geology or eco-environment (Gu et al., 2022). Many authors also agree that besides nature, historical and cultural sites (Kim et al., 2003; Lee et al., 2010b; An et al., 2019; Vengesayi et al., 2009; Lee et al, 2009; Gu et al., 2022) and cultural events and festivals (Lee et al., 2010b; Vengesayi et al., 2009; Islam et al., 2017; Lee et al, 2009; Gu et al., 2022; Nasa et al., 2020) are crucial for nature-based destination attractiveness.

Accessibility is another attribute acknowledged by all of the authors, though it is conceptualised differently by some of them. For example, Deng, King, and Bauer (2002) and Kim, Lee, and Klenosky (2003) provide a more detailed breakdown of both external (transportation to the site) and internal (mobility within the park or destination) accessibility, while other studies, such as Gu et al. (2022) and Lee et al. (2009), also address this aspect but focus more on specific transportation services or road networks. The emphasis on accessibility reveals a practical understanding that no matter how attractive a destination is, it must be reachable and navigable for tourists. Safety and security are also emphasised as essential factors, particularly in studies by Lee et al. (2009), Gu et al. (2022), Lee (2020), Aryia et al. (2017), Vengesayi et al. (2009) and Islam et al. (2017).

The most variety of specific attributes is within the broad category of tourism amenities and infrastructure. The most commonly mentioned are accommodation facilities (Kim et al., 2003; Lee et al., 2010b; An et al., 2019; Vengesayi et al., 2009; Lee, 2020; Lee et al, 2009; Gu et al., 2022; Nasa et al., 2020) and information network (Kim et al., 2003; Lee et al., 2010b; An et al., 2019; Lee, 2020; Islam et al., 2017; Gu et al., 2022; Nasa et al., 2020)), however authors such as Deng, King, and Bauer (2002), Kim, Lee, and Klenosky (2003), An et al. (2019) and Gu et al. (2022) also listed educational facilities, while Lee (2020), Lee et al. (2009), Gu et al. (2022) and Nasa et al (2020) considered catering services and Aryia et al (2017) included pricing as one of the factors. Deng, King, and Bauer (2002), An et al. (2019), Vengesayi et al. (2009), Islam et al. (2017) and Gu et al. (2022) also agreed that local communities and their attitudes towards tourists are an important factor for nature-based destination attractiveness.

While understanding the key attributes that shape nature-based destination attractiveness and how they vary is crucial, it is equally important to examine how these attributes have been evaluated and the results that past studies have generated.

2.5. Evaluation of the nature-based tourism attractiveness in literature

Part of the existing literature examines nature-based destination attractiveness from a demand-side perspective, by evaluating tourists' perceptions of what destinations have to offer. It is argued that in the end, the travellers are the final judges of the level of attractiveness and the success or failure of destinations is dependent on that. By surveying 236 visitors to hot spring sites in Taiwan, Lee et al. (2009) explored the factors determining the attractiveness of hot spring tourism. The Authors used a factor analysis and regression analysis to evaluate the attractiveness of the attributes. They concluded that maintenance of a sanitary, safe and healthy bathing environment is the most basic requirement for the hot springs tourism sector to be attractive and sustainable. The factor of the natural resources was rated second highest, confirming that the highest concentration and greatest variety of natural hot springs remain the second most important contributor to the overall attractiveness of the hot springs tourism sector. It should be highlighted that according to their results, the factors of cultural assets and leisure, and recreation were not rated as important for this particular type of tourism.

Similar results were achieved by Islam et al., 2017, who identified the most important drivers for developing destination competitiveness of Bangladesh’s nature-based tourism by evaluating tourists’ perceptions. The Authors performed an Exploratory Factor Analysis (EFA)

based on data collected from 432 Bangladeshi tourists. The results show that the most important attributes are personal safety and security of the place, followed by easy access to transportation services, a variety of natural attractions, well-developed tourism markets, roads, and natural scenic beauty and calmness. Opportunities for visiting friends and relatives and similarity with the local lifestyle were found unimportant.

On the contrary, when Vengesayi et al. (2009) examined the influence of tourist attractions, destination support services, and people-related factors on the attractiveness of a tourism destination, accessibility was considered the strongest predictor of destination attractiveness. The study took place in Zimbabwe, the data was collected from 275 international visitors and evaluated with the multiple regression model. Besides accessibility, there were some people-related factors significantly associated with destination attractiveness such as customer service, residents' support for tourism, and attitude to tourists. The other types of destination support services such as destination utilities and communication facilities were identified as not significantly related to destination attractiveness. In general, the destination attractions were found to be the core determinants of tourism attractiveness.

The study developed by Aryia et al. (2017) aimed to establish tourism destination attractiveness as perceived by tourists visiting Lake Nakuru National Park in Kenya. By using a Principal Component Analysis (PCA) on data collected from 402 tourists, they identified safety and security inside the park, and unique wildlife resources as the most attractive characteristics, in the first and second rating respectively. Tourists have also rated attributes of variety and proximity of wildlife resources, quality of park route signs, quality of road systems, abundance of wildlife resources, park branding as a rhino sanctuary and park branding as a bird sanctuary as attractive. However, park entry fee, guiding fee, and cost of meals and accommodation were rated as not attractive.

Another study performed on a national park in a different location has presented slightly different results. Nasa et al. (2020) examined the attractiveness of a nature-based tourism destination in Thailand, known as Phu Kradueng National Park (PKNP) in Loei Province, through tourists' perspectives. The sample gathered was 465 tourists visiting the park and data was processed with descriptive analysis. The results of their study showed that the majority of tourists perceived the unique natural environment, with a cold temperature and the richness and abundance of flora and fauna resources as the main reason for them to visit PKNP. They indicated that the natural beauty was the most attractive feature of the national park, followed by the climate and the uniqueness of the pine forest and grassland of the mountain. Mountain

hiking is the most popular activity for the visitors. In addition, cleanliness and safety were found to be of crucial importance for the tourists.

There is also some literature examining destination attractiveness from the supply point of view, as the attractions existing in destinations are considered to be equally important, being the force pulling the travellers to visit. Lee (2020) conducted research aimed to contribute to the understanding of factors determining the attractiveness of a camping destination. The study was completed in Taiwan with thirty-seven experts with more than ten years of experience in their respective areas of expertise as government officers, industry practitioners and scholars, using the Analytic Hierarchy Process (AHP). The results found that the dimension of tourism attractions was the primary contributor to the tourism attractiveness of a camping destination, followed by amenities and supplementary services. The accessibility was considered the least significant. Further, the top three factors identified as most crucial to destination attractiveness were natural attractions, provision of lodging and safety and security services. The top five ranked attributes were: availability of picnic areas, beach, lakes and rivers nearby, rustic atmosphere, availability of sanitary facilities, and mild climate year-round, many of which are associated with the availability and variety of natural attractions.

In a study of sustainable forest recreation tourism, Lee et al. (2010b) explored the opinions of an expert panel on factors affecting the attractiveness of this type of tourism in Taiwan. They gathered information from 10 forest managers, tourism enterprises and academic scholars also through the AHP process. They concluded that tourist attractions were the most important dimension, while complementary services appeared to be of the lowest importance. The factors of natural resources, external access, provision of lodging and catering and information services were found the most crucial for each dimension in the sequence of tourist attractions, accessibility, amenities and complementary services. Regarding the attributes, the uniqueness of forest landscapes and scenery and special climate phenomena were considered two of the most important features determining the attractiveness of forest recreation tourism. The reliability and convenience of access to forest recreation sites were also highly evaluated. The provision of high-quality accommodation and cuisine is considered an essential component to enrich visitors' recreational experience in forest settings. The three lowest-ranking items, shopping, museum exhibits and outdoor furniture, are associated with the factor of recreation facilities.

Similarly, by using the same method, Deng et al. (2002) attempted to evaluate and assess 36 National Parks in the state of Victoria in Australia, to enhance the tourist experience by improving the management of the parks. The authors, in consultation with a range of

experts, have performed AHP analysis on the elements identified for the evaluation of the attractiveness of national parks and forest reserves. Their results showed that, in order of importance, the five dominant elements of tourism attractiveness are natural and cultural resources, accessibility, tourism facilities, local community, and lastly, peripheral attractions.

Contrary to Deng et al. (2002), An et al. (2019) have found that natural characteristics were not considered the most important criteria supporting the attractiveness of particular national parks for tourists. The Authors conducted a study, where the aim was to explore the attributes associated with tourism attractiveness and evaluate the tourism performance of national parks in Vietnam. Their sample consisted of thirty heads of management boards of national parks and the data collected was modelled with the stochastic multicriteria acceptability analysis (SMAA) and preference ranking organisation method for enrichment evaluation (PROMETHEE) method. They found that the most important attribute was trails, which are part of a wider category of recreation facilities affecting forest-based tourism attractiveness. Such different results when evaluating the attractiveness of national parks solely based on experts' opinions suggest that it is necessary to consider the knowledge and perspectives of both experts and tourists to achieve reliable results.

The existing literature offers a limited evaluation of nature-based attractiveness from a combined demand and supply perspective. Marzuki (2016) proposed a universal evolution attraction framework for nature-based tourism destination (NBTD), intending to improve both the objectivity and the applicability of NBTD to facilitate the assessment method's popularisation. He introduced a new PRI framework that integrates the Delphi Technique, GIS, and statistical methods, covering the phases of defining, inventorying, selecting, evaluating, and ranking NBTD components. This framework offered advantages in comprehensive evaluation, consideration of diverse perspectives, and facilitating in-depth discussions among experts for each factor. However, due to the unique characteristics of NBTD and the lack of a pair-wise comparison method like AHP, the PRI framework had limitations in establishing a universal scoring and ranking system, as well as in identifying causal relationships between different NBTD components.

Thus, a better model has been proposed by Gu et al. (2022), who used the Fuzzy-AHP Evaluation Method, which is a fuse of the Analytic Hierarchy Process (AHP) and the Fuzzy Comprehensive Evaluation method (FCEM), to evaluate the destination attractiveness of Changbai Mountain Biosphere Reserve (CMBR) in China. The main aim of their study was to develop and apply a novel methodological approach for assessing the tourism attractiveness of nature-based destinations. They have adopted two questionnaires, one directed to 12

experts with extensive familiarity with the destination and the second for 460 tourists visiting the reserve. It was found that tourist attractions are the most important dimension contributing to nature-based tourism attractiveness (NBTA), followed by accessibility and development conditions. Complementary services were identified to be the dimension with the lowest importance. The factors of natural attractions, external access, tourism amenities, and safety and sanitation were the most important aspects of dimensions in the order of tourist attractions, accessibility, development conditions, and complementary services. In contrast, the attributes of topography and geography, historical relics, road network, charter buses, education-oriented facilities, host government support, emergency rescue system, and visitor centers were most important for each factor in the sequence of natural attractions, cultural attractions, external access, internal access, tourism amenities, stakeholder's attitude, safety and sanitation, and information services. However, when the overall priority of attributes is analysed, the top three ranking factors were determined as natural attractions, cultural attractions and external access. Topography and geography, eco-environment, historical relics, road network, and forest landscape were found the top five ranked attributes. On the contrary, the five lowest-ranking attributes were tour guide interpretation, road signs, interpretation boards, recreation facilities and shopping facilities. By combining both perspectives, they were able to evaluate the overall attractiveness score of the CMBR as a nature-based destination, that is at the level of "good", suggesting that some aspects might still have to be improved. Their findings also confirmed that this fuzzy-AHP approach is a more reliable and comprehensive method for evaluating destination attractiveness than pre-existing approaches.

The summary of the above literature has been presented in Table 1. In the studies conducted on tourists, there is no one commonly used method for evaluation of the results, each of the authors used a different one. Nevertheless, some of the results have been similar, for example, the attribute of safety is most commonly ranked as the most important for nature-based destination attractiveness by Lee et al. (2009), Nasa et al (2020), Islam et al. (2017) and Aryia et al. (2017). Some findings also suggest that natural resources are crucial (Lee et al., 2009; Nasa et al., 2020; Islam et al., 2017). Moreover, Nasa et al. (2020) found attributes such as rare flora and fauna, natural beauty, climate and forest landscape to be ranked the highest. Islam et al. (2017) have found that the most crucial, besides the natural beautiful scenery, is the accessibility, which was confirmed also by Vengesayi et al. (2009). However, the same attribute is found to be evaluated differently among experts. Even though Lee et al. (2010b) and Gu et al. (2022) confirm that accessibility is important, Lee (2020) found it to be one of the least important factors.

Table 1. Evaluation of nature-based tourism destination attractiveness in literature.

Reference	Destination	Who was studied	Methods / Statistical tools	Main conclusions
Lee et al. (2009)	Hot Spring Sites in Taiwan	236 visitors to hot springs sites	Factor analysis and logistic regression analysis	The maintenance of a sanitary, safe, and healthy bathing environment is the most important factor for the hot springs tourism sector to be viewed as attractive and sustainable. Natural resources were rated second highest. Cultural assets and leisure, and recreation were not rated as important.
Nasa et al. (2020)	Phu Kradueng National Park (PKNP) in Loei Province, Thailand	465 tourists visiting PKNP	Descriptive analysis	It was found that the unique natural environment, with a cold temperature and the richness and abundance of flora and fauna resources, is the main reason to visit PKNP. They indicated that the natural beauty was the most attractive feature of the national park, followed by the climate and the uniqueness of the pine forest and grassland of the mountain. In addition, cleanliness and safety were found to be of crucial importance for the tourists.
Islam et al. (2017)	Bangladesh	432 Bangladeshi tourists	Exploratory Factor Analysis (EFA)	The most important attributes are personal safety and security of the place, followed by easy access to transportation services, a variety of natural attractions, well-developed tourism markets, roads, and natural scenic beauty and calmness. Opportunities for visiting friends and relatives and similarity with the local lifestyle were found unimportant.
Vengesayi et al. (2009)	Zimbabwe	275 international visitors to Zimbabwe	Multiple regression models	Accessibility was considered the strongest predictor of destination attractiveness. Customer service, residents' support for tourism, and attitude to tourists were also considered important. The other types of destination support services such as destination utilities and communication facilities were identified as not significantly related to destination attractiveness.
Aryia et al. (2017)	Lake Nakuru National Park, Kenya	402 tourists	Principal Component Analysis (PCA)	Safety and security inside the park, and unique wildlife resources as the most attractive characteristics. Tourists have also rated attributes of variety and proximity of wildlife resources, quality of park route signs, quality of road systems, abundance of wildlife resources, park branding as a rhino sanctuary and park branding as a bird sanctuary as attractive. However, park entry fee, guiding fee, and cost of meals and accommodation were rated as not attractive.

An et al. (2019)	National Parks in Vietnam	30 heads of management boards of national parks	Multiple criteria decision analysis with the stochastic multicriteria acceptability analysis (SMAA) and preference ranking organization method for enrichment evaluation (PROMETHEE) method	The most important attribute was trails, which are part of a wider category of recreation facilities affecting forest-based tourism attractiveness.
Lee et al. (2010b)	Alishan Forest Recreation Area, Taiwan	10 forest managers, tourism enterprises and academic scholars	Analytic Hierarchy Process (AHP)	Tourist attractions were the most important dimension, while complementary services appeared to be of the lowest importance. The factors of natural resources, external access, provision of lodging and catering and information services were found the most crucial for each dimension in the sequence of tourist attractions, accessibility, amenities and complementary services. Regarding the attributes, the uniqueness of forest landscapes and scenery and special climate phenomena were considered two of the most important features determining the attractiveness of forest recreation tourism. The reliability and convenience of access to forest recreation sites were also highly evaluated. The provision of high-quality accommodation and cuisine is considered an essential component to enrich visitors' recreational experience in forest settings. The three lowest-ranking items, shopping, museum exhibits and outdoor furniture, are associated with the factor of recreation facilities.
Deng, King, and Bauer (2002)	36 National Parks in the state of Victoria, Australia	The authors in consultation with a range of experts	Analytic Hierarchy Process (AHP)	The five dominant elements of tourism attractiveness are natural and cultural resources, accessibility, tourism facilities, local community, and peripheral attractions.

Lee (2020)	Camping sites, Taiwan	37 experts with more than 10 years of experience in their respective areas of expertise as government officers, industry practitioners and scholars	Analytic Hierarchy Process (AHP)	The dimension of tourism attractions was the primary contributor to the tourism attractiveness of a camping destination, followed by amenities and supplementary services. The accessibility was considered the least significant. Further, the top three factors identified as most crucial to destination attractiveness were natural attractions, provision of lodging and safety and security services. The top five ranked attributes were: availability of picnic areas, beach, lakes and rivers nearby, rustic atmosphere, availability of sanitary facilities, and mild climate year-round.
Gu et al. (2022)	Changbai Mountain Biosphere Reserve (CMBR), China	12 experts with intimate and extensive familiarity with the destination and 460 tourists	Fuzzy-AHP Evaluation Method - Analytic Hierarchy Process (AHP) and Fuzzy Comprehensive Evaluation method (FCEM)	It was found that tourist attractions are the most important dimension, followed by accessibility and development conditions. Complementary services were identified to be the dimension with the lowest importance. The factors of natural attractions, external access, tourism amenities, and safety and sanitation were the most important aspects of dimensions in the order of tourist attractions, accessibility, development conditions, and complementary services. In contrast, the attributes of topography and geography, historical relics, road network, charter buses, education-oriented facilities, host government support, emergency rescue system, and visitor centers were most important for each factor in the sequence of natural attractions, cultural attractions, external access, internal access, tourism amenities, stakeholder's attitude, safety and sanitation, and information services. The top three ranking factors were determined as natural attractions, cultural attractions and external access. Topography and geography, eco-environment, historical relics, road network, and forest landscape were found the top five ranked attributes. On the contrary, the five lowest-ranking attributes were tour guide interpretation, road signs, interpretation boards, recreation facilities and shopping facilities. They were able to evaluate the overall attractiveness score of the CMBR as a nature-based destination, that is at the level of "good".

Source: Own work.

Nevertheless, there is some consensus between the studies conducted with experts, like the common use of the AHP method which seems to be a widely used tool for evaluating nature-based tourism attractiveness. Lee et al. (2010b), Deng, King, and Bauer (2002), Lee (2020) and Gu et al. (2022) concluded that both natural resources and tourist attractions in general are crucial for the destination's attractiveness. Deng, King, and Bauer (2002) and Gu et al. (2022) mention, that experts rate cultural resources highly, Lee et al. (2010b) and Lee (2020) prove that climate is crucial and Gu et al. (2022) and Lee et al. (2010b) also list unique forest landscape as one of the most important attributes for nature-based destination attractiveness. There is also some agreement, that complementary services, shopping facilities and recreation facilities are the least important among experts' evaluations (Lee et al., 2010b; Gu et al., 2022). Tourists' opinions vary on that matter.

Given that the results vary depending on the study design, it is important to understand and analyse the specific characteristics of the study site – Madeira.

2.6. Madeira as a nature-based tourism destination

The island of Madeira, often referred to as the "pearl of the Atlantic", is one of the oldest tourist destinations in the world (Almeida, 2016). The general motives for tourists arrival are related to the natural qualities of the island (climate, relief, vegetation cover) and the anthropogenic material and immaterial heritage (architectural monuments, costumes, music, dance, cuisine, customs and rituals) as well as to the manifestations of contemporary culture such as festivals, concerts, exhibitions and shows organised periodically or occasionally in various locations on the island (Kaczmarek & Kapusta, 2022).

Madeira Islands have won the title of "Europe's Leading Island Destination" in total ten times, in the years 2013-2014, 2016-2021 and 2023-2024 (World Travel Awards, 2024) and the title of "World's Leading Island Destination" continuously since 2015 (World Travel Awards, 2023). It is often called the Island of Eternal Spring, as nature is Madeira's greatest tourist asset. Tourists are attracted by the tropical-Mediterranean vegetation with its numerous endemic species (including the colourful exotic flowers with which Madeira's landscape is associated), and the hillsides covered with vines (Gałązka, 2024). The climate on the island is a very mild, temperate subtropical and there are microclimatic enclaves associated with the varied topography resulting from the volcanic genesis of the island (Kaczmarek & Kapusta, 2022). Due to that, there is a greater lack of seasonality when it comes to tourist arrivals in Madeira, it is popular throughout the whole year, although the peak in arrivals is in spring and summer since winter is the rainy season (Gałązka, 2024).

Over 60% of the island's territory is occupied by the National Park of Madeira, a significant portion of which consists of the endemic Laurissilva laurel forest, listed as a UNESCO World Heritage Site. A network of footpaths runs along the levadas - special irrigation channels developed on Madeira since the 16th century - which form an integral part of the island's cultural landscape (Chojnacka-Ożga & Ożga, 2023). These paths cover almost the entire island, offering numerous hiking opportunities that allow for moderate physical activity and "landscape consumption" (Soares & Nunes, 2020). In addition to traditional leisure activities, hiking, and walking, Madeira's current tourist offer also includes mountain climbing, fishing, sailing, surfing or canyoning, making it an excellent outdoor recreation destination (Chojnacka-Ożga & Ożga, 2023, Soares and Nunes, 2020). Over the years, Madeira has largely managed to prevent significant environmental damage and degradation of natural resources despite a high volume of visitors, preserving its main assets. The main concerns have been limited to minor issues such as uncontrolled construction and challenges related to waste and garbage management (Almeida, 2016). Also, Madeira is proactively developing sustainable tourism practices and policies to optimise environmental resources and secure sociocultural identity (Jesus, 2023).

According to Gałązka (2024), Madeiran culture is one of the most important factors that makes the island attractive. One of the most crucial elements of cultural tourism in Madeira is the celebrations of various holidays and events in the form of festivals, and fiestas, which relate to the traditional heritage of the island (Gałązka, 2024). The island hosts a series of annual events, including the Carnival Festival, the Flower Festival, the Atlantic Festival, the Madeira Wine Festival, the Columbus Festival, the Nature Festival, and the Christmas and End of the Year Festival, along with numerous other celebrations throughout the year (Garcês et al., 2020). Other elements of cultural tourism include folk costumes, the "Bailinho da Madeira" dance, handcrafted cork products, wickerwork, embroidery, and Madeiran wine and poncha, a traditional alcoholic beverage produced on the island (Gałązka, 2024).

There has been some research regarding Madeira in the literature. Oliveira and Pereira (2008) examined how tourists' socio-demographic characteristics and trip aspects affect their valuation of different features of Madeira Island as a tourism destination. Machado et al. (2009) used a logit model to examine the probability of the image of the tourism destination Madeira being strengthened after the tourists visit the destination. Majdak et al. (2021) analysed the conditions and factors that determine the tourist development of Maderia concerning the assumptions of the sustainable development concept and the smart city concept. Cró et al. (2021), used an augmented panel gravity model for tourism to identify the

determinants of international tourist arrivals in an island destination, concluding that promotion expenditures, climate, and the number of direct flights are important competitive factors. Kaczmarek and Kapusta (2022) presented a critical analysis of current approaches to converting intangible heritage, found in both urban and rural cultural spaces, into tourism products based on multiple European destinations, including Madeira. Gałązka (2024) examined the attractiveness of Madeira's cultural assets, particularly those related to the festivals and events celebrated on the island. However, a comprehensive assessment of Madeira as a nature-based tourism destination has not yet been evaluated. To build upon this foundation, the following chapter details the empirical research methodology designed to assess Madeira’s attractiveness as a nature-based tourism destination.

3. Methodology

The objective of this study is to identify key factors that contribute to Madeira's attractiveness, determine their relative importance through expert opinions, and assess tourist perceptions to create a holistic evaluation of the nature-based tourism destination attractiveness. To achieve that, a Fuzzy-AHP Evaluation Method has been introduced. Analytic Hierarchy Process (AHP) was used to deal with data from the experts' questionnaire. Later, Fuzzy-AHP was used to combine experts' and tourists' data. In this chapter the details of the model are presented, followed by the questionnaire design and information about data collection and analysis.

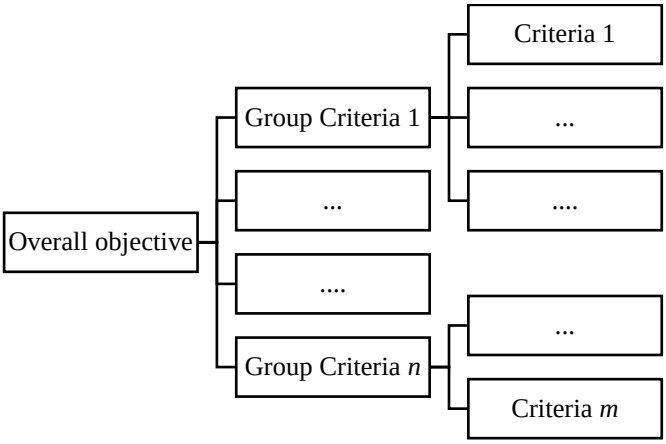
3.1. Fuzzy-AHP Evaluation Method

3.1.1. Analytic Hierarchy Process

One fundamental decision-making method is the Analytic Hierarchy Process (AHP), designed by Saaty (1980). It is made to handle both the intuitive and the rational while choosing the best option among those assessed according to various conflicting and subjective criteria (Saaty & Vargas, 2012). The multi-criteria decision-making (MCDM) methods, including AHP, are based on several steps that will be pointed out in this section.

First, a complex multi-criteria decision-making problem is broken down into a hierarchy with different components at each level (Figure 2). The objectives from a decision-maker’s viewpoint are on top of the hierarchy, followed by criteria and further sub-criteria on the below levels. One important thing is that an element at one level does not have to serve as a standard for every component of the level below it, so in other words, the hierarchy does not have to be complete. As a result, subhierarchies inside a hierarchy can be created that only share the top element (Saaty & Vargas, 2012). That information can be useful if the AHP hierarchy has many elements, as in order to prevent extreme differences, the decision-maker should attempt to group the elements in clusters (Ishizaka & Labib, 2011). When building hierarchies, one must incorporate just enough pertinent material to accurately represent the problem, without becoming insensitive to changes in the constituent parts (Saaty & Vargas, 2012). In general, this hierarchical structure of the criteria helps users focus more intently on certain criteria and sub-criteria while allocating the weights, and this stage is crucial since a different final ranking might result from a different structure (Ishizaka & Labib, 2011).

Figure 2. Example of a three-level hierarchy.



Source: Own work.

After building the hierarchy, the decision-maker begins the prioritisation process to determine the relative importance of the elements at each level (Hsu et al., 2009). Psychologists argue that expressing one's opinion on just two options is simpler and more accurate than doing it simultaneously on all the alternatives (Ishizaka & Labib, 2011). Hence, the decision-maker establishes general priorities for ranking the options in this procedure using straightforward pairwise comparison judgements (Saaty & Vargas, 2012).

Saaty (1980) constructed a 9-point ratio response scale. The person making the decision has the option to verbally state whether they believe that each of the two components is *equally important, slightly more important, more important, much more important, or substantially more important*. Following that, these descriptive preferences would be converted into numerical ratings of 1, 3, 5, 7, and 9, with intermediate values of 2, 4, 6, and 8 for compromising two consecutive qualitative judgements. One important assumption of AHP is that the person making the decision has extensive knowledge about and understands the compared elements (Hsu et al., 2009).

Table 2 illustrates this basic value scale used to describe the intensities of judgements. The efficiency of this scale has been confirmed by numerous applications, as well as a theoretical explanation of the scale that should be used when comparing homogeneous items (Saaty & Vargas, 2012). This scale minimises the impact of assessment uncertainty since it is insensitive to even tiny changes in a decision maker's preferences (Hsu et al., 2009).

Table 2. The scale of relative importance.

Scales of Relative Importance	Meaning
1	Item *i* is equally important to item *j*
3	Item *i* is slightly more important than item *j*
5	Item *i* is more important than item *j*
7	Item *i* is much more important than item *j*
9	Item *i* is substantially more important than item *j*
2, 4, 6, 8	Intermediate scales

Source: Gu, X., Hunt, C. A., Jia, X., & Niu, L. (2022). Evaluating nature-based tourism destination attractiveness with a Fuzzy-AHP approach. *Sustainability*, *14*(13), 7584.

Comparisons are recorded in a positive reciprocal matrix. The relative relevance of criterion *i* and criterion *j* is ascertained by creating $n \times n$ comparison matrix *A*, if there are *n* criteria to be examined. For $i \neq j$, element a_{ij} is the number between 1 and 9 (according to Table 2), if item *i* is equally or more important than item *j*. For $i \neq j$, element $a_{ij} = 1/a_{ji}$ when item *i* is less important than item *j*. Element a_{ii} is 1 (Terzi, 2019).

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ a_{21} & \ddots & a_{ij} & \vdots \\ \vdots & a_{ji} = 1/a_{ij} & \ddots & \vdots \\ a_{n1} & \cdots & \cdots & 1 \end{bmatrix}$$

Consulting several experts helps to prevent prejudice that may arise from considering the opinions of just one expert. Thus, since multiple experts are usually involved in a decision-making process, the standard AHP must be modified for group decisions. If there is a synergistic group and not a collection of individuals, the consensus vote is used. However, when reaching an agreement proves to be challenging due to factors like many participants or remote individuals, a mathematical aggregation may be utilised (Ishizaka & Labib, 2011). The most popular technique computes priorities by using the geometric mean of each evaluation as an element in the pair-wise matrix, creating a new pairwise aggregated comparison matrix (Escobar & Moreno-Jimenéz, 2007). To maintain the reciprocal property, the geometric mean must be used rather than the arithmetical mean (Ishizaka & Labib, 2011).

The relative weights of the criteria or alternatives, which are derived from the pairwise comparison matrices, are represented by a vector called the priority vector. This vector helps to understand the ranking or preference of options in a consistent and quantifiable way. There are several ways to compute the priority vector. One of the most frequently found is to calculate the principal eigenvector corresponding to the largest eigenvalue of the pairwise comparison matrix. The following steps are applied to calculate the priority vector (or

eigenvector) *p*, as it is computed by normalising the pairwise comparison matrix (Ishizaka & Labib, 2011; Saaty & Vargas, 2012; Taherdoost, 2017):

1) Summing each column of the pairwise comparison matrix.
2) Dividing each element by the sum of its column to normalise the matrix.
3) Averaging the rows of the normalised matrix to obtain the priority vector *p*.

When the precise value (or an estimate) of *p* is given in normalised form, a straightforward method to find the exact value (or an estimate) of the maximum eigenvalue (λ_{max}) is to sum the columns of matrix *A* and then multiply the resulting vector by the priority vector *p* (Saaty & Vargas, 2012).

The last step of AHP is to validate the consistency property of matrices, which guarantees the consistency of decision-makers' assessments (Vahidnia et al., 2008). The Consistency Index (*CI*), which is later used to produce the Consistency Ratio (CR), is calculated using the following formula (Taherdoost, 2017):

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

where *n* is the dimension of the matrix; λ_{max} is maximal eigenvalue of *A*.

Table 3 can be utilised to extract the value of random index (RI), associated with the matrix dimension *n*.

Table 3. Average random Consistency Index (RI).

n	1	2	3	4	5	6	7	8	9	10
Random consistency index (RI)	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

Source: Saaty, T. L., & Vargas, L. G. (2012). Models, Methods, Concepts & Applications of the Analytic Hierarchy Process. In *International series in management science/operations research/International series in operations research & management science*.

Having that value, the last ratio can be calculated. The CR is established as follows:

$$CR = \frac{CI}{RI}$$

It should be noted that, generally, if CR is less than 0.1, the judgments are consistent, which indicates that the comparison findings are valid and the derived weights can be used (Vahidnia et al., 2008). If not, the matrix needs to be adjusted until consistency is achieved.

Despite AHP's widespread use, criticism is frequently directed at it for failing to effectively address the inherent uncertainty and imprecision involved in translating a decisionmaker's perception into precise numerical values (Deng, 1999). Therefore, using a

basic AHP approach could be ineffective and produce unreliable results (Vahidnia et al., 2008).

3.1.2. Fuzzy-Analytical Hierarchy Procedure

It is logical to measure the ambiguity and reservations in human judgment (Hassan et al., 2023). To account for some of the uncertainty, a combined Fuzzy-AHP approach integrates AHP with Fuzzy Comprehensive Evaluation Method (FCEM) in multi-criteria Fuzzy Comprehensive Evaluation. The FCEM is a technique rooted in fuzzy mathematics that utilises the principle of fuzzy relation synthesis. It quantifies factors that have vague boundaries and are challenging to measure, allowing for a comprehensive assessment of the degree to which the evaluated items belong to certain categories, considering multiple factors (Zhu, 2022). It has been demonstrated that the Fuzzy-AHP combination works well for managing fuzzy assessments, such as smart tourism attractions (Wang et al., 2016) or nature-based tourism attractiveness (Gu et al., 2022). The five specific steps of fuzzy-AHP are as follows (Cui, 2021; Wang et al., 2016; Gu et al., 2022):

1) Determine the item set of the evaluated object.

The set of items related to the evaluated object consists of various factors that can impact it and is represented by *U* as follows:

$$U = \{u_1, u_2, u_3, \dots, u_m\}$$

where u_i stands for the *i*th factor affecting the evaluated objects. These factors typically exhibit varying levels of fuzziness.

2) Determine the evaluation set.

The evaluation set consists of elements representing different comprehensive evaluation outcomes for the evaluated object, as determined by the evaluators. It is defined by *V* as follows:

$$V = \{v_1, v_2, v_3, \dots, v_n\}$$

where v_j stands for the *j*th evaluation outcome. In this study, following Gu et al. (2022), it was considered $V = \{V_1, V_2, V_3, V_4, V_5\}$ = {“poor”, “fair”, “moderate”, “good”, and “excellent”}.

3) Determine the weight set.

In this step, the previously mentioned AHP procedure is used to calculate the weight set. The priority vector (eigenvector corresponding to the maximum eigenvalue of the judgment matrix) becomes the evaluation weight vector *W*.

4) Construct the fuzzy judgment matrix.

The fuzzy judgment matrix *R* is defined as follows:

$$R = \begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_m \end{bmatrix} = \begin{bmatrix} R_{11} & R_{12} & \cdots & R_{1n} \\ R_{21} & R_{22} & \cdots & R_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ R_{m1} & R_{m2} & \cdots & R_{mn} \end{bmatrix}$$

where *R* represents the evaluation results of the item set *U*. Here, R_{ij} denotes the degree of membership of the *i*th item u_i to the *j*th evaluation rank v_j, reflecting the fuzzy relationship of each item. In this study, R_{ij} is determined by the ratio of the number of questionnaires at the corresponding evaluation level to the total number of valid questionnaires.

5) Complete the fuzzy comprehensive evaluation.

The Fuzzy Comprehensive Evaluation is obtained by calculating the interaction between the single item weight vector *W* and the fuzzy judgment matrix R, expressed as:

$$B = W \circ R = (b_1, b_2, \ldots, b_m)$$

where b_i represents the membership degree of the evaluated samples to each evaluation standard. The evaluation results are typically determined using the principle of maximum membership degree.

3.1.3. Establishing an Attractiveness Evaluation Model

The purpose of this study is to assess the overall nature-based tourism destination attractiveness of Madeira. To achieve this, an attractiveness evaluation structure of nature-based tourism was developed, building on the work of Gu et al. (2022) and adapted to accurately reflect the specific conditions of Madeira. The authors in their study have combined the existing literature of nature-based tourism attractiveness to create a framework, that assessed the attractiveness of nature-based tourism with weights corresponding to the entire range of destination attributes. The overall structure of the hierarchy remained the same, however, some attributes have been modified and added to better align with and reflect the specific characteristics of the research study site of Madeira. The model identifies four key dimensions that contribute to the overall attractiveness of nature-based tourism destinations (tourist attractions, accessibility, development conditions, and complementary services).

The model's third level further breaks down these four dimensions. The principal elements of a destination's attractiveness are its *tourist attractions*, which are the main reasons people visit places. These key features include the destination's climate, eco-environment, natural resources, culture, and historic architecture. These elements serve as the primary draws and motivations for travel (Crouch & Ritchie, 1999; Gu et al., 2022). The attractions are then categorized into two groups: cultural and natural attractions. The dimension of

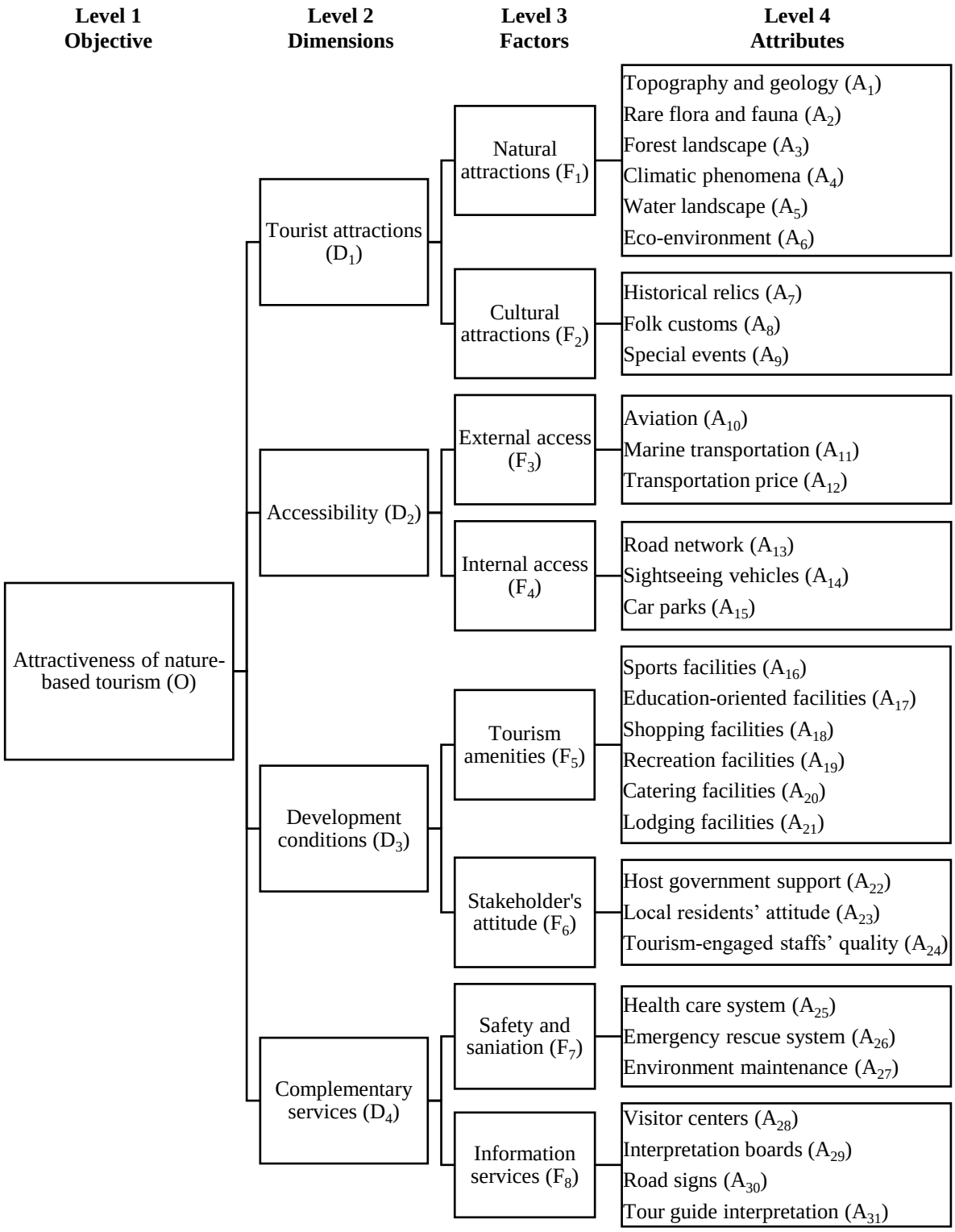
accessibility refers to the ease or difficulty of moving between locations and can be evaluated from two perspectives: external access and internal access.

Accessibility is the element within which the most significant changes to the model were made compared to the study by Gu et al. (2022) due to the difference in the study site characteristics. Since Madeira is an island with only an internal road system, the road network attribute has been reassigned from external access to internal access. For the same reason, due to the lack of a railway system on Madeira, the railway attribute has been exchanged for aviation, as planes are the main means of transport allowing access to the island. The attribute of internal shuttle service has been removed entirely, as there was no equivalent of such vehicles on the island. Within the internal access, the name charter buses has been changed to sightseeing vehicles, to accurately portray the categories of vehicles available on the island. Moreover, it must be noted that according to Martin and Witt (1988), transportation costs are an equally important factor driving international tourism demand as an overall cost of living. From the perspective of tourists, price has a vital role in a destination's attractiveness (Morachat, 2003) and reducing costs is crucial for attracting long-distance travellers (Jin-song, 2003). Therefore, an attribute of transportation price has been added below the level of external access to complete the hierarchy.

The dimension of *development conditions* involves the attitudes of various stakeholders, such as host governments, local communities, and tourism practitioners, toward the travel industry and tourists. It also includes the availability of supporting tourism infrastructure designed to meet visitors' basic needs. A higher quality infrastructure foundation, combined with a wide range of well-developed amenities, can enhance visitor satisfaction and make the destination more attractive (Murphy et al, 2000; Gu et al., 2022). The role of stakeholder's attitudes in the development and management of tourism is increasingly recognized in the literature on sustainable tourism (Lasso & Dahles, 2021; Heslinga et al., 2019).

Finally, included in the dimension of *complementary services*, information services, and safety and sanitation, are considered crucial in evaluating the quality of recreational experiences in nature-based tourism. Visitors to nature-based destinations, such as forests, require information to ensure their safety throughout various stages of their journey - from deciding to visit a site to arriving and experiencing it (Findlay & Southwell, 2004; Lee et al, 2010). The availability of such information services and security plays a significant role in encouraging people to visit a particular site or participate in leisure activities (Findlay & Southwell, 2004, Lee et al, 2010, Gu et al., 2022). Figure 3 above illustrates an overview of all four layers in this model.

Figure 3: The hierarchy of the determinants of attractiveness in nature-based tourism.



Source: Own work based on Gu, X., Hunt, C. A., Jia, X., & Niu, L. (2022). Evaluating nature-based tourism destination attractiveness with a Fuzzy-AHP approach. Sustainability, 14(13), 7584.

3.2. Questionnaire design

The Fuzzy-AHP approach considers both visitors' assessments of an area's attractiveness and expert evaluations of the resources and attractions that exist in the destination (Gu et al., 2022). Thus, for this study, two questionnaires were developed to evaluate the proposed model: one aimed at gathering visitors' opinions on the attractiveness of nature-based tourism in the Madeira region, and the other designed to determine the assessment criteria's weight through expert consultation. Both questionnaires collected basic demographic data as well.

The experts of Madeira's tourism were asked to rank the relative importance of the four dimensions, eight factors, and thirty-one attributes shown in Figure 3 above. Following Satty's methodology (1980), these experts were asked to compare pairs of statements, assessing the relative importance of the elements. Each level was evaluated separately, with an additional division at the fourth level, where only attributes within the same factor at the third level were compared. The experts were asked what, according to their opinion, is prioritised more from a tourist's perspective when considering a travel destination (Madeira) and to rate the relative importance of the chosen item *i* versus *j* on the scale presented in Table 2 above (file used to collect data is presented in Appendix A).

In order to collect data about tourists 'perspectives, a self-administered questionnaire was prepared. Participants were asked to rate thirty-one attribute items on a five-point Likert scale, ranging from 1 - strongly disagree to 5- strongly agree. The questions have been structured as follows: for example, the first question assesses topography and geology, so, based on Table 4, it is phrased as: "Do you agree that the topography of Madeira is complex and variable, with typical geomorphic features?".

Table 4. The initial perception items of nature-based tourism destinations.

No.	Attributes	Attribute Description
A_1	Topography and geology	The topography of Madeira is complex and changeable, with typical geomorphic features.
A_2	Rare flora and fauna	The number of species of animals and plants in Madeira is extremely rich.
A_3	Forest landscape	Madeira has high vegetation coverage, rich tree species, and is a unique forest landscape.
A_4	Climatic phenomena	The very mild and moderate subtropical climate of Madeira is very attractive to tourists.
A_5	Water landscape	Madeira has rich water landscape types with a high aesthetic value.

A_6	Eco-environment	The ecological environment in Madeira is good, with fresh air, a comfortable climate, high-quality water, and a clean environment.
A_7	Historical relics	There are many historical relics in Madeira which create a strong atmosphere of cultural heritage.
A_8	Folk customs	Madeira has a colourful folk culture with distinctive local characteristics.
A_9	Special events	The festival activities in Madeira are colourful and of special heritage significance.
A_{10}	Aviation	There are many flights to Madeira.
A_{11}	Marine transportation	There are many sea connections to Madeira.
A_{12}	Transportation price	It is possible to reach Madeira at a reasonable price.
A_{13}	Road network	The roads in Madeira are convenient and the road conditions are excellent.
A_{14}	Sightseeing vehicles	There are plenty of sightseeing vehicles in Madeira with ample interpretive signage.
A_{15}	Car parks	The space of the parking lots in Madeira is sufficient and convenient.
A_{16}	Sports facilities	The sports facilities in Madeira are complete, meeting the needs of tourists at different levels for various sports.
A_{17}	Education-oriented facilities	The education-oriented facilities in Madeira are perfect, and tourists can obtain extensive ecological and environmental knowledge.
A_{18}	Shopping facilities	The shopping facilities in Madeira are sufficient and there are extensive souvenirs with local characteristics.
A_{19}	Recreation facilities	Madeira provides a high number of entertaining places for tourists to enjoy.
A_{20}	Catering facilities	Madeira has adequate food service facilities, and these services highlight the local cuisine, rich variety, and reasonable cost of food.
A_{21}	Lodging facilities	The accommodation environment in Madeira is clean and safe at a reasonable cost.
A_{22}	Host government support	Local government strongly supports the development of Madeira as a tourist destination.
A_{23}	Local residents' attitude	Local residents in Madeira are friendly and courteous to tourists.
A_{24}	Tourism-engaged staffs' quality	The quality of the tourism-engaged staff in Madeira is very high, and their level of service quality is satisfactory.
A_{25}	Health care system	The medical system in Madeira is good and can effectively deal with the sudden illness or injury of tourists.
A_{26}	Emergency rescue system	The rescue system in Madeira is good and can quickly deal with any emergency events for tourists.

A_{27}	Environment maintenance	Waste is dealt with in a very timely fashion in Madeira, and the environment is clean and tidy.
A_{28}	Visitor centers	The environment of the tourist information offices in Madeira is comfortable, and tourists can enjoy warm, thoughtful, convenient, and fast services.
A_{29}	Interpretation boards	The explanations provided on the interpretation signs are accurate and humanized, and tourists can enrich themselves.
A_{30}	Road signs	The road and trail signs in Madeira are concise and clear and match the scenic environment very well.
A_{31}	Tour guide interpretation	The service attitude of tour guides is excellent, and their interpretive knowledge is accurate and rich, meeting the educational needs of tourists in Madeira.

Source: Own work based on Gu, X., Hunt, C. A., Jia, X., & Niu, L. (2022). Evaluating nature-based tourism destination attractiveness with a Fuzzy-AHP approach. Sustainability, 14(13), 7584.

The questionnaire also included sociodemographic questions such as gender, age, education, monthly income and occupation.

3.3. Data collection

The population for a part of this study was Polish people, who had already visited Madeira. Participants have completed an online distributed tourist survey, created with the Google Forms tool and distributed mainly on various Facebook group communities for Polish travellers and Madeira visitors. Internet sampling was chosen for its efficiency and especially for its ability to reach selected targets (Bhutta, 2012). The questionnaire has been translated into Polish to accommodate the target group of tourists better (see Appendix B). Participation was voluntary, respondents were anonymous, data were analysed collectively for global trends and respondents were informed about the use of data. The questionnaire was open between July and December 2023 and a total of 339 questionnaires were obtained from which 329 were from tourists who have visited Madeira, thus considered valid, representing an effective response rate of 97.1%. Table 5 outlines the sociodemographic information of the tourists. Over 75% of respondents were female and over 28% were aged between 35 and 44. Around 80% of participants have finished higher education, 30% of them were earning between 1000 and 1999 euros per month and almost 69% were employed.

Table 5. Summary of tourists' profile (N=329).

Demographic variables		N	Percent
Gender	Male	80	24.3
	Female	249	75.7
Age	Less than 18	1	0.3
	18-24	23	7.0
	25-34	110	33.4
	35-44	94	28.6
	45-54	67	20.4
	55-64	26	7.9
	65 and over	8	2.4
Education	Middle School (until Grade 9)	1	0.3
	High School	49	14.9
	Higher Education (bachelor's or master´s)	262	79.6
	Doctorate	17	5.2
Monthly income	No income	8	2.4
	Less than 500 €	6	1.8
	500€ - 999€	40	12.2
	1000€ - 1999€	99	30.1
	2000€ - 2999€	96	29.2
	3000€ - 3999€	35	10.6
	4000€ - 4999€	22	6.7
	Over 4999€	23	7.0
Current employment status	Student	13	4.0
	Retired	14	4.3
	Unemployed	5	1.5
	Employed	226	68.7
	Self-employed	71	21.6

Source: Own work.

The expert questionnaire was performed between March and June 2024 via online meetings on the Zoom platform. Following recommendations from the initial participants, ultimately there were identified 5 experts who completed the questionnaire. These experts consisted of higher education professors and tourism practitioners, who all have intimate and extensive familiarity with Madeira. Table 6 below provides a summary of the characteristics of the expert participants - 60% of them were male, 60% were aged between 51 and 60 years old, 80% had experience in the relevant field of more than 20 years, 80% had finished doctorate studies and 80% had worked in as a university professor or in the education field related to Portuguese tourism.

It should be noted, that the AHP can be effective with a limited number of experts. As mentioned by Cheng and Li (2001), because AHP is a subjective method, it does not necessarily require a large number of experts. Tsyganok et al. (2012) observed that expert

competence becomes increasingly important in smaller groups, indicating that AHP can be particularly valuable when relying on fewer, highly skilled experts. Furthermore, research by Lee et al. (2010) indicates that the perspectives of a small group of key informants are often sufficient to produce relevant and reliable results, even if they only provide approximate estimates. Thus, for the AHP methodology, the 5 responses from qualified experts in total were considered sufficient.

Table 6. Summary of experts' profile (N=5).

Characteristics		N	Percent
Gender	Male	3	60.0
	Female	2	40.0
Age	41-50	2	40.0
	51-60	3	60.0
Experience (years)	16-20	1	20.0
	More than 20	4	80.0
Education	Higher Education (bachelor's or master´s)	1	20.0
	Doctorate	4	80.0
Work field	Education/Professor	4	80.0
	Tourism	1	20.0

Source: Own work.

3.4. Data analysis

All the data from both questionnaires has been processed and analysed with the help of two software programs: Microsoft Office Excel and R 4.4.1. For the 5 expert questionnaires, the data was first organised using Excel to create $n \times n$ tables for each comparison at every level of the hierarchy based on the expert responses (corresponding to the judgement matrices described in section 3.1.). These tables were then aggregated into a single judgement matrix and normalised using R software to extract local and global weightings for each element. The consistency of each response was verified (see Appendix C for R codes for these procedures). For every comparison matrix, consistency ratios were calculated, and all satisfied the consistency conditions from section 3.1. (the highest consistency index obtained was 0.0818).

Tourist questionnaires assessed 31 attributes of the attractiveness of nature-based tourism in Madeira. The descriptive statistics of the results have been performed in Excel. For the fuzzy matrix, as explained above, R_{ij} is determined by the ratio of the number of questionnaires at the corresponding evaluation level to the total number of valid questionnaires, which has been calculated with the help of R software, as well as all the evaluation sets based on the results of R and the weight sets.

4. Results

4.1. Results of Analytic Hierarchy Process – Experts' Questionnaire

The relative importance of elements contributing to nature-based tourism attractiveness was established using five sets of normalised weights (Table 7). Weights apply to every attribute, factor and dimension. Local weights show how important or prioritised each element is concerning the others at a certain level of the hierarchy. Their application according to dimension reveals that *tourist attractions* (0.38021) is the most significant dimension contributing to nature-based destination attractiveness. It is followed by *development conditions* (0.27572), and *accessibility* (0.22170), however *complementary services* (0.12236) seems to be the dimension that contributes the least.

The factors that were highest in terms of importance among the dimensions of tourist attractions, accessibility, development conditions, and complementary services are, respectively, *natural attractions* (0.25077), *external access* (0.14531), *tourism amenities* (0.07570), and *safety and sanitation* (0.16802). In contrast, the most important attributes with respect for each factor in the order of natural attractions, cultural attractions, external access, internal access, tourism amenities, stakeholder attitude, safety and sanitation, and information services were *eco-environment* (0.22913), *special events* (0.38213), *transportation price* (0.55418), *road network* (0.51768), *sports facilities* (0.23576), *local residents' attitudes* (0.55180), *health care system* (0.43802) and *visitor centers* (0.38753).

By merging the local weights of criteria and alternatives, global weights are utilised to establish the overall priority or ordering of alternatives. By integrating the weights of the criteria and the local performance of the alternatives, they represent the relative relevance of the alternatives when taking the complete hierarchy into account. After a close examination of the global weights (Table 7), it can be established that *natural attractions* (0.09534), *cultural attractions* (0.07879) and *external access* (0.03222) are the top three factors contributing to nature-based tourism attractiveness.

The top five ranked attributes are *special events* (0.03011), *historical relics* (0.02568), *folk customs* (0.02300), *eco-environment* (0.02185), and *forest landscape* (0.02012). *Road signs* (0.00088), *tour guide interpretation* (0.00093), *interpretation boards* (0.00123), *education-oriented facilities* (0.00133), and *host government support* (0.00177) were ranked the lowest.

Therefore, given the results, the weight vector of each index is as follows:

- Attractiveness of nature-based tourism (WD_1–WD_4): (0.38021, 0.22170, 0.27572, 0.12236);
- Tourist attractions (WF_1–WF_2): (0.25077, 0.20721);
- Accessibility (WF_3–WF_4): (0.14531, 0.08151);
- Development conditions (WF_5–WF_6): (0.07570, 0.03094);
- Complementary services (WF_7–WF_8): (0.16802, 0.04053);
- Natural attractions (WA_1–WA_6): (0.05743, 0.21081, 0.21104, 0.09956, 0.19203, 0.22913);
- Cultural attractions (WA_7–WA_9): (0.32597, 0.29190, 0.38213);
- External access (WA_{10}–WA_{12}): (0.36622, 0.07960, 0.55418);
- Internal access (WA_{13}–WA_{15}): (0.51768, 0.21424, 0.26808);
- Tourism amenities (WA_{16}–WA_{21}): (0.23576, 0.06395, 0.10570, 0.15944, 0.20631, 0.22883);
- Stakeholder's attitude (WA_{22}–WA_{24}): (0.20719, 0.55180, 0.24101);
- Safety and sanitation (WA_{25}–WA_{27}): (0.43802, 0.38092, 0.18107);
- Information Services (WA_{28}–WA_{31}): (0.38753, 0.24841, 0.17702, 0.18704).

Table 7. Local and global weights for determining the attractiveness of nature-based tourism destination.

Dimension(D)/ Level 2	Local Weight	Factor(F)/Level 3	Local Weight	Global Weight	Attribute(A)/Level 4	Local Weight	Global Weight	Rank
Tourist attractions (D_1)	0.38021	Natural attractions (F_1)	0.25077	0.09534	Topography and geology (A_1)	0.05743	0.00548	14
					Rare flora and fauna (A_2)	0.21081	0.02010	6
					Forest landscape (A_3)	0.21104	0.02012	5
					Climatic phenomena (A_4)	0.09956	0.00949	10
					Water landscape (A_5)	0.19203	0.01831	7
					Eco-environment (A_6)	0.22913	0.02185	4
		Cultural attractions (F_2)	0.20721	0.07879	Historical relics (A_7)	0.32597	0.02568	2
					Folk customs (A_8)	0.29190	0.02300	3
					Special events (A_9)	0.38213	0.03011	1
Accessibility (D_2)	0.22170	External access (F_3)	0.14531	0.03222	Aviation (A_{10})	0.36622	0.01180	9
					Marine transportation (A_{11})	0.07960	0.00256	23
					Transportation price (A_{12})	0.55418	0.01785	8
		Internal access (F_4)	0.08151	0.01807	Road network (A_{13})	0.51768	0.00936	11
					Sightseeing vehicles (A_{14})	0.21424	0.00387	20
					Car parks (A_{15})	0.26808	0.00484	16
Development conditions (D_3)	0.27572	Tourism amenities (F_5)	0.07570	0.02087	Sports facilities (A_{16})	0.23576	0.00492	15
					Education-oriented facilities (A_{17})	0.06395	0.00133	28
					Shopping facilities (A_{18})	0.10570	0.00221	24
					Recreation facilities (A_{19})	0.15944	0.00333	22
					Catering facilities (A_{20})	0.20631	0.00431	19
					Lodging facilities (A_{21})	0.22883	0.00478	17
		Stakeholder's attitude (F_6)	0.03094	0.00853	Host government support (A_{22})	0.20719	0.00177	27
					Local residents' attitude (A_{23})	0.55180	0.00471	18
					Tourism-engaged staffs' quality (A_{24})	0.24101	0.00206	25

Complementary services (D_4)	0.12236	Safety and sanitation (F_7)	0.16802	0.02056	Health care system (A_{25})	0.43802	0.00901	12
					Emergency rescue system (A_{26})	0.38092	0.00783	13
					Environment maintenance (A_{27})	0.18107	0.00372	21
		Information services (F_8)	0.04053	0.00496	Visitor centers (A_{28})	0.38753	0.00192	26
					Interpretation boards (A_{29})	0.24841	0.00123	29
					Road signs (A_{30})	0.17702	0.00088	31
					Tour guide interpretation (A_{31})	0.18704	0.00093	30

Source: Own work.

4.2. Results of the tourist questionnaire

The Polish tourists' perceptions of attributes contributing to the attractiveness of Madeira are presented in Table 8.

Table 8. Polish tourists' perception of the attractiveness of Madeira.

Attributes	Mean	St. dev.
Topography and geology	4.74	0.637
Rare flora and fauna	4.22	0.918
Forest landscape	4.68	0.644
Climatic phenomena	4.81	0.497
Water landscape	4.58	0.711
Eco-environment	4.71	0.578
Historical relics	3.34	0.982
Folk customs	4.11	0.863
Special events	4.26	0.885
Aviation	3.67	0.983
Marine transportation	2.56	1.017
Transportation price	3.43	1.063
Road network	3.62	1.101
Sightseeing vehicles	3.37	0.995
Car parks	3.26	1.037
Sports facilities	3.13	0.786
Education-oriented facilities	3.22	0.879
Shopping facilities	4.31	0.834
Recreation facilities	3.82	0.967
Catering facilities	4.39	0.801
Lodging facilities	4.05	0.864
Host government support	4.00	0.882
Local residents' attitude	4.50	0.741
Tourism-engaged staffs' quality	4.35	0.775
Health care system	3.39	0.785
Emergency rescue system	3.41	0.792
Environment maintenance	4.22	0.819
Visitor centers	3.79	0.876
Interpretation boards	4.00	0.870
Road signs	4.17	0.810
Tour guide interpretation	3.95	0.901
Average	**3.94**	**0.141**

Source: Own work.

Contrary to experts' evaluation, the highest-ranked attributes relate to nature. *Climatic phenomena* (Mean = 4.81, St. Dev = 0.497) has the highest mean score, indicating that respondents find it to be the most important attribute contributing to the attractiveness of the destination, followed by *topography and geology* (Mean = 4.74, St. Dev = 0.637) and *eco-*

environment (Mean = 4.71, St. Dev = 0.578). The relatively low standard deviation also suggests strong agreement among respondents.

Marine transportation (Mean = 2.56, St. Dev = 1.017): has the lowest mean score, suggesting that respondents find it as the least important attribute, together with *sports facilities* (Mean = 3.13, St. Dev = 0.786) and *car parks* (Mean = 3.26, St. Dev = 1.037).

It is worth mentioning, that attributes of *transportation price* (St. Dev = 1.063) and *road network* (St. Dev = 1.101) have the highest standard deviations, suggesting diverse opinions among respondents, possibly due to varying personal experiences or expectations.

Since the overall average of all the attributes in Table 8 is 3.94, respondents generally agree that all the attributes positively contribute to Madeira's attractiveness. This score implies that the destination is perceived favourably overall, with most attributes being viewed as strengths or at least adequate in contributing to its attractiveness as a nature-based tourism destination.

4.3. Fuzzy Judgment Matrix construction

As previously mentioned, the number of tourist questionnaires at the corresponding evaluation level to the total number of valid questionnaires is used to compute R_{ij}. Eight fuzzy judgement matrixes of the fourth level of Madeira, R_{41}, R_{42}, R_{43}, R_{44}, R_{45}, R_{46}, R_{47}, and R_{48}, can be constructed. From left to right, each row's assessment level ranges from 1 (strongly disagree) to 5 (strongly agree). Each row corresponds to an attribute A_i, in sequence: for R_{41} - A_1: Topography and geology; A_2: Rare flora and fauna; A_3: Forest landscape; A_4: Climatic phenomena; A_5: Water landscape; A_6: Eco-environment; for R_{42} - A_7: Historical relics; A_8: Folk customs; A_9: Special events; for R_{43} - A_{10}: Aviation; A_{11}: Marine transportation; A_{12}: Transportation price; for R_{44} - A_{13}: Road network; A_{14}: Sightseeing vehicles; A_{15}: Car parks; for R_{45} - A_{16}: Sports facilities; A_{17}: Education-oriented facilities; A_{18}: Shopping facilities; A_{19}: Recreation facilities; A_{20}: Catering facilities; A_{21}: Lodging facilities; for R_{46} - A_{22}: Host government support; A_{23}: Local residents' attitude; A_{24}: Tourism-engaged staffs' quality; for R_{47} - A_{25}: Health care system; A_{26}: Emergency rescue system; A_{27}: Environment maintenance; and lastly for R_{47} - A_{28}: Visitor centers; A_{29}: Interpretation boards; A_{30}: Road signs; A_{31}: Tour guide interpretation.

$$R_{41} = \begin{bmatrix} 0.00608 & 0.01216 & 0.03343 & 0.13070 & 0.81763 \\ 0.01216 & 0.03647 & 0.15198 & 0.31915 & 0.48024 \\ 0.00304 & 0.01216 & 0.04255 & 0.18845 & 0.75380 \\ 0.00304 & 0.00304 & 0.01824 & 0.13374 & 0.84195 \\ 0 & 0.02736 & 0.04863 & 0.23708 & 0.68693 \\ 0.00608 & 0.00304 & 0.01824 & 0.21884 & 0.75380 \end{bmatrix}$$

$$R_{42} = \begin{bmatrix} 0.02432 & 0.16413 & 0.38602 & 0.29483 & 0.13070 \\ 0.00304 & 0.03951 & 0.18541 & 0.38906 & 0.38298 \\ 0 & 0.03040 & 0.20365 & 0.24316 & 0.52280 \end{bmatrix}$$

$$R_{43} = \begin{bmatrix} 0.01520 & 0.10334 & 0.30091 & 0.35866 & 0.22188 \\ 0.20669 & 0.17933 & 0.50152 & 0.07599 & 0.03647 \\ 0.03343 & 0.16413 & 0.31611 & 0.31003 & 0.17629 \end{bmatrix}$$

$$R_{44} = \begin{bmatrix} 0.03647 & 0.14894 & 0.20365 & 0.38298 & 0.22796 \\ 0.02736 & 0.14286 & 0.41033 & 0.26748 & 0.15198 \\ 0.04863 & 0.17629 & 0.36170 & 0.29483 & 0.11854 \end{bmatrix}$$

$$R_{45} = \begin{bmatrix} 0.02128 & 0.11550 & 0.65046 & 0.13982 & 0.07295 \\ 0.03040 & 0.12462 & 0.52888 & 0.23100 & 0.08511 \\ 0.00912 & 0.02736 & 0.10334 & 0.36474 & 0.49544 \\ 0.00912 & 0.08511 & 0.26140 & 0.36474 & 0.27964 \\ 0.00304 & 0.03040 & 0.09119 & 0.32523 & 0.55015 \\ 0.00608 & 0.04559 & 0.17325 & 0.43769 & 0.33739 \end{bmatrix}$$

$$R_{46} = \begin{bmatrix} 0.00304 & 0.01824 & 0.31611 & 0.30395 & 0.35866 \\ 0.00304 & 0.02128 & 0.06687 & 0.29483 & 0.61398 \\ 0.00304 & 0.01824 & 0.11246 & 0.35562 & 0.51064 \end{bmatrix}$$

$$R_{47} = \begin{bmatrix} 0.01216 & 0.02128 & 0.66565 & 0.17021 & 0.13070 \\ 0.01216 & 0.02736 & 0.62614 & 0.20669 & 0.12766 \\ 0.00608 & 0.02128 & 0.14894 & 0.39514 & 0.42857 \end{bmatrix}$$

$$R_{48} = \begin{bmatrix} 0.00608 & 0.03040 & 0.37994 & 0.33131 & 0.25228 \\ 0.00304 & 0.06079 & 0.17629 & 0.45289 & 0.30699 \\ 0.00304 & 0.02736 & 0.15502 & 0.42249 & 0.39210 \\ 0.00304 & 0.01216 & 0.37386 & 0.24924 & 0.36170 \end{bmatrix}$$

4.4. Results of Fuzzy Comprehensive Evaluation – Experts and Tourists

The outcomes of a row vector of the third-level Fuzzy Comprehensive Evaluation can be calculated as follows, by utilising eight fuzzy judgement matrices (R_{41}–R_{48}) and their matching sets of weights (WA_1–WA_{31}):

$$VF_1 = (WA_1 - WA_6) \circ (R_{41}) = (0.00525, 0.01721, 0.05827, 0.22354, 0.69573)$$

$$VF_2 = (WA_7 - WA_9) \circ (R_{42}) = (0.00881, 0.07665, 0.25777, 0.30259, 0.35417)$$

$$VF_3 = (WA_{10} - WA_{12}) \circ (R_{43}) = (0.04055, 0.14308, 0.32530, 0.30921, 0.18186)$$

$$VF_4 = (WA_{13} - WA_{15}) \circ (R_{44}) = (0.03778, 0.15497, 0.29030, 0.33460, 0.18235)$$

$$VF_5 = (WA_{16} - WA_{21}) \circ (R_{45}) = (0.01140, 0.06837, 0.29824, 0.31170, 0.31030)$$

$$VF_6 = (WA_{22} - WA_{24}) \circ (R_{46}) = (0.00304, 0.01991, 0.12950, 0.31137, 0.53618)$$

$$VF_7 = (WA_{25} - WA_{27}) \circ (R_{47}) = (0.01106, 0.02359, 0.55704, 0.22483, 0.18348)$$

$$VF_8 = (WA_{28} - WA_{31}) \circ (R_{48}) = (0.00422, 0.03400, 0.28840, 0.36230, 0.31109)$$

Then, using the row vector results VF_i mentioned above, four fuzzy judgement matrices of the third level, R_{31}, R_{32}, R_{33}, and R_{34}, may be created as follows:

$$R_{31} = \begin{bmatrix} 0.00525 & 0.01721 & 0.05827 & 0.22354 & 0.69573 \\ 0.00881 & 0.07665 & 0.25777 & 0.30259 & 0.35417 \end{bmatrix}$$

$$R_{32} = \begin{bmatrix} 0.04055 & 0.14308 & 0.32530 & 0.30921 & 0.18186 \\ 0.03778 & 0.15497 & 0.29030 & 0.33460 & 0.18235 \end{bmatrix}$$

$$R_{33} = \begin{bmatrix} 0.01140 & 0.06837 & 0.29824 & 0.31170 & 0.31030 \\ 0.00304 & 0.01991 & 0.12950 & 0.31137 & 0.53618 \end{bmatrix}$$

$$R_{34} = \begin{bmatrix} 0.01106 & 0.02359 & 0.55704 & 0.22483 & 0.18348 \\ 0.00422 & 0.03400 & 0.28840 & 0.36230 & 0.31109 \end{bmatrix}$$

Using the associated weight sets (WF_1–WF_8) and four fuzzy judgement matrices (R_{31}–R_{34}), the row vector results of the second-level Fuzzy Comprehensive Evaluation may be computed as follows:

$$VD_1 = (WF_1 - WF_2) \circ (R_{31}) = (0.00314, 0.02020, 0.06803, 0.11876, 0.24786)$$

$$VD_2 = (WF_3 - WF_4) \circ (R_{32}) = (0.00897, 0.03342, 0.07093, 0.07221, 0.04129)$$

$$VD_3 = (WF_5 - WF_6) \circ (R_{33}) = (0.00096, 0.00579, 0.02658, 0.03323, 0.04008)$$

$$VD_4 = (WF_7 - WF_8) \circ (R_{34}) = (0.00203, 0.00534, 0.10528, 0.05246, 0.04344)$$

Moreover, the second-level fuzzy comprehensive judgement matrix of Madeira (R) may be created as follows by applying the row vector findings mentioned above:

$$R = \begin{bmatrix} 0.00314 & 0.02020 & 0.06803 & 0.11876 & 0.24786 \\ 0.00897 & 0.03342 & 0.07093 & 0.07221 & 0.04129 \\ 0.00096 & 0.00579 & 0.02658 & 0.03323 & 0.04008 \\ 0.00203 & 0.00534 & 0.10528 & 0.05246 & 0.04344 \end{bmatrix}$$

Ultimately, by utilising assessment matrix R and the corresponding weights sets (WD_1–WD_4), the outcome of the first-level or objective-level Fuzzy Comprehensive Evaluation may be derived by applying $B = (WD_1 - WD_4) \circ (R)$:

$$B = (0.00370, 0.01734, 0.06180, 0.07674, 0.11976)$$

It is common practice to define the outcomes of a fuzzy comprehensive evaluation using the maximum-membership-degree concept. The membership-degree values of "poor," "fair," "moderate," "good," and "excellent" are, according to vector B, 0.00370, 0.01734, 0.06180, 0.07674, and 0.11976, in that order. The highest membership degree value among them is "excellent" (0.11976). Thus, when Madeira is evaluated as a Nature-Based Tourism Destination via the combination of both expert and Polish visitor assessments, the Nature-Based Tourism Attractiveness evaluation score in Madeira is 0.11976 (at the level of “excellent”), indicating the “attractiveness” level is very high.

However, even though the overall evaluation is considered “excellent”, not all areas achieved that ranking. The results at the third level of the Fuzzy Comprehensive Evaluation according to the maximum-membership-degree concept show, that both *external access* and *safety and sanitation* have the highest membership degree value only at the level of “moderate” (0.32530 and 0.55704 respectively), while *internal access*, *tourism amenities* and *information services* have the highest values at the level of “good” (0.33460, 0.31170 and 0.36230 respectively), and *natural attractions*, *cultural attractions* and *stakeholder's attitude* have the highest values at the level of “excellent” (0.69573, 0.35417 and 0.53618 respectively). The results at the second level of the Fuzzy Comprehensive Evaluation indicate that even though the dimension of *tourist attractions* and *development conditions* have the highest membership degree value of “excellent” (0.24786 and 0.04008 respectively), and *accessibility* has the value of “good” (0.07221), the dimension of *complementary services* has the highest value only at the level of “moderate” (0.10528).

5. Discussion

The study aimed to assess Madeira's overall attractiveness as a nature-based tourism destination through a comprehensive evaluation using both expert opinions and tourist perceptions. The data was collected from a panel of experts in tourism with a deep knowledge of Madeira and also Polish people who have already visited Madeira as tourists.

The assessment of the experts' pairwise comparisons revealed that the dimension of *tourist attractions* has been found as the most important element contributing to the nature-based destination attractiveness of Madeira. According to experts, the most significant factors are *natural attractions*, *cultural attractions* and *external access*. The top three ranked attributes contributing to Madeira's attractiveness are *special events*, *historical relics*, and *folk customs*. On the other hand, the least important attributes identified are *road signs*, *tour guide interpretation* and *interpretation boards*. That answers the first research question set for this study. Contrary to experts' evaluation, the highest-ranked attributes contributing to the tourism destination attractiveness of Madeira as perceived by Polish tourists are *climatic phenomena*, *topography and geology*, and *eco-environment* and the attributes ranked the lowest are *marine transportation*, *sports facilities* and *car parks*. This information answers the second research question. The main finding of this study is the overall attractiveness of Madeira as a nature-based tourism destination is very high, as the result indicates the level of "excellent", which answers the last research question set for this study.

In more detail, applying the AHP procedure to experts' data revealed that *tourist attractions* were considered the most significant dimension contributing to nature-based destination attractiveness, followed by *development conditions* and *accessibility*. *Complementary services* were considered the least important dimension. This aligns with the findings presented by Lee et al. (2010) and Gu et al. (2022), who also concluded that tourist attractions and complementary services are considered the most and least important dimensions respectively. On the contrary, Lee (2020) found accessibility to be not significant for camping tourism. When it comes to factors contributing to nature-based tourism attractiveness, as mentioned before, the top three are *natural attractions*, *cultural attractions* and *external access*, which, similarly to dimensions, all of them seem to be aligned with the conclusions of Gu et al. (2022), who also ranked natural attractions, cultural attractions and external access the highest, however, even though the study of Lee et al. (2010) also considered natural attractions and external access as important, the third spot was taken by tourism facilities. External access being one of the most important factors also aligns with

research about Madeira, since Cró et al., (2021) concluded that, for Madeira, the number of direct flights is an important competitive factor for international tourist arrivals. When it comes to attributes, in this study, the top five are *special events*, *historical relics*, *folk customs*, *eco-environment*, and *forest landscape*. *Road signs*, *tour guide interpretation*, *interpretation boards*, *education-oriented facilities*, and *host government support* were ranked the lowest. The first three highest-ranked attributes are unexpected when compared to previous literature. Usually, one of the nature-related attributes is ranked as first. In this case, they only appear at the fourth and fifth positions. Gu et al. (2022) found topography and geography, eco-environment, historical relics, road network, and forest landscape to be the most important, from which three attributes overlap with the top five list of this study. These findings are less aligned with the conclusions of Lee et al. (2010), who ranked forest landscapes and scenery, railway, climatic phenomena, quality accommodation and cuisine and road network the highest. However, it is important to note, that the existing literature on Madeira heavily focuses on the importance of the culture, especially events and festivals. Gałązka (2024) highlighted, that Madeiran culture is one of the most important factors that makes the island attractive. Thus, in the case of this particular destination, many attributes referring to culture and history being at the top of the list are justifiable.

On the other hand, the attributes of Madeira that are ranked the highest according to tourists, are the ones related to nature - *climatic phenomena*, *topography and geology*, and *eco-environment.* These findings confirm the results of Nasa et al. (2020), who proved, that visitors to national parks highly value the natural environment and the climate. Also, Cró et al., (2021) found that for Madeira, climate is one of the important competitive factors for international tourist arrivals, which seems not to be as important of an attribute according to experts' opinions but is aligned with the findings from tourists data. However, according to Aryia et al. (2017), Lee et al. (2003) and Islam et al. (2020) before nature, it is safety and security that are the highest-valued attributes, as perceived by tourists. The lowest-ranked attributes of *marine transportation*, *sports facilities* and *car parks* confirm the conclusions of Vengesayi et al. (2019) that destination support services such as destination utilities and communication facilities are not significantly related to destination attractiveness.

Even though the overall score of Madeira's attractiveness as a nature-based tourism destination was found to be "excellent", some areas still have not achieved that ranking and could be improved. For instance, the factors of *external access*, *safety and sanitation*, and the dimension of *complementary services* have the highest degree of membership value only at the "moderate" level. To enhance Madeira's attractiveness among Polish tourists in the future,

there are still prospects for further improvement with tourist planning, development strategies and new research directions. The results suggest that the importance of secondary services that can significantly influence tourist satisfaction may be undervalued. Addressing these gaps will be crucial for maintaining Madeira's competitive advantage in the nature-based tourism market. To enhance Madeira's attractiveness among Polish tourists in the future, there are still prospects for further improvement with tourist planning, development strategies and new research directions.

This study contributes to the broader literature on evaluating nature-based tourism destination attractiveness using quantitative modelling approaches and the study of Madeira as a nature-based destination. The observed similarities and differences between the results of experts' and tourists' evaluations demonstrate that models produce distinct results when applying the demand-driven approach or the supply perspective individually, despite some shared attributes between experts and tourists. This underscores the importance of an integrative approach, as utilised in this study. The findings of this study also offer valuable insights for tourism planners and marketers in Madeira to enhance the island's attractiveness as a nature-based tourism destination. Generally, addressing the issues with lower-ranked attributes through targeted improvements will enhance Madeira's attractiveness and sustainability as a top nature-based tourism destination.

However, this study is not without limitations. As Vigolo (2015) highlighted, perceptions of destination attributes might depend on tourists' region of origin. As only Polish tourists have been studied, future research could expand to include perspectives from other key tourism markets to increase the broader applicability of these findings. Moreover, the respondent base is relatively small, and expanding it is necessary to gain more comprehensive insights. Especially the expert panel, as although the sample was chosen based on extensive experience and deep understanding of this specific destination, it was both selective and limited in size. And lastly, other dimensions not included in this study could play a significant role in explaining tourists' and experts' opinions towards Madeira, thus further research exploring all dimensions could provide a more holistic understanding of the destination's overall attractiveness and reveal additional factors influencing its attractiveness.

5. Conclusions

Nature-based tourism, as an emerging major segment of world tourism, and its attractiveness continue to be the topic of many academic discussions in recent years. The experience and perception tourists have of a destination are influenced by a variety of factors that contribute to the complex nature of tourism attractiveness. Understanding these factors is crucial not only for grasping what makes a location attractive but also for developing strategies to advance the tourism sector (Yevloyeva, 2024). Since a destination that effectively meets tourists' needs and preferences is more likely to be selected over others and perceived as more attractive, the evaluation of destination attractiveness seems to be crucial for overall tourism industry success (Vengesayi et al., 2009). Consequently, it is increasingly important to establish a framework for the business and government sectors to assess nature-based tourism attractiveness and ensure the long-term sustainability of nature-based tourism (Gu et al., 2022).

Previous studies on destination attractiveness have predominantly concentrated on either supply or demand approaches, with integrative approaches being less common. Even rarer are assessments of nature-based tourism destination attractiveness that consider both local expert evaluations of natural amenities and visitor demand. The ability to obtain scores from all perspectives provides an opportunity to explore the interaction between these factors in shaping the overall tourism attractiveness of various regions (Formica & Uysal, 2006). Madeira, in particular, has not been extensively studied in the context of nature-based tourism, and the relative significance of the attributes influencing its tourism attractiveness remains largely unexplored.

This study provides a comprehensive assessment of the overall tourism attractiveness and contributing attributes, of a nature-based destination, Madeira. By combining the Analytic Hierarchy Process with the Fuzzy Comprehensive Evaluation method, both visitors' perceptions and experts' opinions have been evaluated. Data from 5 experts and 329 tourists was collected from two separate questionnaires designed for this study.

This work contributes to the research of destination attractiveness measurement and supply-demand interaction, and further tests the method proposed by Gu et al. (2022). It also adds to the limited literature on the attractiveness of nature-based tourism destinations and Madeira as a nature-based destination specifically. The results provide academics, governmental bodies, business associations, and other stakeholders in the tourism sector with a comprehensive framework for qualitative and quantitative evaluation of the supply and

demand factors that influence the attractiveness of nature-based destinations. It also highlights the need for a balanced approach that integrates both expert insights and tourist perceptions. The application of the Fuzzy-AHP method demonstrates its effectiveness in assessing complex tourism dynamics, offering valuable tools for stakeholders to enhance destination management and sustainability. As global demand for nature-based tourism continues to grow, the insights from this research can guide future strategies to ensure that natural destinations like Madeira remain competitive, attractive, and environmentally sustainable for generations to come. Thus, the theoretical and methodological contributions of this work will benefit not only the academic community but also industry professionals and decision-makers in the tourism sector.

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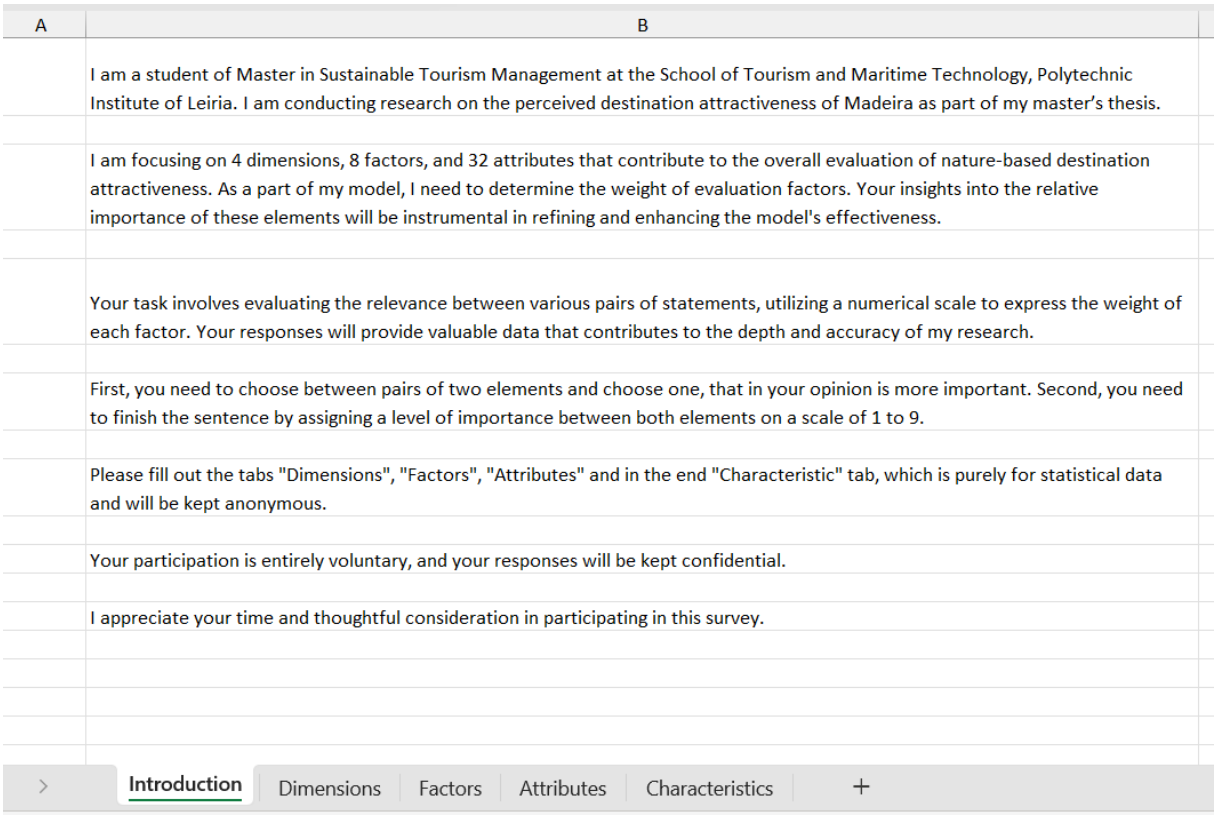
Appendices

Appendix A. The experts' questionnaire

Since the experts' questionnaire is quite extensive, only one print of each tab in the questionnaire Excel sheet is presented below to show the general design of the survey.



I am a student of Master in Sustainable Tourism Management at the School of Tourism and Maritime Technology, Polytechnic Institute of Leiria. I am conducting research on the perceived destination attractiveness of Madeira as part of my master's thesis.

I am focusing on 4 dimensions, 8 factors, and 32 attributes that contribute to the overall evaluation of nature-based destination attractiveness. As a part of my model, I need to determine the weight of evaluation factors. Your insights into the relative importance of these elements will be instrumental in refining and enhancing the model's effectiveness.

Your task involves evaluating the relevance between various pairs of statements, utilizing a numerical scale to express the weight of each factor. Your responses will provide valuable data that contributes to the depth and accuracy of my research.

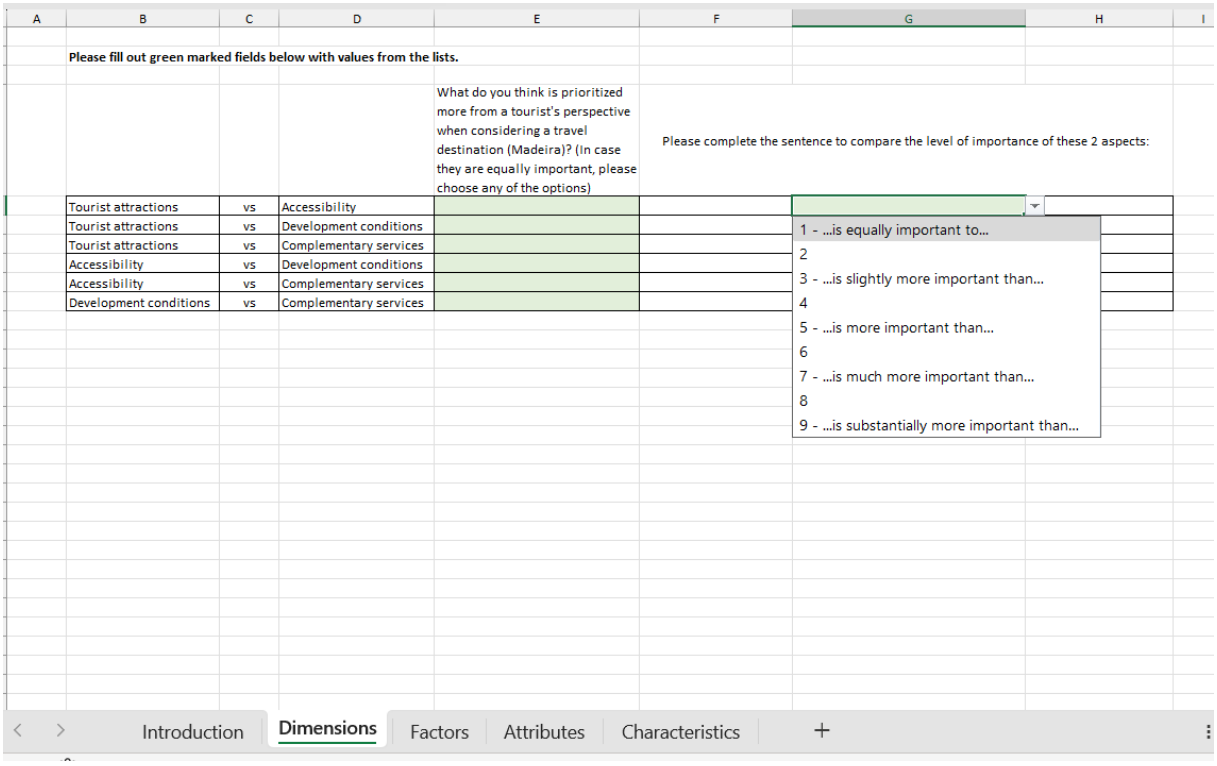
First, you need to choose between pairs of two elements and choose one, that in your opinion is more important. Second, you need to finish the sentence by assigning a level of importance between both elements on a scale of 1 to 9.

Please fill out the tabs "Dimensions", "Factors", "Attributes" and in the end "Characteristic" tab, which is purely for statistical data and will be kept anonymous.

Your participation is entirely voluntary, and your responses will be kept confidential.

I appreciate your time and thoughtful consideration in participating in this survey.

Introduction | Dimensions | Factors | Attributes | Characteristics

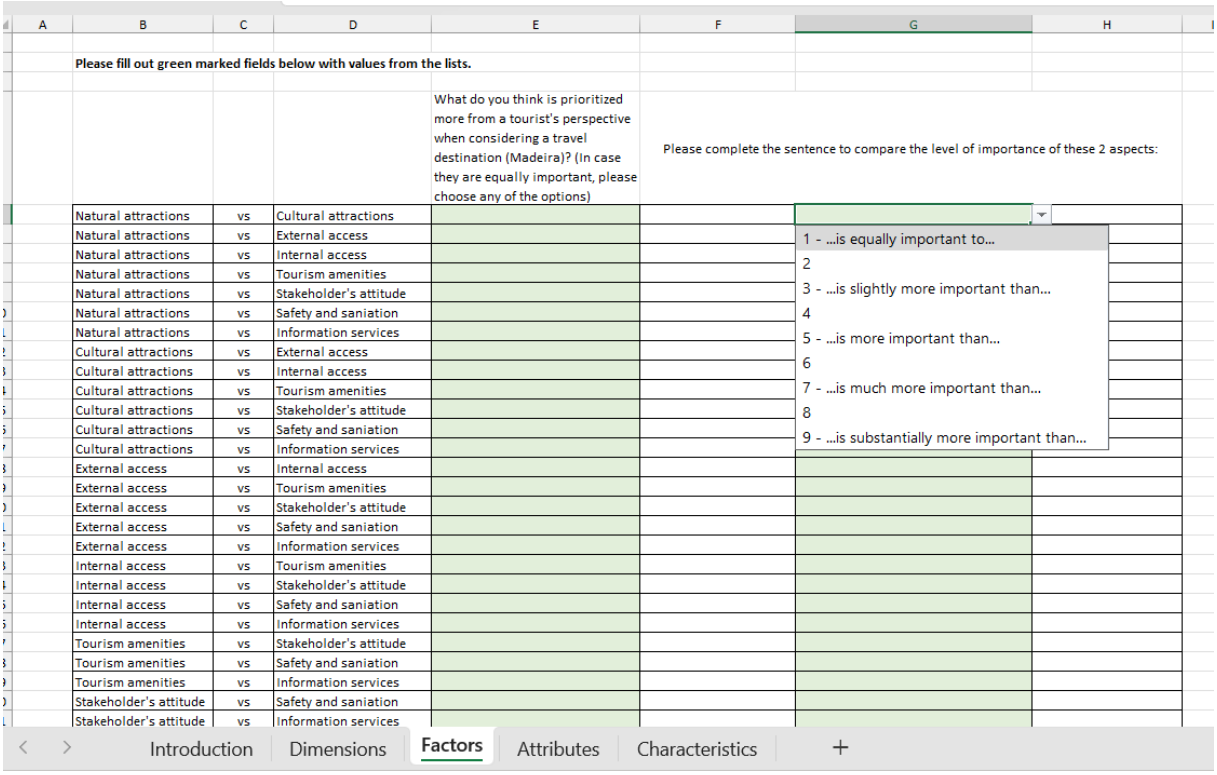


Please fill out green marked fields below with values from the lists.

			What do you think is prioritized more from a tourist's perspective when considering a travel destination (Madeira)? (In case they are equally important, please choose any of the options)	Please complete the sentence to compare the level of importance of these 2 aspects:
Tourist attractions	vs	Accessibility		
Tourist attractions	vs	Development conditions		
Tourist attractions	vs	Complementary services		
Accessibility	vs	Development conditions		
Accessibility	vs	Complementary services		
Development conditions	vs	Complementary services		

1 - ...is equally important to...
2
3 - ...is slightly more important than...
4
5 - ...is more important than...
6
7 - ...is much more important than...
8
9 - ...is substantially more important than...

Introduction | Dimensions | Factors | Attributes | Characteristics

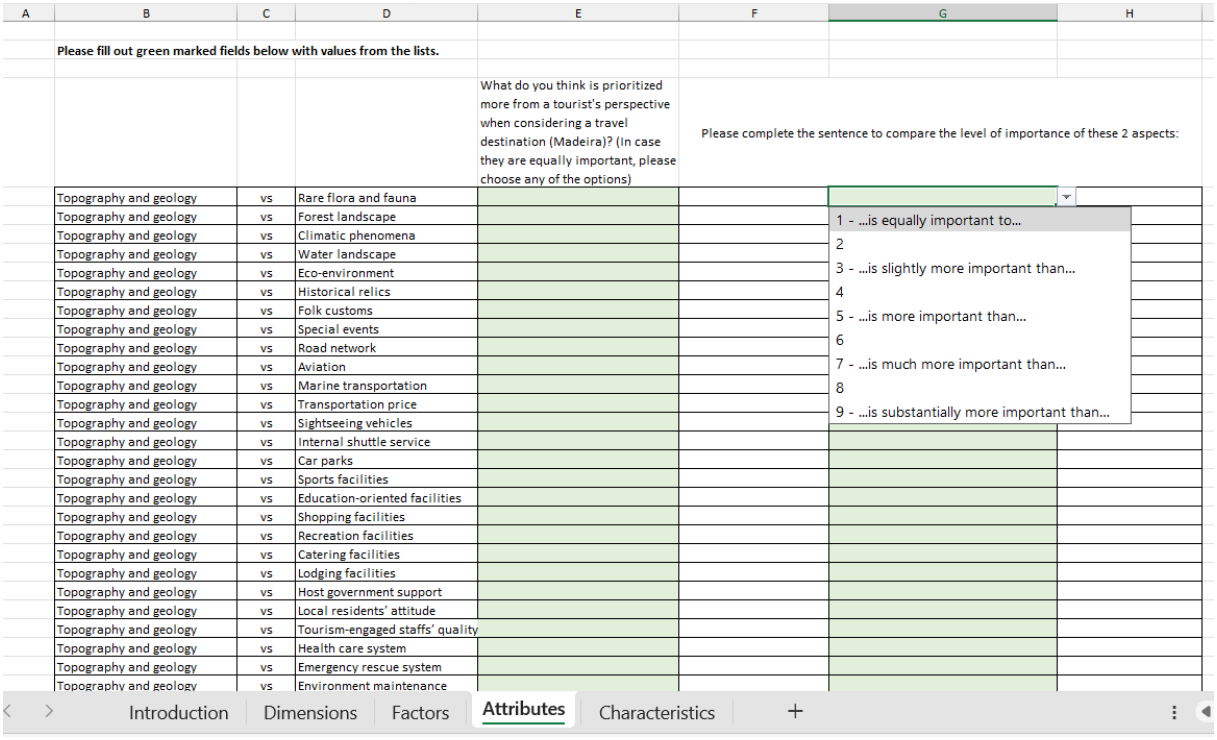


Please fill out green marked fields below with values from the lists.

			What do you think is prioritized more from a tourist's perspective when considering a travel destination (Madeira)? (In case they are equally important, please choose any of the options)	Please complete the sentence to compare the level of importance of these 2 aspects:
Natural attractions	vs	Cultural attractions		
Natural attractions	vs	External access		
Natural attractions	vs	Internal access		
Natural attractions	vs	Tourism amenities		
Natural attractions	vs	Stakeholder's attitude		
Natural attractions	vs	Safety and saniation		
Natural attractions	vs	Information services		
Cultural attractions	vs	External access		
Cultural attractions	vs	Internal access		
Cultural attractions	vs	Tourism amenities		
Cultural attractions	vs	Stakeholder's attitude		
Cultural attractions	vs	Safety and saniation		
Cultural attractions	vs	Information services		
External access	vs	Internal access		
External access	vs	Tourism amenities		
External access	vs	Stakeholder's attitude		
External access	vs	Safety and saniation		
External access	vs	Information services		
Internal access	vs	Tourism amenities		
Internal access	vs	Stakeholder's attitude		
Internal access	vs	Safety and saniation		
Internal access	vs	Information services		
Tourism amenities	vs	Stakeholder's attitude		
Tourism amenities	vs	Safety and saniation		
Tourism amenities	vs	Information services		
Stakeholder's attitude	vs	Safety and saniation		
Stakeholder's attitude	vs	Information services		

1 - ...is equally important to...
2
3 - ...is slightly more important than...
4
5 - ...is more important than...
6
7 - ...is much more important than...
8
9 - ...is substantially more important than...

Introduction | Dimensions | Factors | Attributes | Characteristics | +

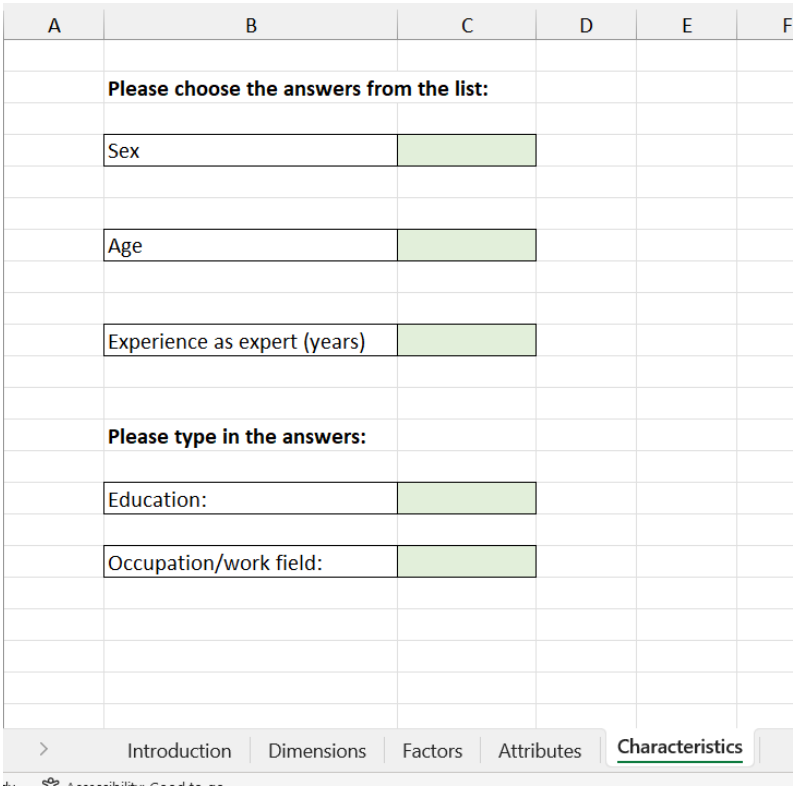


Please fill out green marked fields below with values from the lists.

			What do you think is prioritized more from a tourist's perspective when considering a travel destination (Madeira)? (In case they are equally important, please choose any of the options)	Please complete the sentence to compare the level of importance of these 2 aspects:
Topography and geology	vs	Rare flora and fauna		
Topography and geology	vs	Forest landscape		
Topography and geology	vs	Climatic phenomena		
Topography and geology	vs	Water landscape		
Topography and geology	vs	Eco-environment		
Topography and geology	vs	Historical relics		
Topography and geology	vs	Folk customs		
Topography and geology	vs	Special events		
Topography and geology	vs	Road network		
Topography and geology	vs	Aviation		
Topography and geology	vs	Marine transportation		
Topography and geology	vs	Transportation price		
Topography and geology	vs	Sightseeing vehicles		
Topography and geology	vs	Internal shuttle service		
Topography and geology	vs	Car parks		
Topography and geology	vs	Sports facilities		
Topography and geology	vs	Education-oriented facilities		
Topography and geology	vs	Shopping facilities		
Topography and geology	vs	Recreation facilities		
Topography and geology	vs	Catering facilities		
Topography and geology	vs	Lodging facilities		
Topography and geology	vs	Host government support		
Topography and geology	vs	Local residents' attitude		
Topography and geology	vs	Tourism-engaged staffs' quality		
Topography and geology	vs	Health care system		
Topography and geology	vs	Emergency rescue system		
Topography and geology	vs	Environment maintenance		

1 - ...is equally important to...
2
3 - ...is slightly more important than...
4
5 - ...is more important than...
6
7 - ...is much more important than...
8
9 - ...is substantially more important than...

Introduction | Dimensions | Factors | Attributes | Characteristics | +



Appendix B. The tourists' questionnaire

The final tourist questionnaire in Polish as presented on Google forms tool.

> # Atrakcyjność destynacji turystycznych opartych na przyrodzie - przypadek Madery (Portugalia)
>
> Jestem studentką studiów magisterskich w zakresie Zrównoważonego Zarządzania Turystyką w Szkole Turystyki i Technologii Morskich, na Instytucie Politechnicznym w Leirii (Portugalia). W ramach pracy magisterskiej prowadzę badania nad postrzeganiem atrakcyjności turystycznej Madery.
>
> Niniejsze badanie ma charakter ściśle akademicki i gwarantuje anonimowość zebranych danych. Kwestionariusz skierowany jest do polskich turystów, którzy kiedykolwiek odwiedzili Maderę.
>
> Dziękuję za poświęcony czas i udział w badaniu.

Czy byłaś/byłeś kiedykolwiek na Maderze? *

- ◯ Tak
- ◯ Nie

Oceń, w jakim stopniu zgadzasz się z następującymi stwierdzeniami:

Skala: 1 – Zdecydowanie się nie zgadzam; 2 – Nie zgadzam się; 3 – Nie mam zdania; 4 – Zgadzam się; 5 – Zdecydowanie się zgadzam

Czy zgadzasz się, że topografia Madery jest złożona i zmienna, oraz posiada typowe cechy geomorfologiczne*? *

* Geomorfologia - nauka o różnych rzeźbach powierzchni Ziemi, takich jak wzgórza, równiny, plaże, rzeki, góry itd.

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	◯	◯	◯	◯	◯	Zdecydowanie się zgadzam

Czy zgadzasz się, że liczba gatunków zwierząt i roślin na Maderze jest niezwykle bogata? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	◯	◯	◯	◯	◯	Zdecydowanie się zgadzam

Czy zgadzasz się, że Madera ma wysokie pokrycie roślinnością, bogate gatunki drzew i jest wyjątkowym krajobrazem leśnym? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	◯	◯	◯	◯	◯	Zdecydowanie się zgadzam

Czy zgadzasz się, że bardzo łagodny i umiarkowany klimat subtropikalny Madery jest bardzo atrakcyjny dla turystów? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że Madera ma bogaty krajobraz wodny o wysokich walorach estetycznych? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że środowisko ekologiczne na Maderze jest dobre, ze świeżym powietrzem, komfortowym klimatem, wysokiej jakości wodą i czystym środowiskiem? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że na Maderze jest wiele historycznych zabytków, które tworzą silną atmosferę dziedzictwa kulturowego? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że Madera ma barwną kulturę ludową z charakterystycznymi lokalnymi cechami? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że festiwale na Maderze są kolorowe i mają szczególne znaczenie dla dziedzictwa kulturowego? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że drogi na Maderze są dogodne, a warunki drogowe są doskonałe? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że jest wiele lotów na Maderę? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że istnieje wiele połączeń morskich z Maderą? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że na Maderę można dotrzeć za przystępną cenę? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że na Maderze jest wiele pojazdów turystycznych z odpowiednim oznakowaniem? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że powierzchnia parkingów na Maderze jest wystarczająca i dogodna? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że obiekty sportowe na Maderze są kompletne i spełniają potrzeby turystów na różnych poziomach zaawansowania w różnych dyscyplinach sportowych? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że obiekty edukacyjne na Maderze są doskonałe, a turyści mogą uzyskać szeroką wiedzę ekologiczną i środowiskową? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że możliwości robienia zakupów na Maderze są wystarczające i można tam znaleźć wiele pamiątek z lokalnymi cechami? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że Madera oferuje turystom dużo miejsc rozrywkowych? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że Madera ma odpowiednie usługi gastronomiczne, z naciskiem na lokalną kuchnię, bogata różnorodnością i przystępnymi cenami żywności? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że zakwaterowanie na Maderze jest czyste i bezpieczne za rozsądną cenę? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że władze lokalne zdecydowanie wspierają rozwój Madery jako kierunku turystycznego? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że mieszkańcy Madery są przyjaźni i uprzejmi wobec turystów? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że jakość personelu zaangażowanego w turystykę na Maderze jest bardzo wysoka, a poziom świadczonych przez ten personel usług jest zadowalający? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że służba zdrowia na Maderze jest dobra i może skutecznie radzić sobie z nagłymi zachorowaniami lub urazami turystów? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że system ratownictwa na Maderze jest dobry i może szybko poradzić sobie z nagłymi zdarzeniami z udziałem turystów? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że na Maderze odpady są usuwane na bieżąco, a środowisko jest czyste i zadbane? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że biura informacji turystycznej na Maderze są komfortowe, a turyści mogą korzystać z bogatych, kompleksowych, wygodnych i szybkich usług? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że wyjaśnienia podane na znakach informacyjnych są dokładne i zrozumiałe, a turyści mogą dzięki nim wzbogacić swoją wiedzę? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że znaki drogowe i szlakowe na Maderze są zwięzłe i jasne oraz bardzo dobrze pasują do malowniczego otoczenia? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Czy zgadzasz się, że podejście przewodników jest doskonałe, a ich wiedza i umiejętności interpretacyjne są dokładne i bogate, spełniając potrzeby edukacyjne turystów na Maderze? *

	1	2	3	4	5	
Zdecydowanie się nie zgadzam	○	○	○	○	○	Zdecydowanie się zgadzam

Metryczka

Płeć: *

- ○ Kobieta
- ○ Mężczyzna
- ○ Inna niewymieniona

Wiek: *

- ◯ Mniej niż 18
- ◯ 18-24
- ◯ 25-34
- ◯ 35-44
- ◯ 45-54
- ◯ 55-64
- ◯ 65 lub starsza/y

Wykształcenie: *

- ◯ Podstawowe
- ◯ Średnie
- ◯ Wyższe (licencjackie, inżynierskie lub magisterskie)
- ◯ Doktoranckie

Miesięczny dochód netto gospodarstwa domowego (w walucie Euro): *

- ◯ Brak dochodu
- ◯ Mniej niż 500€ (ok. 2225zł)
- ◯ 500€ - 999€ (ok. 2225 - 4445zł)
- ◯ 1000€ - 1999€ (ok. 4446 - 8895zł)
- ◯ 2000€ - 2999€ (ok. 8896 - 13345zł)
- ◯ 3000€ - 3999€ (ok. 13346 - 17795zł)
- ◯ 4000€ - 4999€ (ok. 17796 - 22245zł)
- ◯ Powyżej 4999€ (ok. 22245zł)

Obecny status zatrudnienia: *

- ◯ Student/Uczeń
- ◯ Na emeryturze
- ◯ Bezrobotna/y
- ◯ Zatrudniona/y
- ◯ Samozatrudniona/y

Also, the tourist questionnaire as firstly designed for the purpose of this study, in English, is presented below.

I am a student of Master in Sustainable Tourism Management at the School of Tourism and Maritime Technology, Polytechnic Institute of Leiria (Portugal). I am conducting research on the perceived destination attractiveness of Madeira as part of my master's thesis.

This study is strictly academic and guarantees the anonymity of the collected data. This questionnaire is addressed to Polish tourists who have previously visited Madeira.

Thank you for your time and participation.

1. Have you visited Madeira before?
   - ☐ Yes – Proceed to Question 2.
   - ☐ No – Proceed to the end of the questionnaire.

2. Rate to what extent do you agree with the following statements:

A_1. Do you agree that the topography of Madeira is complex and changeable, with typical geomorphic features?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_2. Do you agree that the number of species of animals and plants in Madeira is extremely rich?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_3. Do you agree that Madeira has high vegetation coverage, rich tree species, and is a unique forest landscape?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_4. Do you agree that the very mild and moderate subtropical climate of Madeira is very attractive to tourists?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_5. Do you agree that Madeira has rich water landscape types with a high aesthetic value?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_6. Do you agree that the ecological environment in Madeira is good, with fresh air, comfortable climate, high-quality water, and a clean environment?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_7. Do you agree that there are many historical relics in Madeira which create a strong atmosphere of cultural heritage?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_8. Do you agree that Madeira has colourful folk culture with distinctive local characteristics?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_9. Do you agree that the festival activities in Madeira are colourful and of special heritage significance?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{10}. Do you agree that the roads on Madeira are convenient, and the road conditions are excellent?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{11}. Do you agree that there are many flights to Madeira?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{12}. Do you agree that there are many maritime connections to Madeira?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{13}. Do you agree that Madeira can be reached for an affordable price?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{14}. Do you agree that there are plenty of sightseeing vehicles in Madeira with ample interpretive signage?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{15}. Do you agree that the space of the parking lots in Madeira is sufficient and convenient?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{16}. Do you agree that the sports facilities in Madeira are complete, meeting the needs of tourists at different levels for various sports?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{17}. Do you agree that the education-oriented facilities in Madeira are perfect, and tourists can obtain extensive ecological and environmental knowledge?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{18}. Do you agree that the shopping facilities in Madeira are sufficient and there are extensive souvenirs with local characteristics?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{19}. Do you agree that Madeira provides a high number of entertaining places for tourists to enjoy?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{20}. Do you agree that Madeira has adequate food service facilities, and these services highlight the local cuisine, rich variety, and reasonable cost of food?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{21}. Do you agree that the accommodation environment in Madeira is clean and safe at reasonable cost?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{22}. Do you agree that local government strongly supports the development of Madeira as a tourist destination?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{23}. Do you agree that local residents in Madeira are friendly and courteous to tourists?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{24}. Do you agree that the quality of the tourism-engaged staff in Madeira is very high, and their level of service quality is satisfactory?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{25}. Do you agree that the medical system in Madeira is good, and can effectively deal with the sudden illness or injury of tourists?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{26}. Do you agree that the rescue system in Madeira is good, and can quickly deal with any emergency events for tourists?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{27}. Do you agree that waste is dealt with in a very timely fashion in Madeira, and the environment is clean and tidy?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{28}. Do you agree that the environment of the tourist information offices in Madeira is comfortable, and tourists can enjoy warm, thoughtful, convenient, and fast services?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{29}. Do you agree that the explanations provided on the interpretation signs are accurate and humanized, and tourists can enrich themselves?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{30}. Do you agree that the road and trail signs in Madeira are concise and clear, and match the scenic environment very well?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

A_{31}. Do you agree that the service attitude of tour guides is excellent, and their interpretive knowledge is accurate and rich, meeting the educational needs of tourists in Madeira?

1 – Strongly disagree	2 - Disagree	3 - Do not agree nor disagree	4 - Agree	5 – Strongly agree

Respondent's characterization

3. Gender
   - □ Male
   - □ Female
   - □ Other non-listed

4. Age
   - □ Less than 18
   - □ 18-24
   - □ 25-34
   - □ 35-44
   - □ 45-54
   - □ 55-64
   - □ 65 and over

5. Education
   - □ Middle School (until Grade 9)
   - □ High School
   - □ Higher Education (bachelor or master´s)
   - □ Doctorate

6. Monthly income
   - □ No income
   - □ Less than 500 €
   - □ 500€ - 999€
   - □ 1000€ - 1999€
   - □ 2000€ - 2999€
   - □ 3000€ - 3999€
   - □ 4000€ - 4999€
   - □ Over 4999€

7. Current employment status:
    - Student
    - Retired
    - Unemployed
    - Employed
    - Self-employed

Appendix C. Example of calculations in R for AHP

The example of code in R for aggregating the answers about dimensions into one matrix, normalizing the matrix and calculating the local weights is presented below. To fully present the results, real calculation results have been presented too.

The first step was to aggregate all answers into one comparison matrix:

```
> # Define the pairwise comparison matrices from multiple experts
> expert1_dimensions <- as.matrix(dimensions1)
> expert2_dimensions <- as.matrix(dimensions2)
> expert3_dimensions <- as.matrix(dimensions3)
> expert4_dimensions <- as.matrix(dimensions4)
> expert5_dimensions <- as.matrix(dimensions5)
> # Function to aggregate matrices using geometric mean
> aggregate_matrices <- function(...) {
+   matrices <- list(...)
+   n <- length(matrices)
+   exp(Reduce("+", lapply(matrices, log)) / n)}
>
> # Aggregate the expert judgments
> aggregated_dimensions <- aggregate_matrices(expert1_dimensions, expert2_dimensions, expert3_dimensions, expert4_dimensions,
expert5_dimensions)
> print("Aggregated Pairwise Comparison Matrix:")
[1] "Aggregated Pairwise Comparison Matrix:"
> print(aggregated_dimensions)
     Tourist attractions Accessibility Development conditions Complementary services
[1,]           1.0000000     2.6455806              1.0592238               2.701920
[2,]           0.3779889     1.0000000              0.8620970               2.459509
[3,]           0.9440875     1.1599623              1.0000000               1.933182
[4,]           0.3701072     0.4065851              0.5172819               1.000000
>
```

The next step was to normalize this matrix:

```
> # Function to normalize a matrix
> normalize_matrix <- function(matrix) {
+   col_sums <- colSums(matrix)
+   normalized_matrix <- sweep(matrix, 2, col_sums, FUN = "/")
+   return(normalized_matrix)}
```

```
> # Normalize the aggregated matrix
> normalized_aggregated_dimensions <- normalize_matrix(aggregated_dimensions)
>
> print("Normalized Aggregated Pairwise Comparison Matrix:")
[1] "Normalized Aggregated Pairwise Comparison Matrix:"
> print(normalized_aggregated_dimensions)
     Tourist attractions Accessibility Development conditions Complementary services
[1,]           0.3714457    0.50758167              0.3080390              0.3337924
[2,]           0.1404023    0.19186021              0.2507114              0.3038453
[3,]           0.3506772    0.22255061              0.2908158              0.2388233
[4,]           0.1374747    0.07800751              0.1504337              0.1235390
>
```

Then, the priority vector (local weights) have been calculated:

```
> # Function to calculate the priority vector
> calculate_priority_vector <- function(normalized_matrix) {
+   priority_vector <- rowMeans(normalized_matrix)
+   return(priority_vector)}
> # Calculate the priority vector = Local weights!
> priority_aggregated_dimensions <- calculate_priority_vector(normalized_aggregated_dimensions)
>
> print("Priority Vector/Local weights for dimensions:")
[1] "Priority Vector/Local weights for dimensions:"
> print(priority_aggregated_dimensions)
   Tourist attractions          Accessibility Development conditions Complementary services
             0.3802147              0.2217048              0.2757167              0.1223637
>
```

The last step is to check the consistency criteria:

```
> # Function to calculate the consistency ratio
> calculate_consistency_ratio <- function(comparison_matrix, priority_vector) {
+   n <- nrow(comparison_matrix)
+   lambda_max <- sum((comparison_matrix %*% priority_vector) / priority_vector) / n
+   CI <- (lambda_max - n) / (n - 1)
+   RI <- c(0.00, 0.00, 0.58, 0.90, 1.12, 1.24, 1.32, 1.41, 1.45)  # Random Index for matrices of order 1 to 9
+   CR <- CI / RI[n]
+   return(list(CI = CI, CR = CR))}
> # Calculate the consistency ratio
> consistency_aggregated_dimensions <- calculate_consistency_ratio(aggregated_dimensions, priority_aggregated_dimensions)
>
> print("Consistency Index (CI):")
[1] "Consistency Index (CI):"
> print(consistency_aggregated_dimensions$CI)
[1] 0.03358013
> print("Consistency Ratio (CR):")
[1] "Consistency Ratio (CR):"
> print(consistency_aggregated_dimensions$CR)
[1] 0.03731125
```

The same process has been repeated for factors and attributes.