GEO-TOURISM: CAVE TOURISM DEVELOPMENT AT WADI SANNUR CAVE RESERVE

Tamer Hamdy Ayad[1], Noha Mohamed Hafez[2]
[1] Department of Management, School of Business, King Faisal University, 380 Al-Ahsaa, Saudi Arabia,
Tourism Studies Department, Faculty of Tourism and Hotels, Suez Canal University, 41522 Ismailia, Egypt.
ORCID ID: https://orcid.org/0000-0003-0737-4569
Email: tayad@kfu.edu.sa
[2] Tourism Guidance Department, Faculty of Tourism and Hotels, Suez Canal University, 41522 Ismailia, Egypt.

ABSTRACT: The objective of this study is to evaluate the feasibility of promoting cave tourism in Wadi Sannur Cave and to provide sustainable solutions for the development of cave tourism in the Wadi Sannur Cave Reserve. The researchers gathered data from many stakeholders in the tourism industry. They employed quantitative data analysis methods and utilised the strategic analytical tool known as "SWOT." The findings indicate that the current management and utilisation of the reserve for tourism and research objectives does not align with its significant geological worth. The suggested strategy matrix is to facilitate sustainable development of cave tourism in the Wadi Sannur Cave Reserve by providing guidance and support to decision-makers, planners, and development authorities. Its purpose is to enable effective planning that maximises the utilisation of the reserve while ensuring long-term sustainability.

Keywords: Geo-tourism, Cave Tourism, Geo-heritage, Wadi Sannur Cave.

1. Introduction

Tourism stands as one of the rapidly expanding economic domains worldwide (UNWTO, 2020). An insightful exploration of the global tourism landscape reveals a marked surge in the participation of travellers in activities aligned with nature-based tourism (Liu et al., 2016). This phenomenon is particularly evident in the realm of geo-tourism, a category falling under the umbrella of nature-based tourism. Notably, among the various pursuits within geo-tourism, cave tourism (Dowling, 2011) has witnessed a noteworthy surge in demand. According to Antić, Tomić, et al. (2020), an estimated 26 million individuals embarked on cave visits across the globe within a single year. This upsurge in tourist engagement has triggered a notable global movement toward enhancing services within locales boasting distinctive geological attributes. The aim is to reconfigure these areas into alluring tourist hubs, while concurrently leveraging them as catalysts for fostering sustainable development within local communities (Dowling, 2013). Geo-tourism emerges as a pivotal instrument in both disseminating awareness about geological sites and safeguarding their integrity. Beyond its educational and cultural contributions to visitors, geo-tourism plays a vital role in advocating the principles of sustainable development. By aligning with these principles, it bolsters their practical implementation to benefit local communities and ensure the conservation of natural ecosystems. The designation of a location as a geological tourist destination demands a comprehensive assessment encompassing the site's geological significance, its ecological preservation status, and its suitability for tourism activities. This judicious evaluation forms the bedrock for establishing a framework of sustainable tourism development and effective management within the realm of geo-tourism at the designated site (Milenković, 2021; Vujičić et al., 2011).

Cave tourism constitutes a facet of eco-tourism with substantial potential to drive tourism development and bolster the economic prosperity of the local community (Okonkwo, Afoma, & Martha, 2017). Over recent years, this form of tourism has garnered significant attention from industry stakeholders and decision-makers. This heightened interest stems from its remarkable capacity to draw a substantial influx of tourists, often characterized by substantial spending capabilities (Antić, Peppoloni, & Di Capua, 2020; Demir, 2019). Consequently, caves emerge as pivotal resources within the tourism domain, provided they undergo appropriate development. Such development holds the promise of delivering swift economic, social, and environmental advantages to the host community (Okonkwo et al., 2017).

In recent times, a growing emphasis has been placed on the advancement of tourism within karst landscapes, with particular attention directed towards karst caves distinguished by their unique geological formations (Telbisz et al., 2020; Telbisz & Mari, 2020; Telbisz et al., 2019; Valente et al., 2020). To strike a harmonious equilibrium between the progress of cave tourism and the imperative of environmental preservation, the meticulous execution of sustainable development approaches is imperative (Tomić et al., 2019). Consequently, the present study aims to evaluate the potential for the development of cave tourism within the confines of Wadi Sannur Cave and, in turn, proffer strategies for the sustainable advancement of cave tourism within the Wadi Sannur Cave Reserve.

2. Literature ReviewGeo-tourism

Geo-tourism denotes a form of tourism centred around geological attributes. It was initially conceptualized by Hose (1995) as an avenue that furnishes facilities and services, allowing tourists to garner knowledge and insight into the geological facets of a given site. This definition held sway until Newsome and Dowling (2010) expanded it to encompass not just geological features, but also landscapes. This experience can be pursued through self-guided individual or group exploration or structured guided tours. This concept of geotourism is firmly rooted in sustainable tourism frameworks. It's notably comprehensive, interlinked with a multitude of tourism patterns and activities. It stands classified within the realm of ecotourism (Scheyvens, 1999) and is intertwined with heritage, cultural, and educational tourism Kang and Moscardo (2006). Moreover, it acts as a catalyst for local community development (Blackstock, 2005). Some consider it a means of aiding disadvantaged populations (Ashley & Roe, 2002), and certain studies have even positioned it as an element of rural tourism activities (Clark & Chabrel, 2007; Saxena et al., 2007).

Geotourism and its associated undertakings have been embraced and acknowledged as integral tools in the pursuit of sustainable development, as articulated during the United Nations Conference on Environment and Development (1992). Within this framework, it has been positioned under the perspective of "protection through use and education," a tenet delineated in the conference's concluding report. Rooted in this sustainable ethos, geo-tourism operates with the overarching objective of achieving three principal sustainable aspirations: first, enriching the satisfaction levels of tourists through acquired knowledge; second, contributing to the preservation and perpetuation of natural and geological heritage; and lastly, reaping economic and social advantages for local communities, signifying a socio-economic yield stemming from sustainable tourism activities (Pforr & Megerle, 2006). Moreover, geo-tourism should not be perceived merely as an exploitation of a site's geological attributes. Instead, it should be viewed as one of the endeavours that, through strategic planning hinged on harnessing opportunities, can assume a significant role in the advancement of national development and the broadening of revenue streams. This perspective underscores geo-tourism's potential as a multifaceted contributor to economic growth and diversification (Beigi & Pakzad, 2010).

Cave Tourism

Caves have held a captivating allure for humanity since ancient times. Initially, this fascination revolved around practical applications such as habitation or burial. The inaugural documented instance of a tourist visiting a cave materialized in Mesopotamia (Cigna & Forti, 2013). This curiosity persisted through the Middle Ages, where cave visits were motivated by exploration or religious motives. It's noteworthy that the world's initial organized cave tours with entry fees occurred in Slovenia (Vilenica Cave) and Germany (Baumanshol Cave) (Dowling, 2013; Erikstad, 2008). In contemporary times, numerous caves and geological marvels boasting unique heritage have become more accessible than ever. Day by day, these sites magnetize an increasing number of seekers yearning for novel experiences. This surge in interest presents remarkable prospects for the tourism industry within these caves and the encompassing locales through dedicated development initiatives (Cságoly, Sæþórsdóttir, & Ólafsdóttir, 2017; Ólafsdóttir & Tverijonaite, 2018; Tverijonaite, Ólafsdóttir, & Thorsteinsson, 2018).

The advancement of cave tourism hinges upon the recognition and appreciation of four distinct value categories: scientific, recreational, aesthetic, and cultural. Scientific Values: These encompass the caves' significance in terms of scientific knowledge. This involves the geological history of the caves, offering vital insights into rocks, fossils, and minerals.

Second, recreational values: This dimension refers to the array of tourism and sporting activities pursued by adventure-seeking tourists. This includes cave exploration, camping within or around caves, hiking, and boating. Thirdly, aesthetic values: here, the focus lies on the visual and experiential appeal. It pertains to unique and extraordinary geomorphological or geological traits that distinguish both the caves and their environs.

And lastly, cultural values: This value domain encompasses the entirety of the customs, traditions, beliefs, and heritage rituals of the local populace. It underscores the intrinsic connection between the caves and the cultural heritage of the community.

Collectively, these four dimensions underpin the multifaceted appeal of cave tourism and underline the diverse reasons that attract visitors to these captivating underground realms (Kim et al., 2008).

The Study area

Sannur Cave, situated in Egypt, stands out as an exceptional geological marvel of global rarity. Nestled within the Al-Maatha plateau, north of Wadi Sannur, it lies approximately 70 km east of Beni Suef in central Egypt, and about 200 km distant from Cairo (Governorate, 2023). Its discovery in 1989 was serendipitous, credited to quarry laborers in search of alabaster. By 1992, the site earned the distinction of being declared a geologically safeguarded zone and a national heritage location under Egyptian law, specifically Law No. 102 of 1983 pertaining to the nation's natural reserves Agency (2023). Sannur Cave holds a unique status within the global cave landscape. It stands as the world's sole and most expansive cave exemplifying an extraordinary fossil occurrence rooted in a distinct cave genesis. Even the geological heritage linked with this cave qualifies as possessing international significance (Sallam et al., 2020). Its formation encapsulates the quintessence of karst caves, shaped through the intricate interplay of chemical dissolution and physical erosion acting upon limestone during the middle Eocene epoch (Amin & Eissa, 2008; Sallam, 2022).

Sannur Cave is characterized by a singular chamber configuration, presenting a crescent-shaped expanse. This chamber spans approximately 700 meters in length, 15 meters in width, and reaches heights ranging between 10 to 15 meters (Dabous & Osmond, 2000; Gunay et al., 1997; Service, 2023). The interior of the cave is adorned with an unparalleled array of geological formations, which have materialized over millions of years. These formations trace their origins to the middle Eocene epoch, dating back approximately 40 to 60 million years. During this epoch, a distinctive collection of stalagmites, stalactites, and columns emerged through the gradual sedimentation of cave water enriched with calcium carbonate (Figure 1). Noteworthy among these formations are the uniquely shaped coral reefs or cave popcorn formations (Figure 2). Of exceptional significance within the cave is the presence of the Stone Waterfall formation (Figure 3). It is intriguing to observe that a section of the cave floor displays a resemblance to a freshly formed alluvial plain marked by crevices. This characteristic may potentially be attributed to seasonal water flows, which contribute to the shaping of this topographical feature (Amin & Eissa, 2008; Dabous & Osmond, 2000; Service, 2023).

Figure 1. Stalagmites, stalactites and columns".

Figure 2. The geological formation “Coral Reefs”.

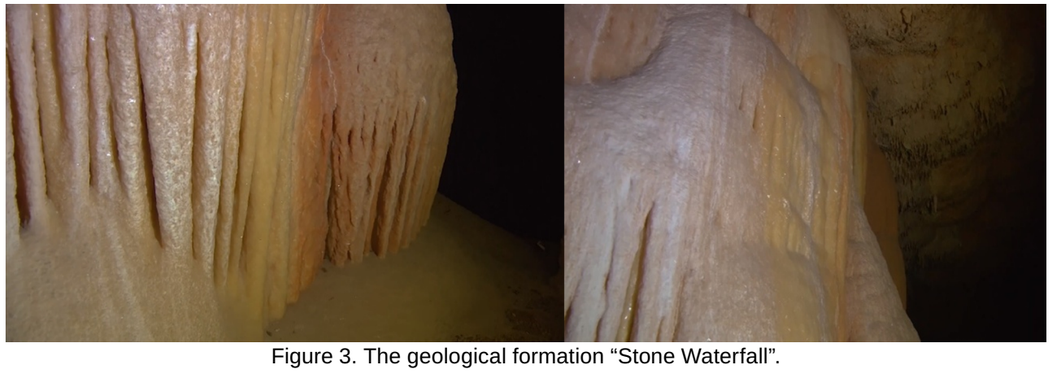

Figure 3. The geological formation “Stone Waterfall”.

The geographical coordinates of the Sannur Cave Reserve are situated within the latitudinal range of 28.36 to 28.38 degrees east and the longitudinal range of 31.16 to 31.18 degrees north. The reserve can be accessed by using the Beni Suef/El Mina desert route and afterwards travelling east of the river Nile at the entry to the village of Sannur. From there, one must traverse a challenging desert path characterised by sand dunes for a duration of over an hour by vehicle. Following this, a further half-hour of walking is required to reach the cave (Figure 4).

The reserve encompasses a variety of surface and beneath caves that have formed due to geological processes involving the shifting of the Earth’s strata. In addition to the cave, an archaeological dam of Roman origin was also unearthed at a distance of 2.5 kilometres in the southeastern direction. The structure in question served the purpose of mitigating the inundation of floodwaters that occurred in Egypt during that particular period, while enhancing the region’s appeal as a tourist destination (Governorate, 2023; Service, 2023).

Figure 4. Wadi Sannur Cave Reserve.

3. Methodology

The scale and the study constructs

This study employed a quantitative research approach to achieve its objectives. The methodology was structured into three distinct phases to comprehensively address the research goals. The first phase, labelled as “Evaluation of Sannur Cave Geological Site,” aimed to assess the potential for cave tourism within the site and to illuminate the geological significance present in the area. The second phase involved “Measuring the Importance of Cave Tourism Development in Wadi Sannur Cave Reserve.” This phase sought to gauge the level of significance associated with the advancement of cave tourism within the Wadi Sannur Cave Reserve. The third phase encompassed a “SWOT analysis,” which facilitated an evaluation of the condition of Wadi Sannur Cave Reserve. This entailed an exploration of its strengths, weaknesses, opportunities, and threats. The ultimate objective of this phase was to outline a strategy for sustainable cave tourism development in Wadi Sannur Cave Reserve, as perceived by stakeholders. The scale utilised for evaluating the potential of cave tourism and the geological heritage values of the Sannur Cave Geological Site was derived from Brilha (2016) work. The scale comprises four distinct criteria encompassing a cumulative count of 37 indications. These criteria include the scientific value, which encompasses 7 indicators; the potential educational use, which encompasses 12 indicators; the potential tourism usage, which encompasses 13 indicators; and the deterioration risk, which encompasses 5 indicators. The scale demonstrated strong dependability, as indicated by a coefficient alpha value of 0.962. The assessment of the significance of cave tourism growth in Wadi Sannur Cave Reserve was conducted using a scale consisting of 10 indicators based on the work of T. Ayad (2017). This scale demonstrated strong reliability, as indicated by a coefficient alpha value of 0.958.

Population and Sample Size

The study’s target population encompasses various Egyptian tourism stakeholders, including tourism professors and researchers, tour operators, ecotourism travel agencies, eco-tourist guides, eco-tour leaders, and government employees associated with Sannur Cave Reserve, the Ministry of Tourism and Antiquities, the Egyptian Tourist Authority, the Agency (2023), and the Tourism Development Authority. Given the lack of specific knowledge on the actual size of the research population, the determination of the sample size was guided by Veal’s (2006) findings. It was assumed that the population consisted of 20,000 individuals, and this assumption was utilised to calculate the appropriate sample size for an infinite population. Based on the Herbert Larkin equation, the determined sample size for the present investigation is 377 individuals (T. H. Ayad, 2017).

Data collection

A self-administered survey was crafted to gather primary data from stakeholders in the Egyptian tourism industry. The survey underwent pre-testing by a panel of professors and experts, who refined it through two iterations. The distribution followed a random sampling approach. A total of 390 surveys were disseminated and collected

during the months of October and November in 2022. Among these, 379 surveys were free of any missing data, resulting in an impressive response rate of 97%. The questionnaire comprises three distinct sections, all aligned with the study's objectives. The initial segment prompts respondents to evaluate the potential for cave tourism and the geological significance of the Sannur Cave Geological Site. For each of the 37 indicators, participants were requested to assign a value within the range of 0 to 4. Moving to the second part, the aim was to gauge the significance of developing cave tourism within the Wadi Sannur cave reserve. Respondents were presented with 10 indicators and asked to rate them on a 5-point Likert scale, ranging from "strongly disagree" to "strongly agree."

Concluding with the third segment, respondents were presented with four inquiries designed to elicit their perspectives on the strengths and weaknesses of Wadi Sannur Cave Reserve as a cave tourism destination. Additionally, these questions aimed to uncover potential opportunities and threats for the advancement of cave tourism within the reserve.

Analysis Techniques

The quantitative data analysis involved the utilization of the SPSS version 28 (2021) statistical software and Microsoft Excel Sheet 2013 (15.0). This analysis served the purpose of assessing the status of cave tourism within the study area and comprehending the perspectives of stakeholders concerning the significance of developing cave tourism in the Wadi Sannur cave reserve.

To further delve into the strategic evaluation, the SWOT analysis technique was employed. This strategic tool facilitated the identification of the inherent strengths and weaknesses, along with potential opportunities and threats, pertaining to Wadi Sannur cave reserve as a destination for cave tourism. The outcomes of this analysis subsequently formed the basis for proposing strategies aimed at fostering sustainable development.

4. Analysis and Results

Evaluation of geological values and tourism potential at Wadi Sannur Cave Reserve

The quantitative data analysis involved the utilization of the SPSS version 28 (2021) statistical software and Microsoft Excel Sheet 2013 (15.0). This analysis served the purpose of assessing the status of cave tourism within the study area and comprehending the perspectives of stakeholders concerning the significance of developing cave tourism in the Wadi Sannur cave reserve. To further delve into the strategic evaluation, the SWOT analysis technique was employed. This strategic tool facilitated the identification of the inherent strengths and weaknesses, along with potential opportunities and threats, pertaining to Wadi Sannur cave reserve as a destination for cave tourism. The outcomes of this analysis subsequently formed the basis for proposing strategies aimed at fostering sustainable development.

Table 1. Evaluation of geological values and tourism potential at Wadi Sannur Cave Reserve

Criteria	Indicators	Weighted (%)
Scientific Value %100	Capacity of Representativeness	15
	Locality Importance	20
	Scientific Fame	5
	Conservation Status	15
	Existence of Geological Diversity	10
	Rareness	30
	Regular Usage Obstacles.	5
Potential Educational Use %100	Sensitivity of Geological Component	10
	Ease of Access	10
	Barriers to educational activities	5
	Risk Rate	10
	Facilities	5
	Near Population Density	5
	Diversity of values	5
	Scene of Geological Features	5
	Uniqueness of Geological Diversity	10
	Monitoring Conditions	5
	Instructional Potential	20
	Geological Diversity	10
Potential Touristic Use %100	Sensitivity of Geological Component	10
	Ease of Access	10
	Barriers to touristic activities	5
	Risk Rate	10
	Facilities	5
	Near Population Density	5
	Diversity of values	5
	Scene of Geological Features	15
	Uniqueness of Geological Diversity	10
	Monitoring Conditions	5
	Ease Interpretation Potential	10
	Economic Level	5
	Nearness Tourist Attractions	5
Site Degradation Risk %100	Risk of Destruction of Geological Elements	35
	Nearness to activities or areas that may cause degradation	20
	Legal Protection	20
	Conditions of Access the Site	15
	Density of population that may cause degradation	10

Table 1 presents the varying weights assigned to the 37 variables across four categories. These weights reflect the evaluation of the tourist potential and geological values of Wadi Sannur Cave Reserve, as evaluated by stakeholders in the Egyptian tourism industry. For the initial criterion, termed "Scientific Value," the indicator of "Rareness" held the utmost significance, carrying a weight of 30%. Following closely was the "Locality Importance" indicator, assigned a weight score of 20%. Conversely, indicators like "Scientific Fame" and "Obstacles to Regular Usage" were considered the least crucial, both securing a minimal importance score of 5%. Turning to the second criterion, denoted as "Potential Educational Use," the indicator of "Instructional Potential" stood out as the most pivotal, meriting a weight of 20%. Subsequently, indicators such as "Sensitivity of Geological Components," "Ease of Access," "Risk Rate," "Uniqueness of Geological Diversity," and "Geological Diversity" all shared an equal importance score of 10%. Conversely, the remaining indicators were of equal importance, each achieving a weight of 5%. Shifting attention to the third criterion, labeled "Potential Touristic Use," the "Scenic Display of Geological Features" indicator emerged as the most pivotal, carrying a weight of 15%. Subsequently, indicators including "Sensitivity of Geological Components," "Ease of Access," "Risk Rate," "Uniqueness of Geological Diversity," and "Potential for Interpretation Ease" all held the same level of significance, with an importance score of 10%. Once again, the remaining indicators were accorded equal importance, each securing a weight of 5%. For the fourth criterion, named "Site Degradation Risk," the indicator "Risk of Destruction of Geological Elements" took precedence, boasting an importance score of 30%. Following suit were the "Proximity to Activities or Areas Potentially Causing Degradation" and "Legal Protection" indicators, both assigned the same weight of 20%. Conversely, the "Density of Population that May Cause Degradation" indicator was deemed the least vital, acquiring an importance score of 10%.

Based on the comprehensive findings, the Wadi Sannur Cave Reserve has received a significantly elevated evaluation score in terms of its "Scientific Value" factor, falling within the range of 76-100 on the importance scale. As posited by Brilha (2016) and Mirari, Aoulad-Sidi-Mhend, and Benmlih (2020), a geological site is classified as such if it attains a "scientific value" rating surpassing 75, a criterion that has been met within the study area. The assessment values for the factors "Potential Educational Use" and "Potential Tourist Use" were found to be highly significant, falling within the importance interval of 76-100. This suggests that the Wadi Sannur Cave Reserve possesses geodiversity and holds potential for both educational and tourism purposes. This conclusion aligns with the findings of Brilha (2016) and Mirari et al. (2020), who argue that sites of geological importance with evaluation values exceeding 75 for the criteria of "Scientific Value," "Potential Educational Use," and "Potential Touristic Use" are suitable for tourism and educational activities. In light of these results, it is justifiable to consider enhancing existing facilities and establishing new ones to rehabilitate the site for tourism purposes.

The Measurement of Importance of Cave Tourism Development in Wadi Sannur Cave Reserve

To evaluate the significance of promoting cave tourism in Wadi Sannur Cave Reserve, a measurement tool consisting of ten items was utilised. These items were derived from T. Ayad (2017) work, which emphasises the comprehensive evaluation of ecotourism development, taking into account its diverse effects on the local community in terms of economics, social dynamics, culture, and the environment. Table 2 presents the findings of a descriptive study conducted to assess the perceived significance of promoting cave tourism in the Wadi Sannur Cave Reserve among Egyptian tourism stakeholders.

Table 2. The importance of cave tourism development in Wadi Sannur cave reserve.

Indicators	Min.	Max.	Mean	Std Deviation	Rank
IGTD1. Raising the competitive position of the Egyptian tourist destination in the global tourism market.	1	4	3,84	0,764	6
IGTD2. Preserving the geological heritage resources of Wadi Sannur Cave Reserve.	4	5	4,62	0,316	1
IGTD3. Preserving the natural resources that characterize the region and planning for their sustainability.	3	5	4,55	0,422	2
IGTD4. Establishing and raising the efficiency of infrastructure networks.	3	5	4,44	0,612	3
IGTD5. Attracting new tourism investments to the region.	3	5	4,55	0,422	2
IGTD6. Provide, develop and raise the efficiency of cave/geo-tourism infrastructure.	3	5	4,44	0,612	3
IGTD7. Creating new job opportunities for members of the local community (males and females).	4	5	4,62	0,316	1
IGTD8. Improving the level of social services provided to the local community.	3	5	4,28	0,722	4
IGTD9. Increasing economic revenues and benefits, and raising the standard of living for the local community.	4	5	4,62	0,316	1
IGTD10. A tool for preserving the local cultural richness and diversity.	3	5	4,18	0,644	5
The Weighted Average			4.42		
Standard Deviation				0.522	
(*) 5 Points Likert Scale: "1" equal strongly disagree and "5" equal strongly agree.					

The importance of cave tourism development in Wadi Sannur Cave Reserve was assessed using ten indicators, as presented in Table 2. The indicators were ranked based on their mean values, with indicators Nos. IGTD2, IGTD7, and IGTD9 having the highest mean value of 4.62 and a standard deviation of 0.316. Following these indicators, indicators Nos. IGTD3 and IGTD5 had a mean value of 4.55 and a standard deviation of 0.422. Indicator IGTD1 had the lowest average value compared to all other indicators examined, with a mean of 3.84 and a standard deviation of 0.764. Considering the weighted arithmetic mean of the importance of developing cave tourism in Wadi Sannur Cave Reserve as perceived by stakeholders, a weighted mean of 4.42 and standard deviation of 0.522 were recorded, which falls within the interval of 3.40-5.00 on a 5-point Likert scale, which indicates a high level of agreement on importance according to the intervals of levels of Likert scale (Low level 1–2.59; Moderate Level 2.60–3.39; High level 3.40–5). The findings of this study demonstrate a consensus among Egyptian tourism stakeholders regarding the significance of expanding cave tourism in the Wadi Sannur Cave Reserve. These stakeholders recognise the multitude of positive impacts (environmentally, economically, socially, and culturally) associated with such development.

Table 3. Strengths and Weaknesses -Internal Factors Evaluation (IFE).

Code	Strengths	Weight	Score	Weighted Score
S1	-The scarcity of its geological formations, which is globally recognised.	0.068	4	0.272
S2	-Proximity to one of the main cities in central Egypt.	0.046	1	0.046
S3	-The cave is a historical record of earth, during an old era, with its climatic conditions that prevailed at the time.	0.049	2	0.098
S4	-The cave has a global outstanding scientific interest for researchers and scholars in geology.	0.068	4	0.272
S5	-Unique natural potentials, that are characterized by beautiful geomorphological features and unpolluted environment.	0.054	3	0.162
S6	-There are areas suitable for climbing activity, such as Wadi Umm Arqoub.	0.064	4	0.256
S7	- It has been declared as a geological protected area and national heritage area.	0.052	3	0.156
S8	-There is an ancient dam dating back to the Roman era, about 2.5 km east of Sannur Cave.	0.049	2	0.098
S9	-Diversity of wildlife, some of which are rare such as deer and foxes, which are spotted at night in the area.	0.066	4	0.264
Sub-total		0.516		
Code	**Weaknesses**	**Weight**	**Score**	**Weighted Score**
W1	-Lack of geo-tourism tour operators in Egypt.	0.045	3	0.135
W2	-Lack of studies and plans to apply the basic principles of sustainability and environmental protection in the reserve, and how to deal with risks.	0.037	2	0.074
W3	-Lack of qualified, trained and skilled staff in geo-tourism sectors.	0.038	2	0.076
W4	-Poor level of necessary tourism facilities and services within the reserve.	0.065	4	0.26
W5	-Cave tourism is not well recognized in Egyptian tourism market, There is a lack of promotion efforts.	0.052	3	0.156
W6	-Lack of investments in tourism facilities and infrastructure.	0.032	2	0.064
W7	-Weak management system in the reserve, it is not open to receive visitors permanently, visitors need to issue a prior permit to visit.	0.038	2	0.076
W8	-Shortage of local communities' participation in tourism management in study area.	0.031	2	0.062
W9	-Poor infrastructure and superstructure in Wadi Sannur Cave and its surrounding areas.	0.065	4	0.26
W10	-Limited Institutional Capacities for areas with rich geological heritage resources.	0.016	1	0.016
W11	-The lack of geo-tourism development strategies.	0.032	2	0.064
W12	-Low level of public awareness of geodiversity and the geopark concept.	0.032	2	0.064
Sub-total		0.483		
Total		1		

Opportunities and threats of developing cave tourism in Wadi Sannur Cave Reserve

The utilisation of strategic analytical tool known as "SWOT analysis" was employed to ascertain the potential advantages and disadvantages of implementing sustainable cave tourism development strategies within the confines of Wadi Sannur Cave Reserve. This approach aimed to identify the opportunities and threats associated with the establishment of cave tourism in the designated region, while also evaluating the inherent strengths and weaknesses of Wadi Sannur Cave Reserve as a prospective destination for cave tourism. The replies of the stakeholders, secondary data, and observations from the technical visit were meticulously categorised, organised, and thoroughly reviewed many times in order to identify any instances of repetition. The data was subjected to coding, with further merging of closely related categories (Wheelen et al., 2015). Afterward, the perceptions of stakeholders regarding internal and external factors were documented in tables 3 and 4. This laid the foundation for the development of the primary SWOT analysis matrices: the Internal Factor Evaluation matrix (IFE) and the External Factor Evaluation matrix (EFE). In these matrices, the importance of each individual sub-factor was meticulously assessed, and a numerical weight ranging from zero (indicating insignificance) to one (indicating significance) was assigned to each. Subsequently, the weighted scores for the sub-factors in both the IFE and EFE matrices were determined. This was achieved by calculating the product of the weight assigned to each sub-factor and the weight of the normalized factor. The outcome of this computation is illustrated in tables 3 and 4.

Table 3 exhibits the outcomes derived from the assessment of internal factors associated with Wadi Sannur Cave Reserve, positioning it as a potential destination for cave tourism. This evaluation encapsulates the strengths and weaknesses perceived by stakeholders within the Egyptian tourism realm. These aspects were meticulously analysed, leading to the computation of individual relative impact indices for each point. Among these, the strengths that garnered the highest importance and influence, as perceived by stakeholders, were S1: "Globally recognized scarcity of geological formations" and S4: "Exceptional scientific appeal for geology researchers and scholars worldwide," both achieving a weighted score of 0.272. Conversely, in terms of weaknesses, the most impactful points were identified as W4: "Inadequate provision of essential tourism amenities and services within the reserve" and W9: "Underdeveloped infrastructure and framework in Wadi Sannur Cave and its vicinity," both amassing a weighted score of 0.26.

Table 4. Opportunities and Threats -External Factors Evaluation (EFE).

Code	Opportunities	Weight	Score	Weighted Score
O1	-The recent government interest in developing the central and southern governorates of Egypt.	0.015	1	0.015
O2	-Encouraging local entrepreneurship and government support for small and medium enterprises.	0.046	3	0.138
O3	-Sustainability of environmental resources as a main pillar at Egypt's Vision 2030.	0.086	4	0.344
O4	-Availability of the legislative and legal framework that protects the study area, which consider a strategic opportunity.	0.048	3	0.144
O5	-Launching the national environmental action plan for Egypt "Eco-Egypt 2015 -2030".	0.045	3	0.135
O6	The growing interest of a large segment of Egyptians, especially the youth, to visit and discover reserves and places with natural characteristics.	0.057	3	0.171
O7	-The global trend to conserve, protect and sustain natural resources.	0.065	4	0.26
O8	-Growing global demand on ecotourism types.	0.086	4	0.344
O9	Government interest in the tourism industry as an important source of foreign currency, in light of the recurring global economic crises.	0.072	4	0.288
O10	-The interest of the Egyptian state in developing border and remote areas.	0.038	3	0.114
Sub-total		0.558		
Code	**Threats**	**Weight**	**Score**	**Weighted Score**
T1	-The absence of a clear mechanism for cooperation with investors within the protected areas.	0.038	2	0.076
T2	-Conflict of interest among concerning parties; Government, tourism private sector and local communities.	0.048	3	0.144
T3	-Conflict of interests between efforts to protect geological heritage and owners of investments in quarries.	0.018	1	0.018
T4	-Scarcity of awareness campaigns on the importance of preserving geological heritage.	0.028	2	0.056
T5	-Lack of university programs or training courses from accredited and reliable bodies in natural reserves management and geological tourism guidance.	0.051	3	0.204
T6	-Intense global competition in cave tourism/geotourism, including countries close to Egypt such as Lebanon and Turkey.	0.075	4	0.3
T7	-Lack of awareness of the local community of the benefits accruing to them from the development of the reserve.	0.051	3	0.204
T8	-The effects of climate change and nature's wrath, such as earthquakes, landslides and floods.	0.075	4	0.3
T9	-Some practices and activities that have a negative impact on the environment.	0.058	3	0.174
Sub-total		0.442		
Total		1		

Table 4 illustrates the findings stemming from the evaluation of external factors that possess the potential to exert both favourable and adverse influences on the feasibility of cave tourism development within Wadi Sannur Cave Reserve. These factors are encapsulated by opportunities and threats as perceived by stakeholders in the Egyptian tourism domain. The meticulous analysis of these elements culminated in the determination of distinct relative impact indices for each point. Within this context, stakeholders accorded the highest significance and influence to certain opportunities, specifically O3 ("Integration of environmental sustainability into Egypt's Vision 2030") and O8 ("Rising global demand for ecotourism experiences"), both attaining a weighted score of 0.344.

On the converse side, among the identified threats, the most impactful points were acknowledged as T5 ("Absence of university programs or accredited training courses from reputable institutions in natural reserve management and geological tourism guidance") and T7 ("Limited awareness within the local community regarding the accruing benefits from reserve development"), both achieving a weighted score of 0.204.

Sustainable Cave Tourism Development Strategies in Wadi Sannur Cave Reserve

To formulate strategies for the sustainable development of cave tourism in Wadi Sannur Cave Reserve, a comprehensive analysis of its strengths, weaknesses (internal factors), opportunities, and threats (external factors) was conducted. These factors were systematically categorized, scrutinized, and juxtaposed to pave the way for the creation of four distinct strategy types. The initial approach is the "SO" Maxi-Maxi Strategy, which capitalizes on strengths to harness opportunities to the fullest extent. The second strategy, the "WO" Mini-Maxi Strategy, strategically employs weaknesses and opportunities to leverage strengths for addressing weaknesses and making the most of opportunities. The third approach, the "ST" Maxi-Mini Strategy, leverages strengths to mitigate the impact of threats to the highest degree. Lastly, the "WT" Mini-Mini Strategy aims to counter the impact of adverse factors, utilizing weaknesses and addressing threats to minimize their effects (Ravanavar & Charantimath, 2012). These four strategic frameworks were utilized to formulate a matrix delineating sustainable geo-tourism development strategies for Wadi Sannur Cave Reserve, as depicted in Table 1.

Table 5. Cave Tourism Development Strategy Matrix in Wadi Sannur Cave Reserve

	Strengths	**Weaknesses**
Internal Factors Analysis	S1-The scarcity of its geological formations, which is globally recognised. S2-Proximity to one of the main cities in central Egypt. S3-The cave is a historical record of earth, during an old era, with its climatic conditions that prevailed at the time. S4-The cave has a global outstanding scientific interest for researchers and scholars in geology. S5-Unique natural potentials, that are characterized by beautiful geomorphological features and unpolluted environment. S6-There are areas suitable for climbing activity, such as Wadi Umm Arqoub. S7-It has been declared as a geological protected area and national heritage area. S8-There is an ancient dam dating back to the Roman era, about 2.5 km east of Sannur Cave. S9-Diversity of wildlife, some of which are rare such as deer and foxes, which are spotted at night in the area.	W1-Lack of geo-tourism tour operators in Egypt. W2-Lack of studies and plans to apply the basic principles of sustainability and environmental protection in the reserve, and how to deal with risks. W3-Lack of qualified, trained and skilled staff in geo-tourism sectors. W4-Poor level of necessary tourism facilities and services within the reserve. W5-Cave tourism is not well recognized in Egyptian tourism market, There is a lack of promotion efforts. W6-Lack of investments in tourism facilities and infrastructure. W7-Weak management system in the reserve, it is not open to receive visitors permanently, visitors need to issue a prior permit to visit. W8-Shortage of local communities' participation in tourism management in study area. W9-Poor infrastructure and superstructure in Wadi Sannur Cave and its surrounding areas. W10-Limited Institutional Capacities for areas with rich geological heritage resources. W11-The lack of geo-tourism development strategies. W12-Low level of public awareness of geodiversity and the geopark concept.
External Factors Analysis		
Opportunities	**"SO"-Maxi-Maxi strategy**	**"WO"-Mini-Maxi strategy**
O1-The recent government interest in developing the central and southern governorates of Egypt. O2-Encouraging local entrepreneurship and government support for small and medium enterprises. O3-Sustainability of environmental resources as a main pillar at Egypt's Vision 2030. O4-Availability of the legislative and legal framework that protects the study area, which consider a strategic opportunity. O5-Launching the national environmental action plan for Egypt "Eco-Egypt 2015 -2030". O6-The growing interest of a large segment of Egyptians, especially the youth, to visit and discover reserves and places with natural characteristics. O7-The global trend to conserve, protect and sustain natural resources. O8-Growing global demand on ecotourism types. O9-Government interest in the tourism industry as an important source of foreign currency, in light of the recurring global economic crises. O10-The interest of the Egyptian state in developing border and remote areas.	**SO1-**Building strategic partnerships with international organizations interested in the global geological heritage. **SO2-**Scientific and research cooperation with specialized scientific and research bodies interested in studying the geological history of the Earth. **SO3-**Preparing and launching a global marketing campaign to take advantage of the opportunity of the growing global demand for ecotourism. **SO4-**Preparing a study to improve and raise the efficiency of services in the Wadi Sannur Cave Reserve to take advantage of the opportunity of the government's interest towards developing the central and southern governorates of Egypt. **SO5-**Launching a national campaign to urge local entrepreneurs to submit ideas for tourism and environmentally friendly entrepreneurial projects within the reserve, to take advantage of the government's support for local entrepreneurs. **SO6-**Encourage tour operators to prepare and market tourism packages specialized in Cave tourism/geo-tourism, to take advantage of the government's interest in the tourism industry as an important economic resource, in addition to the recently state's approach to preserving the environment and heritage sites.	**WO1-**Adopting a national strategy for the development of geo-tourism in Egypt, and supporting global marketing and promotional efforts. **WO2-**Organizing specialized training programs in cave tourism/geo-tourism to raise the efficiency of workers, and to prepare qualified, trained and skilled staff. **WO3-**Adopting a mechanism for the participation of the local community in the management of the reserve, and allowing them to practice commercially the cultural and heritage activities that distinguish them. **WO4-**Launching awareness campaigns to raise the awareness of local community of environmental issues and the benefits accruing to them from preserving the environment, human heritage sites, and geoparks. **WO5-**Issuing a specialized license for tourist guidance inside nature reserves, and adhering to it as a condition for allowing guides to accompany tourists inside nature reserves and heritage areas. **WO6-**Encourage tour operators to prepare and market tourism packages specialized in cave tourism/geo-tourism. **WO7-**Launching a national governmental initiative to encourage investment in infrastructure projects, superstructure and tourism facilities needed at Wadi Sannur Cave Reserve and its surrounding areas. **WO8-**Develop a national strategy to raise the efficiency of institutional capacities for protected areas and heritage areas. **WO9-**Preparing a national strategy for applying the basic principles of sustainability and environmental protection and dealing with risks in protected areas, and reformulating a professional administrative system for the management of Wadi Sannur Cave Reserve.
Threats	**"ST"-Maxi-Mini strategy**	**"WT"-Mini-Mini strategy**
T1-The absence of a clear mechanism for cooperation with investors within the protected areas. T2-Conflict of interest among concerning parties; Government, tourism private sector and local communities. T3-Conflict of interests between efforts to protect geological heritage and owners of investments in quarries. T4-Scarcity of awareness campaigns on the importance of preserving geological heritage. T5-Lack of university programs or training courses from accredited and reliable bodies in natural reserves management and geological tourism guidance. T6-Intense global competition in geo-tourism, including countries close to Egypt such as Lebanon and Turkey. T7-Lack of awareness of the local community of the benefits accruing to them from the development of the reserve. T8-The effects of climate change and nature's wrath, such as earthquakes, landslides and floods. T9-Some practices and activities that have a negative impact on the environment.	**ST1-**Urging universities to launch university programs or training courses in natural reserves management and geological tourist guidance. **ST2-**Launching awareness campaigns to raise the awareness of local community of the benefits accruing to them from preserving the environment, human heritage sites, and geological heritage. **ST3-**Strict governmental control over any unregulated or illegal tourism activities that have a negative impact on the environment in Wadi Sannur Cave Reserve. **ST4-**Preparing an emergency plan to deal with the effects of climate change and nature's wrath, especially since the Sanur Valley Reserve was negatively affected by torrents before. **ST5-**Preparing a memorandum of understanding between the government, the private sector and the local community to reduce the negative effects of conflicts of interest. **ST6-**Preparing specialized scientific studies to determine the permissible carrying capacity of numbers visitors inside the cave to reduce any negative effects resulting from carbon dioxide. **ST7-**Preparing a clear mechanism for cooperation with investors and benefiting from their economic capabilities to raise the efficiency of services within the reserve, in a way that preserves the environment of the reserve. **ST8-**Conducting a benchmarking study for the successful experiences in managing geological reserves and caves, to help adopt a professional administrative system for Wadi Sannur Cave Reserve, which provides the ability to face the intense global competition in cave tourism/geotourism.	**WT1-**Introducing a new type of license for geo-tourism or eco-tourism operators in Egypt. **WT2-**Developing an environmentally friendly infrastructure within Wadi Sannur Cave Reserve to protect the geological heritage. **WT3-**Creating a brand for cave tourism in Egypt, to directly influence and attract visitors interested in this type of tourism, which will support global marketing and promotional efforts. **WT4-**Developing a mechanism to benefit from local traditions, customs and handicrafts in tourism activities within Wadi Sannur Cave Reserve, which will add a competitive advantage to the tourism product. **WT5-**Supporting the practice of various tourism activities within the reserve, such as camping, climbing, watching wildlife, educational tourism, and even archaeological and historical tourism, depending on the presence of the Roman archaeological dam inside Wadi Sannur Cave Reserve. **WT6-**Continuous updating of the environmental legislative framework and work system in nature reserves to keep pace with global changes. **WT7-**The use of technology and its applications in providing a simulated experience of the region's reality in ancient geological times and the stages of cave formation, which adds a competitive advantage to the tourism product, and contributes significantly to supporting marketing and promotional campaigns. **WT8-**Launching awareness campaigns for the local community on the importance of preserving human and geological heritage sites, and introducing them to the social, cultural and economic benefits accruing to them. **WT9-**Adopting a national plan to raise the efficiency of the infrastructure and superstructure in Wadi Sannur Cave Reserve, in cooperation with investors, in a way that benefits all parties.

5. Discussion and implications

The objective of this study is to assess the potential for the development of cave tourism in the Wadi Sannur Cave Reserve and to provide sustainable solutions for cave tourism growth, as assessed by stakeholders in the Egyptian tourism industry. This study makes a substantial contribution to the existing body of literature on tourism by evaluating the appropriateness of geological sites for utilisation in tourism endeavours.

The findings indicate that the Wadi Sannur Cave Reserve possesses significant geodiversity and holds potential for educational and tourism endeavours. The evaluation scores for the four dimensions (consisting of 37 indicators) employed in the assessment were notably high, surpassing the threshold of 75. This suggests that the Sanur Cave exhibits scientific value, is suitable for educational activities, and can be utilised for tourism purposes. Consequently, there is a rationale for enhancing existing infrastructure, constructing new facilities, and undertaking site rehabilitation to cater to the needs of tourism.

The results indicate that all Egyptian tourism stakeholders are in agreement with the significant value of promoting cave tourism in the Wadi Sannur Cave Reserve, as it offers various positive impacts on the environment, economy, society, and culture. This study assessed the significance of promoting cave tourism and geo-tourism within the designated research region. A comprehensive evaluation was conducted using a scale comprising ten indicators. Notably, all ten elements of the scale demonstrated a substantial level of importance. This finding underscores the imperative and prioritisation of efforts aimed at advancing the development of cave tourism in the Wadi Sannur Cave Reserve.

Moreover, the results of the strategic analytical instrument known as “SWOT analysis” have revealed the significant strengths and opportunities that contribute favourably to the advancement of cave tourism in the Wadi Sannur Cave Reserve. Conversely, the analysis has also identified threats and weaknesses that pose obstacles to the potential progress of development in the reserve. The findings of the study provide confirmation that the scarcity of geological formations in Sannur Cave, which holds global recognition, has generated significant scientific interest among researchers and scholars in the field of geology. Furthermore, the increasing global demand for ecotourism, coupled with the recent attention given by the Egyptian government to environmental concerns and the preservation of heritage sites, as well as the incorporation of environmental issues into Egypt’s Vision 2030,However, the underdeveloped infrastructure and superstructure in Wadi Sannur Cave and its vicinity, inadequate tourism facilities and services, limited local understanding of cave tourism and geo-tourism, ineffective promotional campaigns, the absence of university programmes in natural reserve management and geological tourism guidance, and insufficient awareness among the local community regarding the advantages associated with the reserve’s development collectively hinder the potential and opportunities for cave tourism and geo-tourism growth in Wadi Sannur Cave Reserve. The suggested framework for the development of cave tourism strategies within the Sannur Valley Cave Reserve aims to offer a scientific basis for officials, planners, policymakers, and decision-makers. This framework will enable them to engage in strategic thinking and sustainable planning for the reserve’s future. By presenting a range of strategic options (ST, WO, SO, and WT strategies), this framework aims to leverage the reserve’s strengths, capitalise on available opportunities, address weaknesses, and mitigate potential threats to minimise their impact.

6. Conclusion

The primary goal of this study is to assess the potential for the development of cave tourism and suggest sustainable techniques for the advancement of cave tourism in the Wadi Sannur Cave Reserve. A total of 379 individuals, consisting of tourism academics, researchers, tour operators, authorities, and government employees, participated in the data collection process. The researchers employed quantitative data analysis techniques and the strategic analytical tool known as SWOT. The findings of the study revealed that the management and use of Wadi Sannur Cave Reserve for tourism and scientific endeavours, as well as efforts towards its sustainability, do not align with the reserve’s exceptional geological history and abundant natural resources. The reserve has been plagued by inadequate infrastructure, insufficient tourism facilities, a longstanding lack of government attention, a dearth of sustainable planning, and a deficient incompetent administration. The results indicate that the Wadi Sannur Cave Reserve possesses significant geodiversity and holds potential for both educational and tourism endeavours. Stakeholders in the tourism industry have acknowledged the importance of promoting cave tourism within the reserve. In addition, there exist several notable strengths and opportunities that contribute favourably to the development of cave tourism in the Wadi Sannur Cave Reserve. This study presents a set of four proposed strategies for the sustainable development of cave tourism. These strategies aim to capitalise on the strengths and opportunities available while mitigating the negative impact of weaknesses and threats. The implementation of these strategies will provide valuable guidance to decision-makers, planners, and development officials involved in the planning process for the Wadi Sannur Cave Reserve. The ultimate goal is to ensure sustainable development and maximise the utilisation of this natural resource.

7. Acknowledgement

This work was supported through the Ambitious Funding track by the Deanship of Scientific Research, Vice Presidency for Graduate Studies and Scientific Research, King Faisal University, Saudi Arabia [GRANT4052].

References

Agency, E. E. A. (2023). https://www.eeaa.gov.eg/Topics/85/36/65/Details

Amin, R. M., & Eissa, M. (2008). Radon level and radon effective dose rate determination using SSNTDs in Sannur cave, Eastern desert of Egypt. *Environmental monitoring and assessment, 143*, 59-65. https://doi.org/10.1007/s10661-007-9957-y

Antić, A., Peppoloni, S., & Di Capua, G. (2020). Applying the values of geoethics for sustainable speleotourism development. *Geoheritage, 12*, 1-9. https://doi.org/10.1007/s12371-020-00504-0

Antić, A., Tomić, N., Đorđević, T., Radulović, M., & Đević, I. (2020). Speleological objects becoming show caves: evidence from the Valjevo karst area in Western Serbia. *Geoheritage, 12*, 1-12. https://doi.org/10.1007/s12371-020-00517-9

Ashley, C., & Roe, D. (2002). Making tourism work for the poor: strategies and challenges in southern Africa. *Development Southern Africa, 19*(1), 61-82. https://doi.org/10.1080/03768350220123855

Ayad, T. (2017). Curative Tourism Development in Egypt: Case of Al-Wadi Al-Jadid Governorate. *Journal of The Faculty of Tourism and Hotels, Alexandria University, 14*(2), 31-45. https://journals.ekb.eg/article_48778_bd3f95dc859e04788986952b0ef81285.pdf

Ayad, T. H. (2017). Examining the relationships between visit experience, satisfaction and behavioral intentions among tourists at the Egyptian Museum. *Journal of Association of Arab Universities for Tourism and Hospitality, 14*(2), 93-104. https://doi.org/10.21608/jaauth.2017.48147

Beigi, H., & Pakzad, P. (2010). Investigating geotourism capabilities of the Gavkhoni wetland according to the SWOT model. *WIT Transactions on Ecology and the Environment, 139*, 169-179. https://doi.org/10.2495/ST100151

Blackstock, K. (2005). A critical look at community based tourism. *Community development journal, 40*(1), 39-49. https://doi.org/10.1093/cdj/bsi005

Brilha, J. (2016). Inventory and quantitative assessment of geosites and geodiversity sites: a review. *Geoheritage, 8*(2), 119-134. https://doi.org/10.1007/s12371-014-0139-3

Cigna, A. A., & Forti, P. (2013). Caves: the most important geotouristic feature in the world. *Tourism and Karst areas, 6*(1), 9-26. https://digitalcommons.usf.edu/cgi/viewcontent.cgi?article=5723&context=kip_articles#page=12

Clark, G., & Chabrel, M. (2007). Measuring integrated rural tourism. *Tourism geographies, 9*(4), 371-386. https://doi.org/10.1080/14616680701647550

Cságoly, Z., Sæþórsdóttir, A. D., & Ólafsdóttir, R. (2017). Tourism changing the edge of the wild. *Journal of Outdoor Recreation and Tourism, 17*, 1-8. https://doi.org/10.1016/j.jort.2016.10.004

Dabous, A. A., & Osmond, J. (2000). U/Th isotopic study of speleothems from the Wadi Sannur Cavern, Eastern Desert of Egypt. *Carbonates and Evaporites, 15*, 1-6. https://doi.org/10.1007/BF03175643

Demir, F. (2019). Alternative Tourism Diversity As a Tool for Rural Development: Example of Turkey/Ermenek. *International Journal of Innovative Science, Engineering & Technology, 6*(10), 374-383. https://www.researchgate.net/publication/359312557_Alternative_Tourism_Diversity_as_a_Tool_For_Rural_Development_Example_Of_Turkey_Ermenek

Dowling, R. K. (2011). Geotourism’s global growth. *Geoheritage, 3*(1), 1-13. https://doi.org/10.1007/s12371-010-0024-7

Dowling, R. K. (2013). Global geotourism–an emerging form of sustainable tourism. *Czech journal of tourism, 2*(2), 59-79. https://doi.org/10.2478/cjot-2013-0004

Erikstad, L. (2008). History of geoconservation in Europe. *Geological Society, London, Special Publications, 300*(1), 249-256. https://doi.org/10.1144/SP300.19

Governorate, B. S. (2023). http://www.benisuef.gov.eg/New_Portal/Reports/Cave.aspx

Gunay, G., Ekmekci, M., Bayari, C., Kurttas, T., & ElBedewy, F. (1997). Sannur cave: A crescent shaped cave in Egypt. In (pp. 257-263). Balkema, Rotterdam. https://avesis.hacettepe.edu.tr/yayin/1734f44c-0230-41b4-b0e8-9386793de576/sannur-cave-a-crescent-shaped-cave-in-egypt

Hose, T. A. (1995). Selling the story of Britain's stone. *Environmental interpretation, 10*(2), 16-17. https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/ReferencesPapers.aspx?ReferenceID=952589

Kang, M., & Moscardo, G. (2006). Exploring cross-cultural differences in attitudes towards responsible tourist behaviour: A comparison of Korean, British and Australian tourists. *Asia Pacific Journal of Tourism Research, 11*(4), 303-320. https://doi.org/10.1080/10941660600931143

Kim, S. S., Kim, M., Park, J., & Guo, Y. (2008). Cave tourism: Tourists' characteristics, motivations to visit, and the segmentation of their behavior. *Asia Pacific Journal of Tourism Research, 13*(3), 299-318. https://doi.org/10.1080/10941660802280448

Liu, W., Vogt, C. A., Lupi, F., He, G., Ouyang, Z., & Liu, J. (2016). Evolution of tourism in a flagship protected area of China. *Journal of Sustainable Tourism, 24*(2), 203-226. https://doi.org/10.1080/09669582.2015.1071380

Milenković, J. (2021). Evaluation of geo-sites in the Podrinje-Valjevo Mountains with respect to geo-tourism development. *Geoheritage, 13*(2), 44. https://doi.org/10.1007/s12371-021-00567-7

Mirari, S., Aoulad-Sidi-Mhend, A., & Benmlih, A. (2020). Geosites for geotourism, geoheritage, and geoconservation of the khnefiss national park, southern Morocco. *Sustainability, 12*(17), 7109. https://doi.org/10.3390/su12177109

Newsome, D., & Dowling, R. K. (2010). *Geotourism: the tourism of geology and landscape*. Goodfellow Publishers Ltd. https://www.leisuresolutions.com.au/wp-content/uploads/2019/09/Geotourism_The_Tourism_of_Geology_and.pdf

Okonkwo, E. E., Afoma, E., & Martha, I. (2017). Cave tourism and its implications to tourism development in Nigeria: a case study of Agu-Owuru cave in Ezeagu. *International Journal of Research in Tourism and Hospitality, 3*(3), 16-24. http://dx.doi.org/10.20431/2455-0043.0303003

Ólafsdóttir, R., & Tverijonaite, E. (2018). Geotourism: a systematic literature review. *Geosciences, 8*(7), 234. https://doi.org/10.3390/geosciences8070234

Pforr, C., & Megerle, A. (2006). Geotourism: a perspective from southwest Germany. *Geotourism*, 118-139. https://www.taylorfrancis.com/chapters/edit/10.4324/9780080455334-9/geotourism-perspective-southwest-germany-christof-pforr-andreas-megerle

Ravanavar, G. M., & Charantimath, P. M. (2012). Strategic formulation using tows matrix–A Case Study. *International Journal of Research and Development, 1*(1), 87-90. https://www.semanticscholar.org/paper/STRATEGIC-FORMULATION-USING-TOWS-MATRIX-%E2%80%93-A-CASE-Ravanavar/5d0412dc91e01351420cd29508ab26f61b95dabb

Sallam, E. S. (2022). Speleothems of the Wadi Sannur cave (Eastern Desert, Egypt): a well-preserved archive of paleoenvironmental and palaeoclimatic changes. *International Journal of Earth Sciences, 111*(4), 1269-1271. https://doi.org/10.1007/s00531-022-02177-2

Sallam, E. S., Ruban, D. A., Mostafa, M. T., Elkhodery, M. K., Alwilily, R. L., Molchanova, T. K., & Zorina, S. O. (2020). Unique desert caves as a valuable geological resource: first detailed geological heritage assessment of the Sannur Cave, Egypt. *Arabian Journal of Geosciences, 13*, 1-12. https://doi.org/10.1007/s12517-020-5176-4

Saxena, G., Clark, G., Oliver, T., & Ilbery, B. (2007). Conceptualizing integrated rural tourism. *Tourism geographies, 9*(4), 347-370. https://doi.org/10.1080/14616680701647527

Scheyvens, R. (1999). Ecotourism and the empowerment of local communities. *Tourism Management, 20*(2), 245-249. https://doi.org/10.1016/S0261-5177(98)00069-7

Service, S. I. (2023). https://sis.gov.eg/Story/1065/Sannur-valley?lang=en-us

Telbisz, T., Gruber, P., Mari, L., Kőszegi, M., Bottlik, Z., & Standovár, T. (2020). Geological heritage, geotourism and local development in Aggtelek National Park (NE Hungary). *Geoheritage, 12*, 1-18. https://doi.org/10.1007/s12371-020-00438-7

Telbisz, T., & Mari, L. (2020). The significance of karst areas in European national parks and geoparks. *Open Geosciences, 12*(1), 117-132. https://doi.org/10.1515/geo-2020-0008

Telbisz, T., Stergiou, C. L., Mindszenty, A., & Chatzipetros, A. (2019). Karst features and related social processes in the region of the Vikos Gorge and Tymphi Mountain (Northern Pindos National Park, Greece). *Acta Carsologica, 48*(1), 29–42. https://doi.org/10.3986/ac.v48i1.6806

Tomić, N., Antić, A., Marković, S. B., Đorđević, T., Zorn, M., & Valjavec, M. B. (2019). Exploring the potential for speleotourism development in eastern Serbia. *Geoheritage, 11*, 359-369. https://doi.org/10.1007/s12371-018-0288-x

Tverijonaite, E., Ólafsdóttir, R., & Thorsteinsson, T. (2018). Accessibility of protected areas and visitor behaviour: A case study from Iceland. *Journal of Outdoor Recreation and Tourism, 24*, 1-10. https://doi.org/10.1016/j.jort.2018.09.001

UNWTO. (2020). *International tourism highlights: 2020 edition*. https://www.e-unwto.org/doi/epdf/10.18111/9789284422456

Valente, E., Santo, A., Guida, D., & Santangelo, N. (2020). Geotourism in the Cilento, Vallo di Diano and Alburni UNESCO Global Geopark (Southern Italy): The Middle Bussento Karst System. *Resources, 9*(5), 52. https://doi.org/10.3390/resources9050052

Veal, A. (2006). *Research Methods for Leisure and Tourism: A Practical Guide.* Essex: Pearson Education Limited.

Vujičić, M. D., Vasiljević, D. A., Marković, S. B., Hose, T. A., Lukić, T., Hadžić, O., & Janićević, S. (2011). Preliminary geosite assessment model (GAM) and its application on Fruška Gora Mountain, potential geotourism destination of Serbia. *Acta Geographica Slovenica, 51*(2), 361-376. https://doi.org/10.3986/AGS51303

Wheelen, L. T., Hunger, D. J., Hoffman, N. A., & Bamford, E. C. (2015). Concepts in Strategic Management and Business Policy, Pearson Education. In. Fourteenth Edition. https://files.pearsoned.de/inf/toc/9781292080901