Article

Alternative Forms of Tourism: A Comparative Study of Website Effectiveness in Promoting UNESCO Global Geoparks and International Dark Sky Parks

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Abstract: In the digital age, effective website promotion plays a pivotal role in attracting visitors to alternative forms of tourism. This study examines the websites of 177 UNESCO Global Geoparks and 190 International Dark Sky Parks, employing specific evaluation criteria essential for enhancing the promotion of alternative tourism forms such as geotourism and astronomical tourism. Our findings reveal that geopark websites adeptly promote geotourism through a diverse array of digital tools, with the potential for minor enhancements. In contrast, the majority of dark sky park websites exhibit limited visibility in the promotion of astronomical tourism. These identified criteria and results serve as crucial benchmarks for optimizing the websites of UNESCO Global Geoparks and International Dark Sky Parks, thus ensuring the comprehensive fulfillment of established promotional standards for alternative tourism destinations.

Keywords: environmental communication; international dark sky park; UNESCO global geopark; astronomical tourism; geotourism; internet website

1. Introduction

The significant advancement of internet technology has brought about diverse transformations in the global tourism landscape. Among its various impacts, the domain of tourism marketing has been profoundly reshaped by the internet's pervasive influence. Internet technology is also related to environmental communication [1] by promoting critical environmental issues and transforming individuals' attitudes and behaviors [2]. In parallel, both geotourism and astro-tourism, as types of special interest tourism related to the environment, have understandably gained traction in recent years.

Geotourism primarily focuses on geological and geomorphological features in landscapes as tourist attractions [3]. It embraces geological heritage sites (geosites), ex situ heritage objects (primarily those from museum collections), specially created geoparks, and other geology-related objects for the purposes of tourism and recreation. Its main objectives include the promotion of geological knowledge, an increase in awareness of geological heritage and its conservation needs, and the diversification and sustainable development of the tourism industry [4]. Likewise, astro-tourism is a type of tourism based on the special interest of tourists in sky-related activities such as sky observation and astrophotography and is also classified as a subcategory of nature-based tourism [5].

From small lodgings to expansive hotel chains, establishments have adeptly harnessed the internet's power as a marketing tool, often leveraging dedicated websites for this purpose [6]. In the realm of the global economy, tourism and information and communication technology (ICT) stand as vibrant pillars [7]. Given the escalating reliance of global travelers on the internet as an information conduit, the official website of a destination bears a

significant burden: to entice and persuade prospective tourists through the provision of accurate and compelling information [8]. The website of a destination holds the potential to be the decisive factor, determining whether a traveler commits to a visit or continues their search elsewhere with a mere few clicks. Consequently, the quality of information disseminated via the official destination website becomes a critical asset, primarily falling under the purview of destination management organizations (DMOs) [9].

Through the internet, tourists establish direct connections to a wealth of information that empowers them to seek out optimal deals. This connectivity grants access to a myriad of websites, facilitating comparisons among destinations, hotels, and flight options. Within the realm of social media, a dynamic space where opinions and trends are exchanged, travel agents, agencies, and hotels can strategically advertise with minimal resource expenditure. By engaging in the promotion of services and interacting with the denizens of these networks, these entities can attract fresh clientele effectively. This digital avenue has instigated an acceleration in communication processes and service provisioning. A generation attuned to the digital landscape readily embraces impromptu decisions and eleventh-hour reservations [10].

Over the past two decades, geotourism has emerged as a distinctive form of sustainable tourism, focusing exclusively on geology and landscapes; an endeavor that has captured researchers' attention [11]. This paradigm has engendered diverse interpretations, resulting in varying definitions from different authors [11–13]. The concept of geotourism has undergone an evolution, originating as an alternative tourism centered on geological heritage and geo-conservation and gradually encompassing facets like education and sustainability.

Notably, the Global Geoparks Network has witnessed a remarkable expansion in recent years, guided by two fundamental pillars: active engagement with earth sciences and a comprehensive approach to geotourism. These territories are distinguished by well-defined boundaries and are meticulously overseen by competent management entities, operating under an ethos that intertwines preservation, education, and sustainable progress. The year 2015 marked a pivotal juncture as the UNESCO Global Geoparks (UGGps) scheme gained endorsement within the ambit of the UNESCO International Geosciences and Geoparks Program [14]. This transformative step elevated UGGps to encompass territories that adopt a comprehensive approach to geotourism [15].

UGGps delineate geographical regions of internationally recognized geological significance, distinguished by well-defined boundaries. These areas are meticulously overseen by competent management entities, operating under a comprehensive ethos that intertwines preservation, education, and sustainable progress [16]. Given this multidimensional essence, the imperative of having fitting websites to disseminate their endeavors and geological insights becomes paramount [17]. Conversely, astronomical tourism presents an intriguing avenue for visitors seeking destinations where the allure lies in unblemished nocturnal skies devoid of artificial light pollution [5]. This contrasts starkly with the majority of popular tourist spots, often ensconced in areas aglow with light pollution.

This crusade commenced in 1993 with the inception of the first dark sky park in Michigan, USA, which paved the way for subsequent endeavors like the establishment of a permanent site, the Torrance Barrens Conservation and Dark-Sky Reserve, in Ontario in 1999. Notably, the United States National Park Service pioneered the Natural Sounds and Night Skies Program in 1999. This program serves as a proactive guardian, striving to uphold unblemished night skies and celestial vistas within the purview of the national parks system [18]. Central to the domain of astronomical tourism are dark sky parks, focal areas where celestial tourism flourishes against the backdrop of pristine night skies. These locales boast impeccable nocturnal sky quality and curate an array of meticulously organized astronomy presentations for visitors. Remarkably, those who engage in structured nighttime celestial programs often depart these destinations with a sense of enrichment [19].

A cornerstone in the preservation of such sites is the International Dark Sky Parks (IDSPs) program, inaugurated in 2001. This initiative stands as a global rallying call, galvanizing communities, parks, and safeguarded territories across the globe to champion the

cause of preserving unadulterated dark sites. This endeavor is grounded in the principles of judicious lighting practices and comprehensive education. The expanse of global dark sky places is categorized into five distinct classes. Predominantly, IDSPs take the lead with an impressive count of 113, followed by 37 International Dark Sky Communities, 20 Sanctuaries, 15 Reserves, and finally, 5 Dark Sky Places [20].

2. Literature Review

2.1. Sustainable Tourism Forms: Geoparks and Dark Sky Parks

Websites' role in tourism marketing and their impact on various tourism forms have been extensively studied. This literature review provides an overview of the existing knowledge on websites' significance in destination marketing and their influence on geo-tourism and astro-tourism. The tourism industry has transformed with the rapid advance of internet technology, making the internet a paramount tool for tourism marketing [21]. Digital marketing in tourism, often termed e-marketing or online marketing, is gaining traction [22,23]. Digital tools offer cost-effective and impactful marketing strategies [24,25].

The advent of digital technologies has revolutionized the paradigms of marketing [26], fundamentally altering the landscape of how tourist destinations are promoted online [27]. Given the diverse array of online channels in the tourism industry, a key challenge for marketers is to understand how tourists seek information [28] and to identify effective marketing tools and strategies that optimize profitability.

In the past, the digital marketing landscape was straightforward, with businesses maintaining platforms primarily focused on commercial interests. However, contemporary developments have led to the emergence of new websites with diverse functions [29]. Consequently, the effective utilization of digital marketing tools hinges on a nuanced understanding of these tools in the specific context of tourism. In Ref. [26], the authors advocate for the crucial role of comprehending digital marketing dynamics and leveraging the power of digital tools for success in the tourism industry.

Websites serve as the virtual storefront of an organization, serving as the focal point for its online marketing endeavors [30]. The reliability and trustworthiness of a website as a digital information source are heightened when there is a high degree of institutional control over the published content [27]. Effective website content is characterized by being targeted, relevant, comprehensive, and regularly updated [31,32].

Websites play a vital role in direct customer interaction, fostering brand loyalty [24,31]. The effective use of search engine optimization (SEO) enhances website visibility [23,32].

Social media stands out as a pivotal digital marketing tool, frequently utilized by tourists for both information consumption and engagement purposes [33–35]. It serves as a platform for users to establish virtual communities [34,36] and significantly influences decision-making processes as individuals publicly share their travel experiences [26,37]. Operating as an active social platform, social media harbors a vast pool of potential customers [38]. Its growth is propelled by the innate human desire for social connections and interpersonal interactions [39].

Tourists' instant ability to share, follow, tag, "like", rate, and engage in discussions regarding various content types plays a crucial role in keeping friends and family abreast of their current travel experiences [40–42]. Furthermore, social media posts effectively address the emotional needs of potential customers [34]. The range of social activities, including real-time text messaging and video sharing, fosters online social interaction among individuals, promoting peer-to-peer communication [34].

Social media platforms also serve as a space for tourists to share online reviews of destinations, a practice that has gained popularity as a significant source of information influencing consumer decision-making [43,44]. The use of emoticons, graphical displays of facial expressions, in destination reviews has become a common and convenient tool for online customers to express their ideas or feelings effectively [45]. Remarkably, more than 85% of travelers actively read online reviews during the pre-travel stage, underscoring

the reliance of the majority of customers on the opinions of others when making travel decisions [44,45].

From a marketer's perspective, social media holds significance as a vital platform for communication and fostering brand loyalty [36,46]. Platforms like Facebook provide businesses with the opportunity to create pages that users can "like", granting them access to and updates on new content while facilitating direct interaction with the business [37]. This interaction capability not only enables administrators to comprehend how customers engage with the business page but also allows them to host events and contests and to share stories, photos, and videos to stimulate meaningful conversations among the page's followers [42,47].

The surge in technology has intensified tourists' desire for instant gratification [48]. As a result, tourists seek interactions with businesses that are not only responsive but also available around the clock. Destinations have incorporated technology into frontline customer experiences, notably through the integration of chatbots [49]. Chatbots, characterized as machine chat systems designed to simulate human interactions [50], can be regarded as virtual service agents or "e-service agents" [51].

The integration of chatbots into service experiences by tourism organizations emerges as a crucial feature for enhancing customer satisfaction [49–51]. Given the diverse linguistic landscape of tourism, where individuals may travel to regions with languages different from their own, the use of chatbots becomes particularly valuable in mitigating language barriers [51]. Furthermore, integrating chatbots into existing digital marketing tools, such as websites, represents a promising avenue for business growth [50].

Despite significant research attention, augmented reality (AR) and virtual reality (VR) are still in their early stages in the field of tourism [25,52,53]. AR involves the incorporation of digital information into the real environment, allowing consumers to perceive the actual world in front of them while superimposing additional layers of information, such as text and/or images, to enhance their experience [54]. On the other hand, VR utilizes digital technologies to create a simulated environment that customers can experience and explore through various senses [54]. Tourists can immerse themselves in diverse environments, such as wildlife, whether they are in the city or sitting at their desks at home [53,55].

Mobile travel apps, offering convenience and a range of features, empower spontaneous travel planning [41]. In-app messages and push notifications enhance user engagement [32]. The internet's transformative impact allows tourists to independently purchase products and services, challenging traditional tourism models [52]. Marketers must continuously enhance online strategies given global disparities in technological adoption [52].

Technological advancements have facilitated the swift creation and widespread sharing of content [56]. Content creation is the process of developing written or visual content around ideas and topics tailored to a specific audience, in this context, tourists. This digital information takes various forms, including blogs, videos, infographics, or audio, and is disseminated through digital marketing tools like websites and social media.

Content creation, disseminated through websites and social media, is crucial for destination branding [27]. Quality content on official tourism websites is perceived as more reliable than social media content [27]. An emerging trend is the active involvement of customers in creating and publishing their content, emphasizing the role of user-generated content (UGC) [36,43].

2.2. The Significance of IT in Tourism Marketing

The tourism industry, driven by internet technology, has witnessed a transformative shift. Websites, serving as central hubs, play a crucial role in disseminating information, attracting visitors, and promoting destinations globally [7].

Destination marketing, especially through well-constructed websites, transforms locations into recognizable brands, influencing travelers' decisions [57]. The internet, including social media and travel forums, enables peer-to-peer communication, allowing individuals to make informed travel choices.

Internet marketing's dynamic nature presents opportunities and challenges [58]. The rapid expansion of tourism on the internet, marked by swift online transactions, emphasizes the need for businesses to adapt strategies aligned with evolving customer preferences [59]. Acknowledged for its role in heightening interactivity between consumers and suppliers, the World Wide Web is instrumental in disseminating multimedia information encompassing textual data, graphics, images, video, and sound [60].

Tourism websites convert intangible services into tangible experiences, utilizing multimedia elements to enhance product appeal [27]. Destination image, crucial for attracting tourists, involves cognitive and emotional factors [61]. Positive image construction requires a focus on effective marketing strategies and user-generated content [43,62]. Another study involving 393 tourists revealed a significant impact of destination image on tourists' decisions to return [63]. These studies provide valuable insights into the cognitive and positive factors applied in social media, such as official tourism websites, that influence the decision-making processes of potential tourists, enticing them to visit or revisit a destination.

Constructing the image of a tourist destination to influence the perception and motivation of tourists to visit involves various strategies. Effective marketing strategies play a crucial role in creating a positive destination image, leading to success, while a negative image can result in failure or limitations [64]. Although a positive image can be changed, several factors can turn it negative, and reversing a negative destination image is challenging. Therefore, it is essential to prioritize the destination's image, employing positive marketing strategies to build a robust and positive perception.

Websites play a vital role in shaping a destination's image by optimizing its online presence, ensuring visibility, and providing attractive and positive information [65–68]. Effective communication through websites is essential for engaging potential visitors and influencing their perceptions [69]. The reliance on websites as information hubs underscores their pivotal role in crafting destination images and influencing travel decisions [68].

Therefore, enhancing tourists' perceptions can be achieved by providing comprehensive information through various websites, ultimately contributing to an increase in the number of visitors to the destination. In conclusion, the pivotal role of websites in crafting destination images cannot be understated, and strategic efforts should be directed towards utilizing online resources to motivate and persuade potential visitors to choose the destination for their travels.

2.3. Study Areas

This study focuses on two prominent categories of globally recognized parks: UNESCO Global Geoparks (UGGps) and International Dark Sky Parks (IDSPs). UGGps are territories of international geological significance managed with a comprehensive approach that includes conservation, education, and sustainable development. Recognized for their unique geological heritage, these areas are distributed across various countries. Conversely, IDSPs are dedicated to preserving pristine nocturnal skies free from light pollution, providing visitors with exceptional celestial experiences. These parks, situated in different geographic locations, are characterized by their commitment to safeguarding the natural wonders of the night sky. The research aims to assess the functionality and effectiveness of the official websites of UGGps and IDSPs in promoting geotourism and astronomical tourism.

This inquiry endeavors to uncover the precise information sought by tourists on the official websites of UGGps and IDSPs. Additionally, it seeks to highlight the websites' limitations and provide recommendations for enhancement. To achieve this, we conducted an exhaustive evaluation of the websites of 177 UGGps spanning 46 countries [70] and 190 IDSPs across 29 countries.

To structure this investigation, we meticulously chose the cognitive walkthrough (CW) methodology, which serves as a usability assessment mechanism that links interface traversal with a cogent cognitive model [71]. With an emphasis on facilitating intuitive learning, particularly through exploratory means [72], we employed the CW technique

in appraising the websites of these distinctive parks. This involved formulating specific criteria and questionnaires thoughtfully curated to resonate with experts and visitors engaging with the parks' websites.

In the subsequent sections of this paper, we delve deeper into the evaluation of websites for both UGGps and IDSPs, shedding light on their effectiveness in promoting geotourism and astronomical tourism. Section 3 outlines the approach we adopted for our empirical investigation, highlighting the rationale behind the selection of evaluation criteria and the utilization of the cognitive walkthrough methodology. Section 4 provides a comprehensive overview of the methodology employed in this study, including the research approach, data collection methods, and analytical techniques. In Section 5, we present a comprehensive analysis of the website criteria, unveiling the outcomes of our evaluation for both UGGps and IDSPs. Section 6 engages in an in-depth discourse on the findings, addressing the strengths and areas for improvement identified on the websites of both types of parks. In the final section, Section 7, we synthesize our findings and highlight their implications for the advancement of geotourism and astro-tourism through optimized website promotion.

3. Theoretical Background

Both UGGps and IDSPs play pivotal roles in advancing geotourism. Geotourism, as defined by [73], involves the provision of interpretive and service facilities that enable tourists to delve beyond mere aesthetic appreciation, fostering an enriched understanding of a site's geology and geomorphology. Rooted in the principles of sustainable tourism, geotourism shifts its focus from minimizing ecological impact to conserving the diverse natural and human attributes that distinguish a particular location [74].

UGGps are territories where sites and landscapes of international geological significance are managed under a comprehensive framework encompassing conservation, education, and sustainable development [75].

For the empirical facet of this study, the suitability of websites was evaluated through specific components. The cognitive walkthrough (CW) method was selected for this empirical endeavor. Developed by [76], CW serves as a theory-based usability evaluation technique for interfaces. It identifies issues and proposes potential causes, focusing on the user's exploratory learning approach, akin to a "trial and error" technique. This technique relies heavily on the user's cognitive processes and behavior, thus necessitating analysts with substantial user knowledge [72].

The corpus of prior research predominantly assessing tourist websites, such as [21,57], unveils the discernible differentiation of key factors and variables that underscore a website's comprehensibility and correctness, be it in terms of structure or content. The sample under scrutiny encompasses the websites of 177 UGGps and 190 IDSPs. A meticulous examination was conducted on each website to compile valuable information catered to visitors' needs. The following factors, pivotal in gauging web page quality and correctness, were instrumental in documenting pertinent comments and outcomes, as depicted in Table 1.

Table 1. Documenting factors.

Commercially Significant Website	Contact Phone
Direct Website Link to Dark Sky Park Page	Educational Programs
General Content Website	General Information Email
Incorporation of Modern Digital Applications	Interactive Maps
Integration with Social Media Platforms	Mirroring Website Color Palettes with DSP

Table 1. *Cont.*

Moon Phases, including Full Moon	Multilingual Translation Capability
Navigation Bar	News and/or Newsletter Section
Park Location	Park Location Maps
Park Video	Park-Specific Email or Responsible Person's Email
Photos with Captions	Provision of Free Services
Show Valid Link in the First Five Results	Useful Links Section
Weather and Cloud Cover Information	

The subsequent list provides a comprehensive breakdown of each factor outlined in Table 1, offering detailed descriptions and insights into the criteria considered during the analysis of dark sky parks' online presence.

1. Commercially Significant Website: Websites that play a significant commercial role in promoting tourism, potentially involving partnerships with businesses, advertisements, or revenue-generating activities.
2. Contact Phone: Availability of a contact phone number for the dark sky park, facilitating direct communication for enquiries or assistance.
3. Direct Website Link to Dark Sky Park Page: Inclusion of a direct link on a website leading visitors specifically to the dark sky park page, ensuring easy access to relevant information.
4. Educational Programs: Information about educational programs offered within or in collaboration with the dark sky park, promoting learning experiences related to astronomy or environmental conservation.
5. General Content Website: Websites providing broad content, potentially covering various topics beyond the dark sky park, indicating a diverse range of information.
6. General Information Email: Availability of a general-purpose email address for enquiries, providing a convenient way for visitors to seek information.
7. Incorporation of Modern Digital Applications: Use of contemporary digital applications, suggesting an up-to-date approach to technology for information dissemination.
8. Interactive Maps: Interact and explore the dark sky park's locations and attractions.
9. Integration with Social Media Platforms: Connection to and presence on various social media platforms, enabling broader outreach and engagement with the audience.
10. Mirroring Website Color Palettes with DSP: Consistency in color palettes across different platforms, contributing to brand identity and recognition.
11. Moon Phases, including Full Moon: Provision of information about moon phases, particularly highlighting full moon periods, which may impact stargazing experiences.
12. Multilingual Translation Capability: The ability of the website to be translated into multiple languages, enhancing accessibility for a diverse audience.
13. Navigation Bar: A well-organized navigation bar on the website, simplifying user navigation and improving overall user experience.
14. News and/or Newsletter Section: Inclusion of a dedicated section for news updates or newsletters, providing current and relevant information to visitors.
15. Park Location: Clear indication of the dark sky park's geographical location, aiding visitors in planning their trips.
16. Park Location Maps: Availability of maps showcasing the exact location and layout of the dark sky park.
17. Park Video: Integration of videos that provide visual insights into the dark sky park, offering a virtual preview for potential visitors.
18. Park-Specific Email or Responsible Person's Email: Contact email dedicated to the dark sky park or a specific individual responsible for enquiries.

19.   Photos with Captions: Presentation of photos accompanied by descriptive captions, enhancing the visual storytelling of the dark sky park.
20.   Provision of Free Services: Information about any services or experiences within the dark sky park that are offered without charge.
21.   Show Valid Link in the First Five Results: Ensuring that the dark sky park website appears as a valid link within the first five results of relevant search queries.
22.   Useful Links Section: A curated section featuring links to external resources or partners that visitors may find helpful.
23.   Weather and Cloud Cover Information: Provision of real-time or periodic updates on weather conditions and cloud cover, aiding visitors in planning optimal stargazing experiences.

4. Methodology

4.1. Data Collection

Data for this study were collected through an exhaustive evaluation of the websites of 177 UGGps spanning 46 countries and 190 IDSPs across 29 countries. The evaluation criteria were specifically designed to capture the effectiveness of the websites in promoting alternative tourism forms, such as geotourism and astro-tourism. The following subsection outlines the cognitive walkthrough (CW) methodology employed in this study.

4.2. Cognitive Walkthrough Methodology

The cognitive walkthrough (CW) methodology was chosen as the primary approach for evaluating the websites associated with UGGps and IDSPs. CW is a usability assessment technique focusing on users' cognitive processes during interface interaction [71,72]. It aims to identify usability issues and potential user challenges when interacting with a digital platform.

The CW process involved the creation of a cognitive model encompassing user expectations, goals, and decision-making processes while exploring the websites. To provide additional clarity, we have expanded on the specific evaluation criteria formulated for UGGps and IDSPs, covering aspects such as search engine visibility, communication tools, geographic information, weather considerations, multilingual accessibility, engagement strategies, visual presentation, incorporation of modern digital applications, and social media presence.

For each criterion, a set of tasks was defined to simulate user actions. Researchers, adopting the perspective of users, navigated the websites, evaluating how well the websites facilitated task completion and goal achievement. Any difficulties, inconsistencies, or opportunities for improvement during task execution were meticulously noted [71,72].

Interactions with the websites were comprehensively documented, and both quantitative and qualitative data were collected for each evaluation criterion. The collected data were subsequently analyzed to assess the effectiveness of the websites in promoting geotourism and astro-tourism.

4.2.1. Evaluation Criteria and Tasks

The evaluation criteria encompassed various dimensions, including the following:

- Search Engine Visibility: Assessing the appearance of the website within search results.
- Communication Tools: Examining the availability and effectiveness of communication channels.
- Geographic Information: Analyzing the precision of park locations and mapping features.
- Weather Considerations: Evaluating the incorporation of weather conditions and moon phase information.
- Multilingual Accessibility: Assessing language support and translation features.
- Engagement Strategies: Analyzing sections related to news, newsletters, and educational programs.
- Visual Presentation: Evaluating the use of dark color palettes and overall visual appeal.

- Incorporation of Modern Digital Applications: Assessing the presence and effectiveness of modern applications.
- Social Media Presence: Analyzing the integration and impact of social media on website promotion.

For each criterion, specific tasks were performed to simulate user interactions, and the outcomes were systematically recorded for both quantitative and qualitative analysis.

4.2.2. Questionnaires for Experts and Visitors

Experts and visitors were provided with targeted questionnaires tailored to their respective perspectives. Experts were queried on scientific content, conservation efforts, and the alignment of website information with scientific principles. Visitors were asked about their experiences, preferences, and suggestions for improvement. The responses from these questionnaires added valuable qualitative insights to complement the quantitative data obtained from the CW methodology.

4.3. Data Analysis

Quantitative data, incorporating percentage-based metrics, were meticulously gathered during the cognitive walkthrough (CW) evaluations. These data were subjected to thorough analysis to extract nuanced insights into the effectiveness of the websites in promoting alternative forms of tourism.

Qualitative data, including valuable suggestions and observations from the evaluations, underwent systematic categorization and analysis by our research team. This qualitative analysis served as a crucial lens, providing in-depth insights into user experiences, identifying usability issues, and suggesting potential enhancements for the websites.

To ensure the validity and reliability of the CW evaluation, a sample of websites was randomly selected, and multiple researchers conducted independent evaluations. Discrepancies or variations in evaluations were addressed through thorough discussions among the researchers.

During these discussions, researchers systematically compared their evaluations, focusing on areas of discrepancy and seeking a coherent and consistent application of the evaluation criteria. The goal was to achieve a consensus on the interpretation of user interactions, identify any potential biases, and ensure a standardized approach to the evaluation process.

This collaborative and iterative approach allowed us to enhance the reliability of our findings by minimizing subjectivity and promoting a more uniform application of the evaluation criteria. Our commitment to transparency and rigor in the evaluation process is reflected in the steps taken to resolve any disparities among researchers, ultimately contributing to the robustness of our methodology.

The outcomes of this comprehensive data analysis are meticulously presented in Section 5, offering an in-depth assessment of website criteria and providing insights into both their strengths and areas for improvement.

5. Results

The evaluation of website factors yielded results that are categorized and presented diagrammatically as follows.

In Figure 1, three criteria are juxtaposed: initially, a comparison is made, and then a corresponding evaluation of UGGps and IDSPs websites is conducted. The diagram illustrates the percentage of visitor interactions with the park they are seeking through search engines. Specifically, it outlines the percentage of instances where the website performs the following:

- Displays a Valid Link in the First Five Search Results.
- Directly Refers to the Park's Official Website.
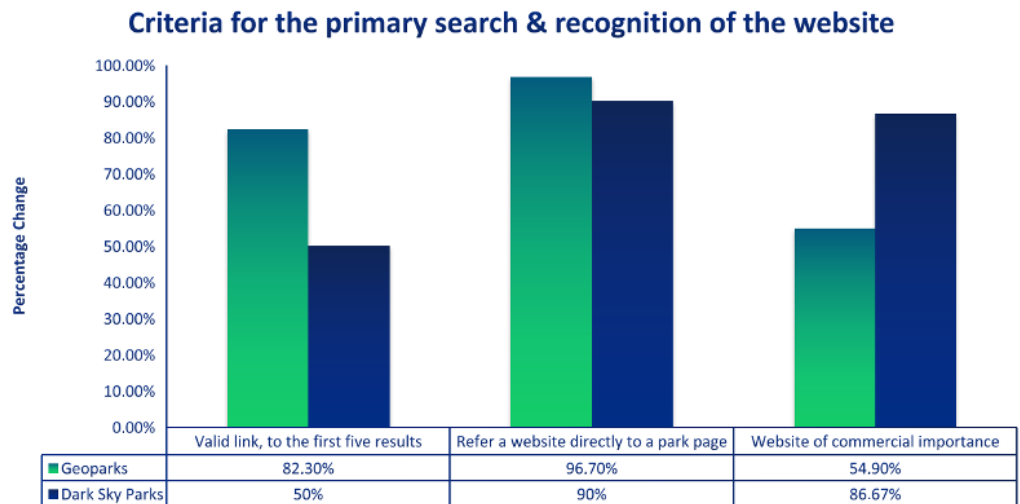- Redirects to a Third-Party Commercial Website, primarily a UGGp (green) and IDSP (blue).

Figure 1. Comparative website criteria for UGGps and IDSPs.

Promoting the novel concepts of UGGps and IDSPs, as well as advancing tourism in these destinations, hinges on the presence of websites that offer pertinent information about the sought-after park. Moreover, securing a prominent position within the initial search engine results is paramount.

From the depicted diagram, the outcomes are relatively favorable for geopark websites, which predominantly surface within the top search results. Conversely, dark sky park websites fare less favorably, with only 50% of them emerging among the top five results. This disparity can be attributed to the distinct requirements for attaining the designation of an IDSP versus a UGGp. While the latter necessitates the existence of a website and active social media engagement, the former does not mandate a dedicated website.

A significant outcome emerges from both UGGps and IDSPs: the overwhelming majority (90% or more) of the links stemming from search engine results lead directly to the parks' information rather than to third-party websites. This trend is particularly pronounced: 96.70% for geoparks and 90% for dark sky parks.

Lastly, the primary aim of these websites is to captivate potential tourists. Examining the leftmost diagram, it is evident that 86.67% of dark sky park websites reference local commercial enterprises, whereas the corresponding figure for UGGps stands at 54.90%. This 31.77% variance highlights the broader scope of information featured on most dark sky park websites, spanning visitor accommodation, dining options, outdoor activities, and more.

Figure 2 illustrates the percentages representing the presence of information or contact details within each park, including email addresses and contact phone numbers. The percentages indicating the availability of contact information are notably satisfactory. Ensuring the presence of such communication elements is vital for effectively informing visitors about the parks. Remarkably, the study reveals that every website of both UGGps and IDSPs includes at least one means of communication.

Figure 3 presents an evaluation of criteria associated with locating the parks from their respective websites. This encompasses location data, including coordinates, as well as maps featuring the park's location. Additionally, it includes the integration of modern interactive maps. The assessment underscores that the presence of location-related information on both UGGps and IDSPs websites is notably satisfactory, as indicated by the percentages: 100% for UGGps and 93.33% for IDSPs. Furthermore, maps displaying each park's location garner significant coverage, with over 80% compliance across the majority of websites. However, the prevalence of the most advanced interactive maps, a more specialized feature, remains limited on both UGGp and IDSP websites, manifesting at percentages of 35.30% and 36.67%, respectively.
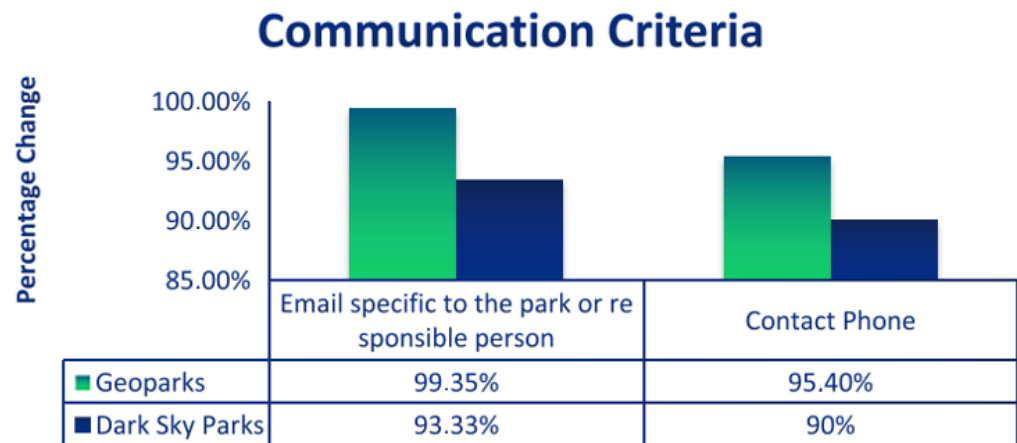
Communication Criteria

	Email specific to the park or responsible person	Contact Phone
Geoparks	99.35%	95.40%
Dark Sky Parks	93.33%	90%

Figure 2. Contact information distribution in parks.

Park Location Criteria

	Park Location	Interactive Maps	Park's Location Maps
Geoparks	100%	35.30%	86.90%
Dark Sky Parks	93.33%	36.67%	80%
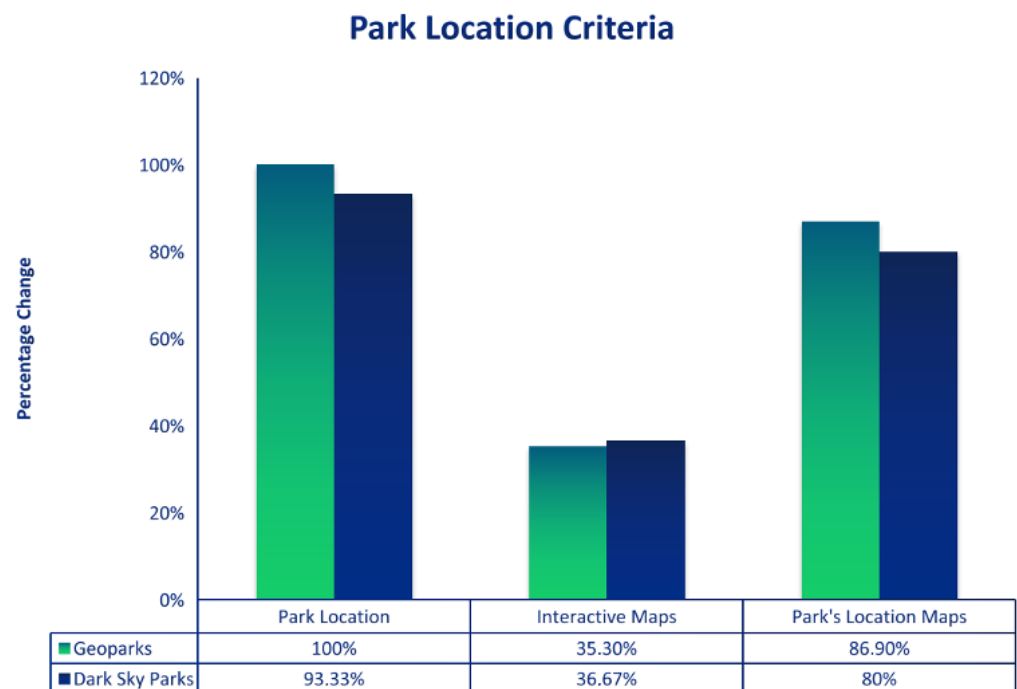
Figure 3. Location criteria distribution on park websites.

Both UGGps and IDSPs curate an array of activities, ranging from guided tours and group visits to geotopes to workshops, environmental games, starlit evenings, astro-observations, and celestial artistry. These pursuits necessitate favorable atmospheric conditions: reduced cloud cover and clear skies. Consequently, the inclusion of weather indications on the parks' websites emerges as a pivotal feature.

Figure 4 delineates the percentages representing the availability of weather presentation applications that showcase current weather conditions to users at the time of their website visits, thereby facilitating trip planning. The figures, spanning both UGGps (11.80%) and IDSPs (23.33%), reveal relatively modest percentages. Notably, IDSPs exhibit a greater prevalence of weather applications.

Within the sphere of IDSPs, the anticipation of moon phases and constellations holds paramount significance for prospective visitors. This prompted an evaluation of two pivotal criteria—access to information about moon phases and the various types of constellations—on the websites. Given that IDSPs primarily seek to mitigate light pollution, the adoption of dark color schemes on their websites proves crucial.
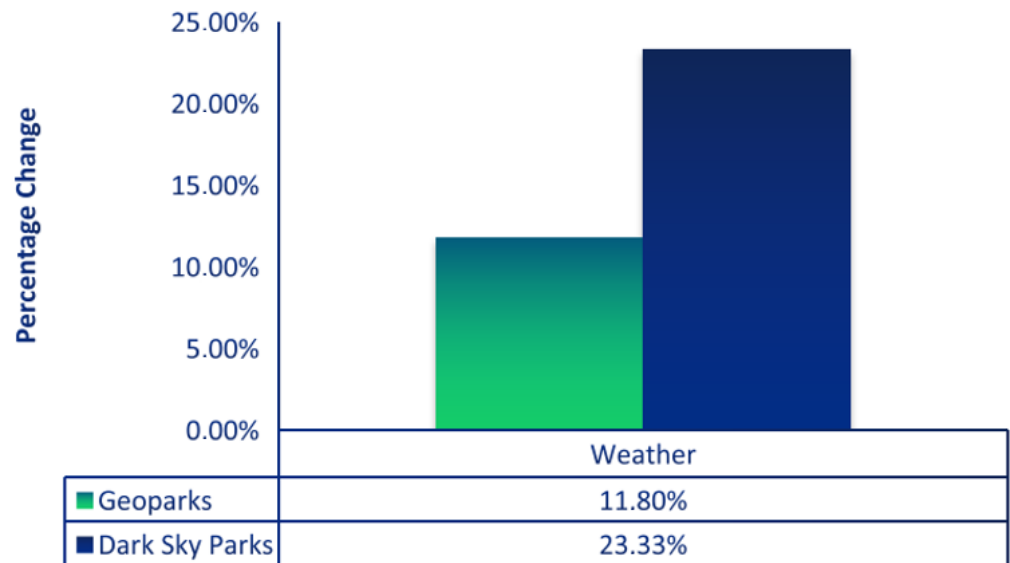
Figure 4. Weather application presence on park websites.

Figure 5 demonstrates that a mere 20% of IDSP websites incorporate information about moon phases and full moon occurrences. Addressing the notion of adopting color palettes that diminish a website's footprint and contribute to light pollution reduction, this practice is observed among 60% of park websites.
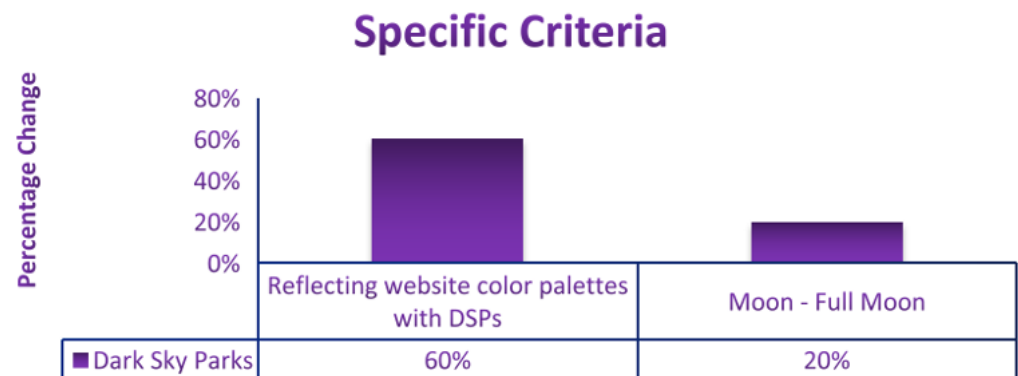

Figure 5. Dark sky park website color palette adoption and weather application incidence.

Figure 6 reveals a compelling narrative: news and newsletters play a pivotal role on both geopark (85.60%) and IDSP (83.33%) websites. These elements serve as vital conduits, disseminating essential information to potential visitors and encapsulating initiatives, workshops, and other noteworthy updates.

Additionally, the incorporation of multiple languages on park websites emerges as a notable aspect. Geoparks excel in this regard, boasting a robust 88.90% coverage of two or more languages. Conversely, the prevalence of multiple languages on dark sky park websites remains modest, registering at 33.33%. This is attributed to certain websites exclusively employing their native language; American dark sky parks often utilize English, while some Chinese and Spanish geoparks opt for content exclusively in their respective languages. Consequently, visitors from diverse countries may face difficulties comprehending the website's content.
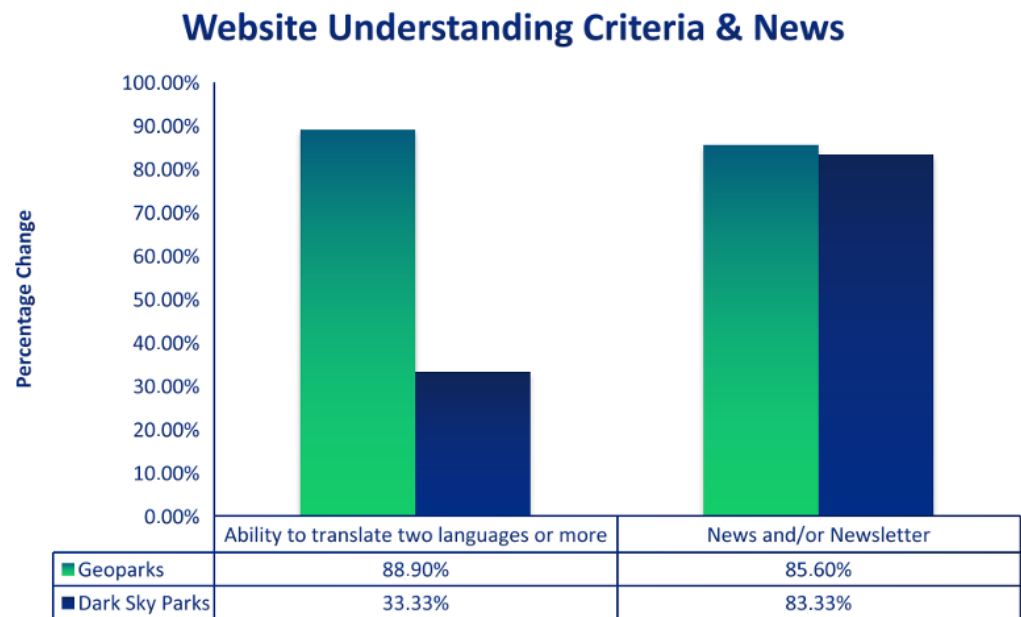
Website Understanding Criteria & News

	Ability to translate two languages or more	News and/or Newsletter
Geoparks	88.90%	85.60%
Dark Sky Parks	33.33%	83.33%

Figure 6. Multilingual content and news presence on park websites.

In Figure 7, the right bar graph unveils the percentages representing the provision of free services via park websites. Evidently, both geoparks and dark sky parks embrace the digital realm, offering an extensive array of complimentary services, each surpassing the 90% threshold. Additionally, the parks extend educational programs through their websites, with rates of 88.89% and 86.67% observed for geoparks and dark sky parks, respectively. Notably, these two criteria rank among the most pivotal, as the availability of free services and educational initiatives—ranging from immersive starlit evenings to festivals and guided tours—stands as an instrumental conduit. These offerings not only inform visitors about the parks' endeavors but also sensitize them to the imperative of conserving the abiotic environment and preserving the natural resource of the dark sky. The popularity of these initiatives is propelled by their accessibility, given their cost-free nature.
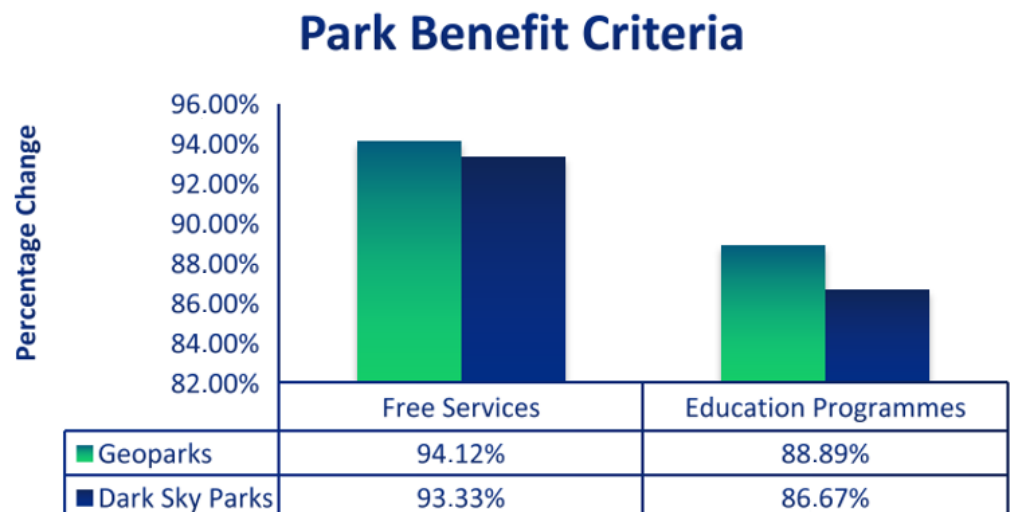
Park Benefit Criteria

	Free Services	Education Programmes
Geoparks	94.12%	88.89%
Dark Sky Parks	93.33%	86.67%

Figure 7. Free services and educational program presence on park websites.

Figure 8 underscores a notable aspect: park websites have yet to fully embrace modern digital applications, including augmented reality, virtual reality, mobile applications, and e-books. The data portray a modest utilization: merely 15% of geoparks and 23.33% of dark sky parks incorporate such applications. The development and integration of these

advanced digital tools necessitate specialized expertise, leading to complexities in their implementation on websites. This phenomenon is further exacerbated by the nuanced nature of creating a tailored user experience for modern digital applications. Dark sky parks, marked by a comparatively more contemporary network, exhibit superior incorporation rates, accounting for the variance in percentages.
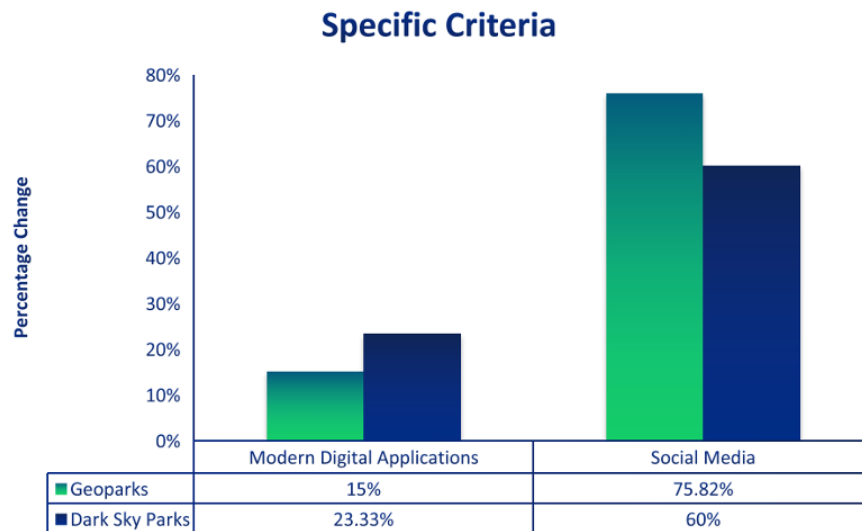
Specific Criteria

	Modern Digital Applications	Social Media
■ Geoparks	15%	75.82%
■ Dark Sky Parks	23.33%	60%

Figure 8. Incorporation of modern digital applications and social media on park websites.

Turning to the realm of social media, the figures chart an interesting landscape. Remarkably, geopark websites outshine dark sky park websites in this arena, registering at 75.82% and 60%, respectively. It is noteworthy, however, that these percentages could conceivably be higher, given the widespread prevalence and advancement of these tools in the contemporary digital landscape.

Figure 9 presents an evaluation of website criteria focused on enhancing visitor convenience, encompassing aspects such as the presence of navigation bars, useful links, photos with captions, and pertinent videos about the parks. The data showcase a consistent trend: nearly all park websites incorporate navigation bars and photos of geotopes and celestial vistas, each exceeding the 90% benchmark. Videos, however, exhibit a moderately lower incidence: geopark websites host relevant video material at a rate of 68.63%, while dark sky park websites exhibit a corresponding rate of 56.66%.
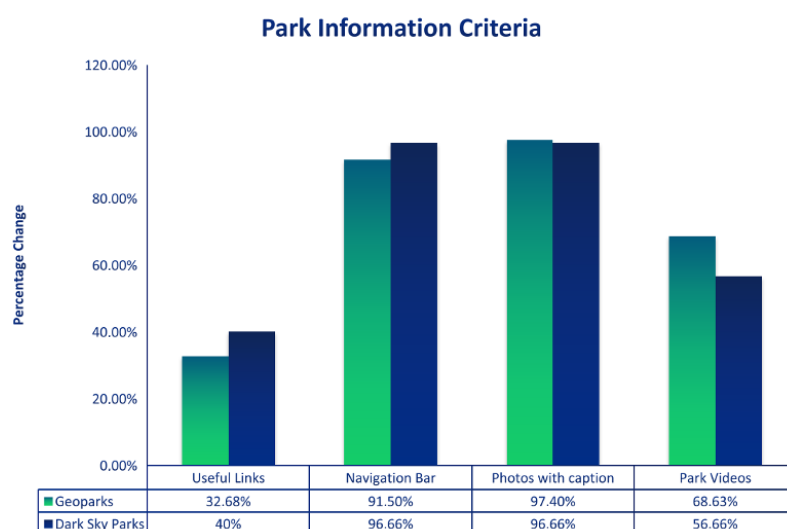
Park Information Criteria

	Useful Links	Navigation Bar	Photos with caption	Park Videos
■ Geoparks	32.68%	91.50%	97.40%	68.63%
■ Dark Sky Parks	40%	96.66%	96.66%	56.66%

Figure 9. Incidence of useful links, navigation bars, photos, and videos on park websites.

The landscape for useful links is nuanced, with geoparks featuring such links at a rate of 32.68%, whereas dark sky parks manifest slightly higher coverage, reaching 40%. It is important to underline that useful links, while a secondary criterion, offer specialized utility to website visitors. Notably, the prevalence of photos on park websites surpasses that of videos, attributed to the relatively greater ease of acquiring photos in comparison to videos.

6. Discussion

6.1. Discussion on the Effectiveness of International Dark Sky Parks' Websites in Promoting Astro-Tourism

The efficacy of a website for aspiring IDSPs holds paramount significance for achieving designation as a dark sky park. This investigation brings forth crucial insights, revealing that a notable proportion (15.7%) of IDSPs maintain dedicated websites. However, a sizeable 22.51% of dark sky park websites either malfunction or do not exist altogether, while a larger share (61.7%) exists within websites of public organizations. Remarkably, various links displayed on the IDA website related to IDSPs are non-functional or redirect to formats like PDFs, articles, or even Facebook pages posing as official IDSP websites. This underscores the limited presence of standalone, dedicated IDSP websites.

The evaluation encapsulates several significant dimensions:

- Search Engine Visibility: Positive outcomes include the appearance of a valid IDSP website within the first five search results, representing 50%. An encouraging 90% directly link to an IDSP page.
- Promoting Sustainable Development: A noteworthy 86.67% of websites feature dedicated sections on astro-tourism, emphasizing a commitment to sustainable development. These sections often extend to include information on accommodation, dining, leisure activities, and local products.
- Visual Presentation: Dark color palettes, aligning with the essence of dark sky preservation, envelop 60% of IDSP webpages.
- Communication Tools: Communication channels such as emails (93.33%) and telephone numbers (90%) are widely available, fostering visitor engagement.
- Geographic Information: Park locations are precisely detailed in 93.33% of cases, often accompanied by interactive maps (36.67%) or specific mapping of IDSP locations (80%), facilitating easy orientation for potential visitors.
- Weather Considerations: Only 23.33% of websites incorporate weather conditions, an essential aspect for stargazing events. Moon phase information, necessary for effective night sky observation, is offered by just 20% of sites.
- Multilingual Accessibility: Multilingual support is crucial, especially given the international nature of tourism. Impressively, 88.9% of websites offer translation into two or more languages.
- Engagement and Information Dissemination: Sections such as news and newsletters (83%) as well as free services and educational programs (both exceeding 83%) play a pivotal role in engaging visitors and conveying the parks' initiatives.
- Resourceful Links and Multimedia: Useful links, which enhance visitor experience, are present on 40% of websites. Navigation bars (99.33%), photos (96.66%), and videos (56.66%) are regularly present to enhance visitor experience.
- Incorporation of Modern Digital Applications and Social Media: Advanced digital tools such as modern applications exhibit a relatively low penetration rate of 23.33%. Conversely, social media presence, crucial for ongoing promotion and engagement, stands at 60%.

This discussion underscores the pivotal role of websites in establishing and promoting IDSPs as astro-tourism destinations. It reveals both strengths and areas for improvement, shaping future endeavors aimed at enhancing these online platforms.

6.2. Discussion on the Effectiveness of UNESCO Global Geoparks' Websites in Promoting Geotourism

Achieving the designation of a UGGp necessitates meeting specific criteria, including the establishment of a functional geopark website. Notably, a considerable 82.3% of geoparks' websites make a valid appearance within the first five search results, reflecting their online prominence. Impressively, 96.7% of these websites directly link to dedicated geopark pages, enhancing user experience and accessibility.

Central to this study is the examination of sustainable development promotion via geoparks' websites. A significant 54.9% of these sites dedicate separate sections to geotourism, illustrating a keen focus on sustainability. In addition, many websites extend beyond geology to offer visitor information on private accommodations, restaurants, recreational activities, and local products.

Communication tools are robustly integrated into geoparks' websites, with email availability reaching 99.35% and telephone numbers being provided on 95.4% of sites. The geographic location of each geopark is conscientiously detailed across all websites, frequently accompanied by interactive maps (35.3%) and dedicated mappings (86.9%) to facilitate swift visitor orientation.

Incorporating weather information is a sensible feature for visitor convenience; however, just 11.8% of websites provide these essential data. Translation capabilities are a fundamental aspect, ensuring accessibility across languages. Impressively, 88.9% of websites offer translation into two or more languages.

Newsletters and event listings (85%) and educational programs (85%) assume a significant role in geoparks' engagement strategies, nurturing visitor awareness and involvement. Useful links, which enhance visitor experience, are present on 32.7% of websites.

Visual elements are robust, with photos of geotopes (97.4%) and videos (68.6%) effectively conveying geoparks' offerings. Incorporating modern digital applications like mobile apps and interactive maps holds potential, yet their adoption remains relatively limited, comprising just 15% of all geoparks' websites.

A critical component of digital presence, social media's significance is evidenced by its integration into 79.7% of geoparks' websites. However, the influence of political regimes in some countries has resulted in disparate engagement, whereas in other cases, like China, high social media activity prevails alongside the use of multiple accounts [77].

This analysis underscores the paramount role of IDSPs' websites in promoting geotourism and fostering sustainable development. While many areas exhibit strengths, including communication and engagement aspects, opportunities for enhancing weather information, digital applications, and cross-cultural engagement are identified.

6.3. Practical Implications

This study holds practical implications for geotourism and astro-tourism destinations:

- Website Enhancement: Park managers and destination marketing organizations can improve websites based on our recommendations. This involves better content organization, streamlined navigation, and interactive features.
- Visitor Experience: Enhanced websites can attract more tourists, contributing to sustainable development and conservation.
- Marketing Strategies: Tailoring marketing efforts to highlight park strengths can attract a broader audience interested in geology or astronomy.
- Global Collaboration: Fostering collaboration among UGGps and IDSPs globally can lead to knowledge sharing and best practice exchange.
- Educational Initiatives: Park management can develop educational programs to deepen visitors' understanding of geological and astronomical phenomena, enhancing the educational aspect of geotourism and astro-tourism.

Incorporating these implications into management and marketing strategies can lead to more effective promotion, increased engagement, and positive conservation impacts.

7. Conclusions and Future Research

In the context of the digital age, websites play a pivotal role in shaping the image and promotion of alternative forms of tourism, such as geotourism and astronomical tourism. This study conducted a comprehensive evaluation of websites belonging to UGGps and IDSPs, offering insights into their effectiveness and areas for improvement. Our findings underscore the need for tailored digital strategies that cater to the unique requirements of these distinctive tourism destinations.

For IDSPs, the evaluation reveals both strengths and limitations in the promotion of astronomical tourism. While a notable number of dark sky parks lack dedicated websites or suffer from malfunctioning sites, the websites that are operational display a commitment to sustainable development. However, several crucial aspects, such as weather information, moon phase details, and multilingual support, still require attention. Furthermore, modern digital applications like mobile apps could significantly enhance visitor engagement and convenience. The integration of social media proves vital for ongoing promotion and engagement.

In the case of UGGps, the websites demonstrate a strong commitment to geotourism and sustainable development. Effective communication tools, detailed geographic information, and multilingual accessibility contribute to a positive user experience. However, opportunities exist for expanding weather information provision, incorporating modern digital applications, and fostering cross-cultural engagement through improved social media strategies.

Moving forward, enhancing the effectiveness of these websites requires a multipronged approach. Implementing improvements based on our identified criteria can contribute to more comprehensive and engaging digital platforms. Moreover, further research could explore the impact of political and cultural factors on website content and engagement strategies.

In conclusion, optimizing the digital promotion of UGGps and IDSPs is integral to attracting visitors and promoting sustainable tourism. By addressing the gaps identified in this study, these alternative tourism destinations can enhance their online presence, engage a wider audience, and contribute to the conservation of natural and cultural heritage while fostering local economic growth.

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