

# Assessment of Tourism Resources for Future Tourism Development: Case of Wadi El Natrun



DOI: 10.46970/2022.28.1.3

Volume 28, Number 1

March 2022, pp. 44-66

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*The purpose of this article is to identify and appraise the prospective tourism resources in Wadi El Natrun for future tourism development, as well as to prioritise their exploitation based on their value to tourism stakeholders. To do this, a questionnaire was created and distributed to 227 stakeholders. The primary data were analysed using a hierarchical analytic technique. We identified and studied seven major indicators and 66 sub-indicators of prospective tourism resources. This study offered a hierarchical system for potential tourism resources in Wadi El Natrun, categorising them according to their significance, suitability, and priority for tourism utilisation. The conclusions of this article can assist investors, policymakers, and planners in formulating effective and sustainable tourist strategies and programmes.*

**Keywords:** Tourism Resources, Tourism Potential, Wadi El Natrun, Hierarchical Analysis Process.

## Introduction

The expansion of societies, the technological revolution, and the globalisation of economic competition have significantly increased the importance and value of resources. It has become critical for any country to maximise its resource utilisation in order to increase its competitiveness. From this vantage point, tourism resources are critical to countries' economies, prompting governments to classify and evaluate their tourism potential resources, as well as to define areas for their optimal use, in a way that ensures meeting current generation's needs without jeopardising future generations' ability to meet their own (Chai et al., 2011).

Barbu et al. (2014) and Dincu et al. (2015) agreed to define tourism potentials as the natural, historical, social, cultural, and economic components that, when combined with technical infrastructure and basic and touristic infrastructure, serve as the foundation for tourism development and determine an area's suitability or unsuitability to receive tourists. Similarly

In this context, there are numerous factors that influence a region's ability to attract tourists, and the most critical of these factors is the availability of tourism resources. While the presence of tourism resources alone is insufficient, as

infrastructure and other facilities must also be available, the established fact is that tourism development in any area should begin by identifying and evaluating the tourism potentials, and if the potentials are positive, tourism development should proceed (Bowtell, 2015). This demonstrates the critical nature of classification and evaluation of tourism resources, which stems from the fact that both the tourist and the investor want to know the capabilities of the site they are dealing with, as well as the value of the tourism resources available at the site, prior to visiting or investing in it (Mohamed & Abood, 2020). Despite the fact that numerous studies have been conducted on the classification and evaluation of tourism resources - as described later - these studies have not addressed the classification and evaluation of tourism resources according to their relative importance in comparison to one another, as will be done in this study, as tourism resources will be classified and evaluated in the case study area according to their importance and relative value in comparison to one another.

The case study area for this paper is Wadi El Natrun, a narrow stretched depression located 110 kilometres northwest of Cairo in Egypt (Gad & El-Zeiny, 2016). It has been of historical significance since the Pharaonic era, as it was the source of the salt of Natron used in mummification, as well as the only place in Egypt where the papyrus plant naturally sprouted (Osman et al., 2010; Shen et al., 2011). Despite the site's historical significance and the diversity of its natural resources, the area has remained undeveloped, and the tourism potential resources have not been recognised scientifically and systematically. The purpose of this article is to identify and appraise possible tourism resources in Wadi El Natrun for future tourism development, as well as to prioritise their utilisation based on their relevance.

## **Literature Review**

### **Tourism Resource Classification**

Tourism resources provide the material foundation for sustainable tourism development and the potential for tourism productivity growth (Guo et al., 2001), and the level of success of various tourist destinations varies according to the tourism potential they possess and how well it is utilised to attract tourists. As a result, no tourism activity may begin at a tourist site without first defining, classifying, and evaluating the tourism potentials available (Formica & Uysal, 2006). Numerous researchers gave their own models and definitions of the notion and classification of tourism resources (Mohamed & Abood, 2020). In monetary terms Kušen (2010) distinguished between tourist resources and tourism attractions, stating that not all tourism resources are tourism attractions, but all tourism attractions are tourism resources, and that the phrase "tourism resource" is synonymous with the term "potential tourism attraction." Thus, the tourism resource may be mainly unknown, un-evaluated, or unprotected, and it will not become a true resource unless visitors have permanent access to it. On the contrary, disagreed with Kušen (2010), stating that they believe the term "tourism resources" has the same meaning as "tourism attractions," and that both terms refer to places that are suitable for visiting, as well as natural and cultural resources that can be exploited through various tourism activities.

In terms of models, there are numerous classification schemes for tourism resources. Swarbrooke (2012) identified four broad categories of tourism resources. The first category includes natural features such as mountains, seas, valleys, hills, and caves; the second category includes man-made structures that were not originally intended to attract visitors for tourism purposes, such as castles, forts, temples, mosques, churches, cathedrals, prisons, and markets; the third category includes man-made structures that were originally intended to attract visitors for tourism purposes, such as museums and amusement parks; and finally, the fourth category includes man-made structures that were originally intended to attract visitors. Boniface et al. (2016) categorised a site's potential tourism resources into two categories: physical features such as seas, rivers, mountains, and forests, and cultural aspects such as customs and traditions, artistic heritage, and different ways of everyday living, crafts, and so on.

There were also more broad classifications, as Fayal and Nilsson et al. (2005) classified potential tourism resources that could be developed into tourist attractions into two broad categories: natural resources, such as unique natural phenomena, wildlife "Fauna and Flora," and natural reserves; and man-made resources, such as traditions, customs, human heritage, and human culture. L. M. Navarro and Pereira (2015) provided a new classification based on the UNESCO criteria for inclusion on the World Heritage List, in which he split tourism resources into three categories, the first of which is the source of resources, which comprises natural, cultural, and human resources. The second category, material resources, encompasses both tangible and intangible assets. Finally, there is the group of resources with movability, which includes both moveable and immovable resources. K. Navarro and Malvaso (2015) grouped prospective tourism resources in any location into two broad groups with several sub-categories. The first category is natural resources, which are divided into five subcategories: climate, geography, water, animals, and vegetation. The second category is cultural resources, which is subdivided into thirteen subsections. The Gunn classification will be used in this study.

### **The Study Area "Wadi El Natrun":**

El Natrun is derived from the Latin word natrium, which means "sodium." It has been a significant place in Egyptian civilisation from ancient times. Wadi El Natrun is considered to be a part of Egypt's western desert, is totally adjacent to the Nile River Delta, and is administratively affiliated with the Beheira Governorate (Sasidharan et al., 2017). Wadi El Natrun is a narrow stretched depression located in Egypt, 110 kilometres northwest of the capital "Cairo" (Gad & El-Zeiny, 2016), and 90 kilometres south of the Mediterranean Sea. It is approximately 50 kilometres long and 8 kilometres wide on average (Abdel-Dayem et al., 2007) the depression narrows at both ends, reaching 2.6 kilometres in the north and 1.24 kilometres in the south (Ali & El Baroudy, 2008; Sasidharan et al., 2017). The Wadi El Natrun Depression has an area of approximately 2,960.5 square kilometres, extends northwest-southeast, and is 23 metres below sea level (Gad & El-Zeiny, 2016). It is also 38 metres below the water level of the Nile's Rosetta branch (Ismail, et al., 2017).

The region contains a variety of geological habitats, including sand dunes, lakes, marshes, salt flats, stony hills, and fertile valleys. Additionally, it is covered by Miocene to Holocene sedimentary layers, including some coastal sediments, sand dunes, bay

sediments, and chalky formations (Habitat, 2013). It is characterised by a series of small shallow lakes, the majority of which are less than half a metre deep (Ismail et al., 2017). The water in the lakes originates from two sources: seepage and springs found in the bottoms of some lakes. Because the evaporation rate is high and the lakes are located in closed basins with no outlet, the water in the lakes contains a high salt concentration and is saline (Gad & El-Zeiny, 2016).

Furthermore, animal diversity exists in Wadi El Natrun, with 173 vertebrates (mammals, birds, reptiles, and amphibians) reported (Wang et al., 2021). In terms of birds, the region is designated as one of Egypt's 34 key bird sites, despite its lack of formal protection (Oppel et al., 2021). It is home to 117 species, two of which are listed on the Red List of Endangered Animals. The International Union for Conservation of Nature published the Red List of Endangered Animals in 1996, which included the two Marbled Teal and the Great Snipe, as well as five animals (Wang et al., 2021). In terms of cultural significance, Wadi al-Natrun was critical to the ancient Egyptians, as it was where they extracted Natrun salt. Indeed, it gained prominence in Egypt throughout the early Christian era. Today, it is the home of numerous monasteries dating all the way back to the fourth century AD. These monasteries are located in the valley's south end, near the path used by the Holy Family on their journey through Egypt (Wang et al., 2021).

## **Tourism Resources in Wadi El Natroun**

### **Cultural Resources**

#### **Tangible Cultural Resources"Archaeological & Cultural Heritage":**

The scattered monasteries in Wadi al-Natrun are considered to be one of Egypt's most significant ancient sites, deserving of protection. Monasticism began in Wadi al-Natrun in al-Qalali (a small cave in the hills), then natural conditions compelled the hermits of al-Qalali to form tight gatherings, which took place inside the monasteries. Barbarian invasions commenced on them, and in order to protect these monks, interior fortifications were erected in each monastery (Mens et al., 2012). Today, just four of the fifty Coptic monasteries that had existed remain. One of them is the Monastery of Saint Macarius (Deir of Abu Makarya), which is located 94 kilometres south of Cairo (the capital city), while the other three are the Monastery of the Romans (Deir el Baramos), the Monastery of the Syrians (Deir Al-Souriyen), and the Monastery of St. Psho (DeirAmbaBichoi), which is located ten kilometres south of Saint (Bear et al., 2021).

#### **- St. Macarius Monastery "Deir Abu Makaria":**

Abu Maqar (Saint Macarius) monastery is the most important and largest monastery in Wadi al-Natrun, and maybe all of Egypt. It was built in the fourth century, completely looted in the fifth century, and then rebuilt in the sixth century. The monastery of Abu Makar served as a haven for Coptic patriarchs driven from Alexandria by the Royal Church and Byzantines. In 866, the main church was restored and the monastery's fortifications were strengthened, ensuring the monastery's survival to the present day. The monastery is dominated by a spectacular three-story tower that served as a haven for the monks in the case of an invasion. There are four small chapels, storage facilities, a mill, and a well on the property. Additionally, Christians revere the relics of Saint Macarius, John the Baptist, and the Prophet Elisha.

**- Monastery of the Romans "DeirelBaramos":**

The monastery's main church (Theodore Church or Saint Tardis) is now defunct. In the nineteenth century, the Church of Saint John the Baptist was erected. The monastery has a three-story tower that houses some seventh-century relics, as well as exquisite twelfth-century murals inside the Church of Saint Michael.

**- Monastery of the Syrians "Deires-Souriyan":**

The Syrian Monastery was founded in the sixth century AD and remained in the hands of Syrian monks until the fifteenth century. The monastery's main church is the Church of the Virgin, which was completed around 980 AD and features a painting of the ascension, and the iconostasis's ivory screen, which depicts religious themes, paintings, and engineering designs dating all the way back to the ninth century. The monastery library has hundreds of antique manuscripts.

**- St. Pshoi Monastery "Deir Amba Bichoi":**

The monastery was founded by Saint Beshwi, one of Saint Macarius' followers. It consists of five churches that are surrounded by the monastery wall. The most significant of them is the Church of Saint Bishoy, which may date all the way back to the ninth century. It is considered the main church within the monastery and is only used during the summer, while the Church of the Virgin is located in the monastery's southeast corner and is only used during the winter. A drawbridge provides access to the tower's storeys, which house the Archangel Michael Church, which features 18th-century icons.

**Intangible Cultural Resources "Traditions and Customs":**

According to the UNESCO Convention for the Protection of Intangible Cultural Heritage, intangible cultural heritage includes all practises, representations, expressions, knowledge, and skills, as well as tools, objects, artefacts, and associated cultural places that are recognised as part of a community's or individual's cultural heritage (Baldwin, 2012).

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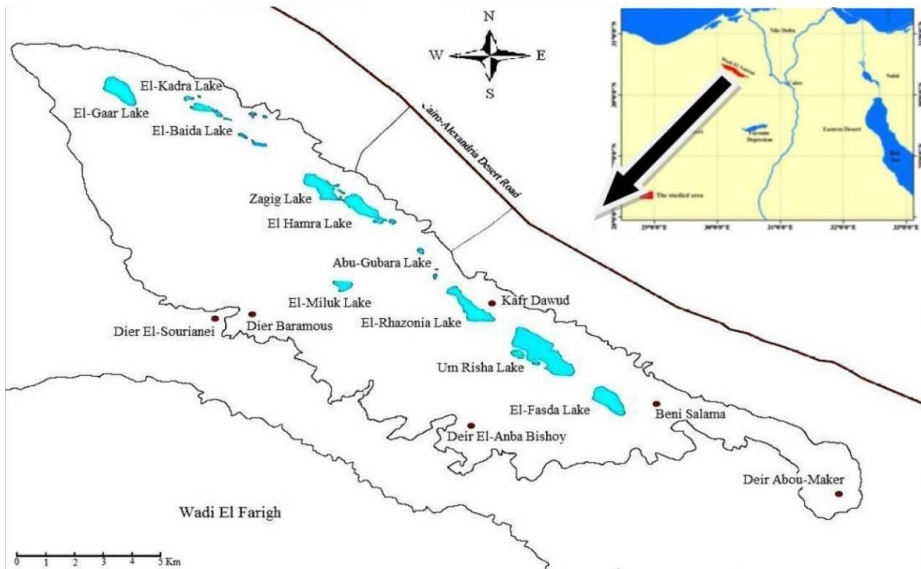
**Natural Resources:**

**Lakes:**

In the heart of the Wadi El Natrun depression lies a group of salt lakes with a surface elevation of 23 metres below sea level. The group consists of eight to nine saline lakes that are fed by springs in the bottom and underground seepages from the River Wadi.

Nile. Due to the rapid rate of evaporation and the lakes' location in isolated basins with no exit, the lakes' water contains a high percentage of salt and is subject to significant changes in level and salinity ((Abd El Ghani et al., 2014; Fradley et al., 2017). Although some lake names indicate a difference in colour due to microbial assemblages (Hamra Means Red, Khadra Means Green, Bayda Means White), the

coloration of lakes is not consistent and is subject to seasonal variations, and despite the variability and discrepancy in the literature regarding the number of lakes in the Wadi El Natrun depression due to drought at certain times of the year, there is agreement on the number of large and significant lakes (Zahran et al., 2009). The location of all lakes in the Wadi El Natrun valley is depicted in Figure 1.



**Figure 1.** Schematic map for Wadi El Natrun depression to show all lakes' position. Source: Abdel-Ghani and Rim, 2014.

### Al Fasidah Lake (Rotten Lake),

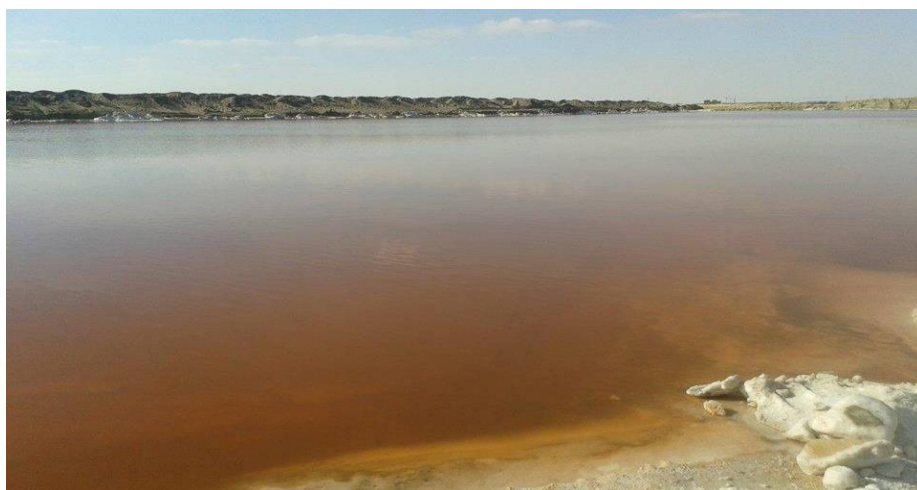
Its area is around 1.5 square kilometres, and the majority of it dries up during the summer. It is distinguished by the colour of its reddish bottom, which contains a low concentration of natrun salt and accumulates in layers around its boundaries. Umm Al-Rishah Lake has a depth of 21 metres below sea level and a surface area of approximately 2.9 square kilometres, and its characteristics are similar to those of Al Fasidah Lake. Al Hamra (Red) and Abu-jbara lakes merge during the summer due to seepage of Nile waters caused by the Nile's high water level. It is distinguished by the presence of a fresh water spring in the midst of its salty water, in a scene that defies all known scientific laws, and it is widely believed among the region's residents that this water spring is connected to the Holy Family's passage through this location during their holy visit to Egypt. Al-Bayda Lake (White Lake) is the largest of the valley lakes (3.5 square kilometres) and has a high salinity with a salinity of 1.

It contains a trace amount of natrun. Al Khadra Lake (Green Lake) turns green in the summer and then dries up. Lake Al Ja'ar, It is one of the valley's larger lakes (2 square kilometres), located near the valley's far north end, and its waters never dry up. Al-Razina Lake has a surface area of approximately 1 square kilometre and dries up throughout the summer (UN Habitat, 2013). Figure 2 depicts a satellite image of Al Hamra Lake, while Figure 3 depicts the salt deposition on the lake's shores.





**Figure 2.** A satellite image of Al Hamra Lake. Source. GoogleEarth.



**Figure 3.** Salt accumulation on the sides of Al Hamra lake. Source. ByAuthor.

### Topography:

Investigating a location's topographical features can aid tourism planners in designating areas and allocating them to various sorts of tourism activity (Ahmadi et al., 2018). In general, Wadi al-Natron is covered with the sediments of the Quadra-Age lake and old alluvial deposits of sand and gravel that formed when the sea encroached and the Nile flowed through it (Abd El Ghani et al., 2014). From this vantage point, the Wadi El Natrun region is divided into three geomorphological units: ancient sedimentary plains, structural plains, and tablelands (Gad & El-Zeiny, 2016). The sedimentary plains (young and old sedimentary plains) have an average slope of 0.1 m / km. For new sedimentary plains, the altitude ranges from +12 to +14 metres, while for ancient

sedimentary plains, the altitude ranges between 60 and 20 metres. The depressions of Wadi El Natrun and Wadi Al Farag have the lowest points, at -23 and -4 metres below sea level, respectively (Kamel et al., 2017). The structural plains cover a large area to the south and west of the ancient sedimentary plains and consist of a series of hills and depressions that alternate in height according to the area's rocky and geological composition (Gad & El-Zeiny, 2016), ranging from 110m to 200m in Jabal Hamza, Dahr El Tashasha, Khashm El Kaoud, El Washika, El Qantara synclinal ridge, and Abu Roash (the ridges (Gad & El-Zeiny, 2016).

Climate:

The climate is one of the most significant factors affecting international travel and tourism, as the climatic conditions of the country of tourist destination influence whether or not to travel there, as well as the level of tourists' satisfaction with tourism services and their participation in the activity, in addition to the critical role Climatic factors play in ensuring the safety and security of tourists (Scott & Lemieux, 2010).

Accordingly, and in terms of the meteorological conditions that predominate in Wadi al- Natrun, the region's climate is defined by hot summers and mild winters, with the region's average maximum temperature reaching 37 degrees Celsius in July and August and 20 degrees Celsius in January. The relative humidity increases in the late summer, autumn, and winter, peaking at a record 62 percent in November, January, and February, before falling below that level in the spring, peaking at 46 percent in May. The percentage of clouds also increases during the winter months, reaching a maximum in January and February and a minimum in summer and early autumn. In terms of rainfall, the rate is deemed low in Wadi El Natrun, where it reaches a maximum of 9 mm in January and is completely dry throughout the summer (Mohammed, 2021; Moussa & Mohamed, 2007). Figure 4 depicts the average temperature of Wadi El Natrun throughout the year.

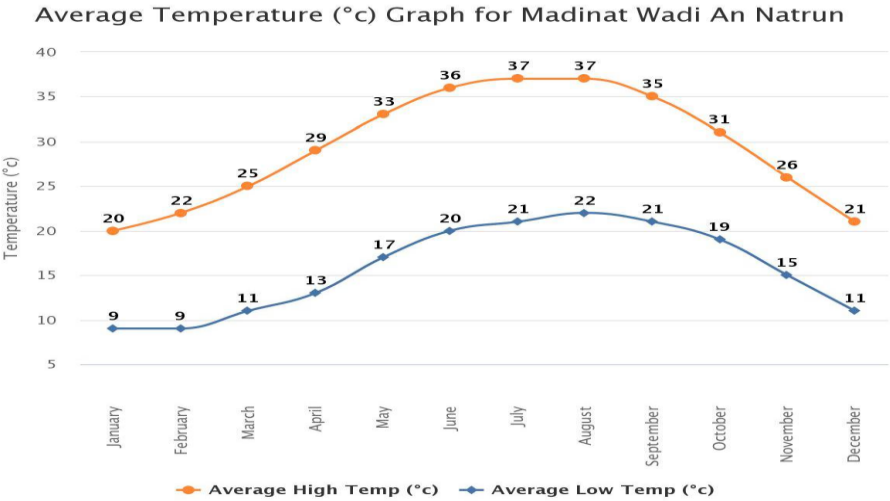


Figure 4. Average temperature during the year in Wadi El Natrun. Source. Meteoblue, 2021.



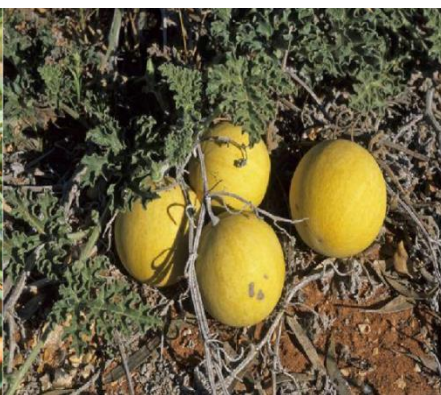
### Flora:

Egyptian flora is composed of endemic species from Africa and Asia, and some species from the Euro-Siberian region are included in this mix (Asgharnejad et al., 2021). Egyptian wild plants number 2,121 species, in addition to roughly 1,000 types of orchard plants, and the initial red list has 457 species, accounting for approximately 20% of the total Egyptian flora. According to the International Union for the Conservation of Nature's classification system, these plants are classified as follows: 14 extinct species, 153 threatened species, 54 extinct species, 173 uncommon species, and 93 undefined species. Wadi El Natrun's vegetation is a mix of desert and wetland flora (marshes). Among the most famous natural wild plants in Wadi El Natrun are *Alhagigraecorum* (Al-Aqoul) Figure 5, *Colocynth* (Hanzal) Figure 6, *Hyoscyamus* (Alsakran), *Juncusacutus* (Al-Sammar), Night blooming jasmine (Mesk Al-Layl), Wormwood, Halfa Barr, Tamarisk (Salt cedar or Al-Tar). These plants are medicinal in nature, as they are used to treat a variety of diseases and to aid in their entry.

Additionally, they are economically significant due to their transformation into numerous pharmaceutical compounds and their usage in the creation of oils, leaves, and fibre (De'bes, 2010).



**Figure 5.** *Al-Aqoul*. Source. By Author.



**Figure 6.** *Colocynth (Hanzal)*. Source. ByAuthor.



**Figure 7.** *Cyperus papyrus*. Source. By Author.



**Figure 8.** *Typhaelephantina*. Source. ByAuthor.

Wadi El Natrun is a somewhat important habitat for migratory waterbirds, with a total of 7,800 waders previously documented, and the area may be even more important during the autumn migration season (Méndez et al., 2021). Wadi El Natrun is known to be home to some of Egypt's largest winter bird populations, including Great Snipe, Shelduck, Eurasian Curlew, Little Stint, Kentish Plover, Curlew Sandpiper, Herons (Figure 9), Flamingo, Marbled Teal Duck (vulnerable conservation status), Shoveler, Northern Pintail, Garganey, Eurasian Coot, and Turtle Dove (Roca de Bes et al., 2013) and Additionally, throughout the spring and autumn, the Common Crane (Figure 10) is known to pass by and rest in huge numbers there, in addition to the nesting of approximately 12 species of waterfowl in Wadi El Natrun, including the largest breeding clan of Kittlitz's Plover birds in Egypt (Méndez et al., 2021; Saleh et al., 2017).



**Figure 9.** Herons. Source. By Author.



**Figure 10.** Common Crane. Source. By Author.

In terms of non-bird biodiversity, Wadi El Natrun is home to a diverse array of wild species, including hares, Egyptian red foxes (Figure 11), Egyptian wolves, Fennec foxes, Egyptian mongooses (Figure 12), and Desert monitors (Méndez et al., 2021). This is in addition to a variety of reptiles, the most notable of which is the rare *Philochortus Zolli* Lizard found exclusively in Wadi El Natrun. Additionally, Wadi Natrun was home to the uncommon *Crocidura Floweri* (BirdLife International, 2021). It's worth noting that *Gazella Leptoceros* was previously found in desert settings in Wadi El Natrun (Gelogo & Kim, 2014).



**Figure 11.** Egyptian red fox. Source. By Author. **Figure 12.** Egyptian mongoose. Source. By Author.

### **Evaluating Tourism Potential:**

Tourist development of any site with adequate tourism potential requires a range of information on the site's prospective tourism resources, which will assist developers, planners, and tourism decision-makers in making the best and most informed judgments. As a result, once a location or area of interest has been identified, the first stage in assessing the site's tourism potential is to inventory and classify existing and potential tourism resources. Numerous studies have been conducted to evaluate tourism from this perspective.

Potentials, and these investigations evaluated them using a variety of methods. For instance, but not exclusively, [Yeh et al. \(2015\)](#) used a mixed-methods approach to assess the potential tourism potential in Ethiopia's Bale region, combining questionnaires, interviews, and field observation, in addition to designing a descriptive research to assess and inventory the study area's current and potential tourism resources. While other studies, such as [Puscasu et al. \(2015\)](#) and [Asmelash and Kumar \(2019\)](#), used the fieldwork approach to analyse tourist resources through personal interviews and group discussions (2015). Other research, such as [Panbamrungkij \(2012\)](#) and [Gadakh et al.](#), have assessed tourist potential using multi-criteria analytic techniques, multi-criteria decision-making approaches, and decision-support techniques (geographic information systems) (2015). This research is mostly based on fieldwork, with stakeholder interviews serving as the primary source of data. It was used to identify and classify possible tourism resources in Wadi El Natrun, as well as to establish their feasibility for tourism development.

## **Methodology**

### **Data collection:**

To confirm the data's credibility, secondary data were gathered from books, journals, official papers, and the websites of international organisations. Primary data were gathered using a closed-ended questionnaire designed specifically to assess the tourist potential of Wadi El Natrun and to identify the relative weights of each indicator and sub-indicator. The author delivered the questionnaires directly to the local population in the research area, to employees of government agencies, to employees of travel agencies that organise day visits to nearby monasteries, and to certain members of families that pursue the profession of desert hunting. Additionally, a group of tourism specialists and academics engaged in tourism development, cultural preservation, biodiversity conservation, and tourism investment has been formed. Distribution occurred in June and July 2020, as well as January 2021. 227 questionnaires were issued, and 12 incomplete questions were eliminated during the data categorization and coding phase, resulting in a total of 215 examined questionnaires with a response rate of 95%. The questionnaire consists of seven tables comparing indicators pair-wise, as well as one primary question followed by an evaluation table. The evaluation table contains seven indicators and 66 sub-indicators. Respondents were asked to assign a weight to the relative importance of each indicator on a scale of one to nine, with one representing equal preference and importance (the lowest degree) and nine representing the highest degree of preference and importance (the highest degree).



**Analytical Techniques:**

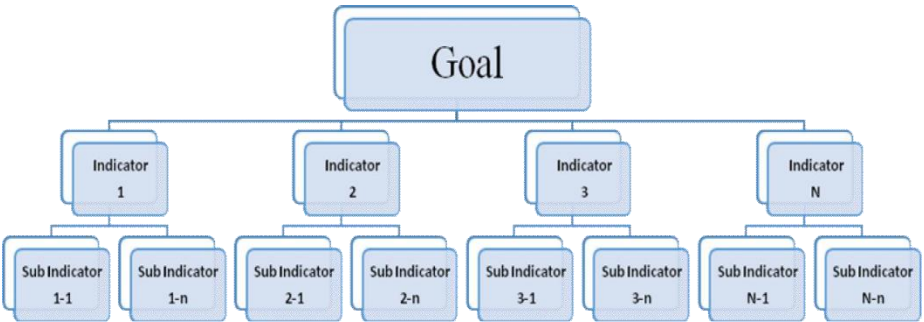
The primary data for this study were analysed using a hierarchical analytic technique. When many dimensions must be evaluated and classified, a reliable weighted approach based on expert consensus on the priority of elements is typically employed to aggregate scores against numerous dimensions in a single dimension.

quantity. The Hierarchical Analysis Process (AHP), a technique for organising and analysing complicated choice criteria, is the most suited method for developing a weighted system for prioritising relevant aspects inside an assessment framework. AHP has been applied in a variety of fields, including tourism, the environment, and sustainability, and has been essential in building a suitable weighting system for assessing tourism potential, resources, and sustainability. Given the method's shown efficiency in this sector, this study employs the AHP hierarchical analysis approach to identify the proper weights for the tourism resources in Wadi Al-Natrun and the order of priority for their utilisation in various tourism activities.

**Results**

**- Hierarchy Structure:**

The proposed hierarchical structure includes the general objective (Goal), the sub-goals (Indicators) and the constituent alternatives for each sub-goal (Sub-indicators) as shown in the following figure 13.



**Figure 13.** The proposed hierarchical structure for the study

**- Pair-wise Comparison:**

At this stage, a suitable structure for key indicators and sub-indicators is developed, upon which the indicators are aggregated; this is accomplished through a bilateral comparison of indicators with respect to the primary purpose, using AHP's Relative importance scale (1-9) (Saaty, 1994). Each of the seven major indicators in this study (Archaeological and Cultural Heritage, Traditions and Customs, Lakes, Topography, Climate, Flora, and Fauna) will be compared to the remaining indicators on a scale of relative importance (1-9), in order to determine the relative importance of each indicator in comparison to the remaining indicators. This process will be repeated. The nine levels of the relative importance scale are progressive in nature, with "1" denoting equal importance, "2" denoting up to moderate importance, "3" denoting moderate to strong importance, "4" denoting strong importance, "5" denoting strong to very strong

importance, "6" denoting strong to very strong importance, "7" denoting very strong importance, "8" denoting up to extreme importance, and "9" denoting extreme importance.

- **Weighting allocation:**

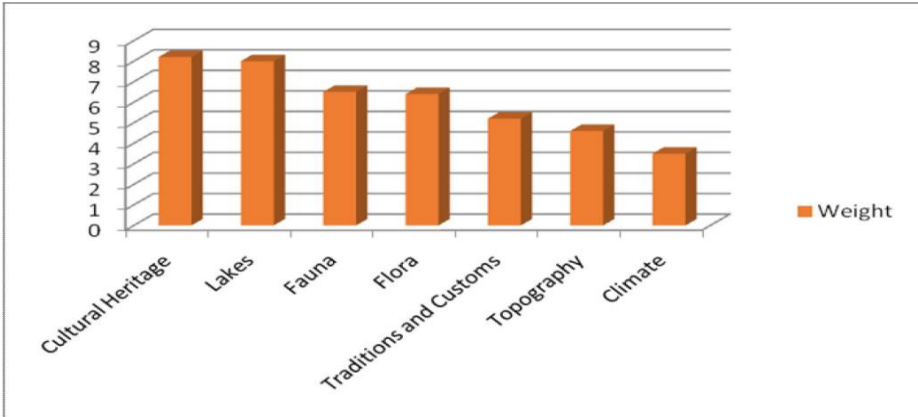
The results of the pair-wise comparisons revealed there liability of the judgments of the comparison process, as it was found that the consistency ratio (CR) is less than 0.1(the cut-off point).The consistency ratio (CR) was calculated using the following equation:

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

Where RCI is a random consistency index and CI is a tabular consistency index, calculated using the equation:

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

Where  $\lambda_{max}$  is the initial eigen value and n is the number of comparable elements. The consistency ratio (CR) for this study was 0.052, which is less than 0.1, indicating that the study is legitimate (Salmeron & Herrero, 2005). The following figure 14 illustrates the bilateral comparisons of indicators in descending order of relevance and consistency from the perspective of tourist stakeholders.



**Figure 15.** The bilateral comparisons of indicators according to the degrees of importance and consistency in descending order.

- **Credit allocation:**

In the Credit allocation step, all sub-indicators' weighting have been determined under each main indicator and based on the weights and pair-wise comparisons. Table 1 shows weights and credits analysis of the indicators and sub-indicators perceived by tourism stakeholders.

**Table 1.** *Weights and credits analysis of the indicators and sub-indicators as perceived by tourism stakeholders*

Indicator	Total Weight(%)	Max. Credit	Sub-indicator	Weight (%)	Mean	Max. Credit	Credit (%)
Tangible Cultural Resources "Archaeological & Cultural Heritage"	%22.8	9	St. Macarius Monastery "Deir Abu Makaria"	10.8	4.68	3	3.6
			Monastery of the Romans "Deirel Baramos"	4	4.24	2	2
			Monastery of the Syrians "Deires-Souriyan"	4	4.18	2	2
			St. Pshoi Monastery "Deir Amba Bichoi"	4	4.12	2	2
Intangible Cultural Resources "Traditions and Customs"	%10.2	15	The traditions of pastoral life	1.6	4.34	2	0.8
			The traditions of nomadic life	1.6	4.66	3	0.533
			The traditions of rural life	1.6	4.08	2	0.8
			Local "Bedouin/Rural clothing"	1.1	4.22	2	0.55
			Ornaments and women's jewelry	0.9	4.22	2	0.45
			Handicrafts	1.3	4.18	2	0.65
			Folkarts	1.2	3.84	1	1.2
			Home food products	0.9	3.88	1	0.9
Natural Resources "Lakes"	%21.2	18	AlJa'ar Lake	1.2	4.44	2	0.6
			AlFasidah Lake	1.8	4.54	3	0.6
			AlKhaḍra Lake	1.2	4.22	2	0.6
			AbuJbara lake	1.2	4.12	2	0.6
			AlRazina Lake	0.8	4.08	2	0.4
			AlHamra Lake	11.8	4.82	3	3.93
			AlBayda Lake	1.8	4.34	2	0.9
			Om Al Risha Lake	1.4	4.08	2	0.7



**Continued. Table 1.** *Weights and credits analysis of the indicators and sub-indicators as perceived by tourism stakeholders*

Indicator	Total Weight(%)	Max. Credit	Sub-indicator	Weight (%)	Mean	Max. Credit	Credit (%)
Natural Resources "Topography"	%9.8	14	North and north east plain	1.4	4.44	2	0.7
			Dahr El Tashasha/Khashm	1.2	4.21	2	0.6
			El Kaoud ridge				
			El Washika/El Qantara synclinal ridge	1.2	4.18	2	0.6
			Wadi El-Natron depression	1.5	4.08	2	0.8
			Wadi El-Farigh depression	2	4.68	3	0.6
			Wadi El-Tarfaya depression	1.5	4.12	2	0.8
			El-Alam/Gebel El-Hadid table land	1	3.86	1	1
Natural Resources "Climate"	%6.6	8	Climate during Winter Months.	1.7	4.12	2	0.9
			Climate during Spring Months.	1.8	4.22	2	1
			Climate during Summer Months.	1.5	4.02	2	0.6
			Climate during Autumn Months.	1.6	4.08	2	0.8
Natural Resources "Flora"	%13.8	24	Cyperus Papyrus	1.6	4.54	3	0.533
			Worm wood	1.2	4.34	2	0.6
			Halfa Barr	1.2	4.22	2	0.6
			Tamarisk, Salt Cedar	0.6	3.89	1	0.6
			Juncus Acutus (Al-Sammar)	0.9	4.08	2	0.45
			Anabasis (Ajram)	0.7	4.12	2	0.35
			Thymelaea (Al-Muthanan)	0.9	4.12	2	0.45
			Typha Elephantina	1.6	4.44	2	0.8
			Night-blooming jasmine (MeskAl-Layl)	0.9	4.32	2	0.45
			Hyoscyamus (Alsakran)	1.4	4.12	2	0.7
			Colocynth (Hanzal)	1.4	4.11	2	0.7
			Hagi Graecorum (Al-Aqoul)	1.4	4.24	2	0.7

**Continued. Table 1.** *Weights and credits analysis of the indicators and sub-indicators as perceived by tourism stakeholders*

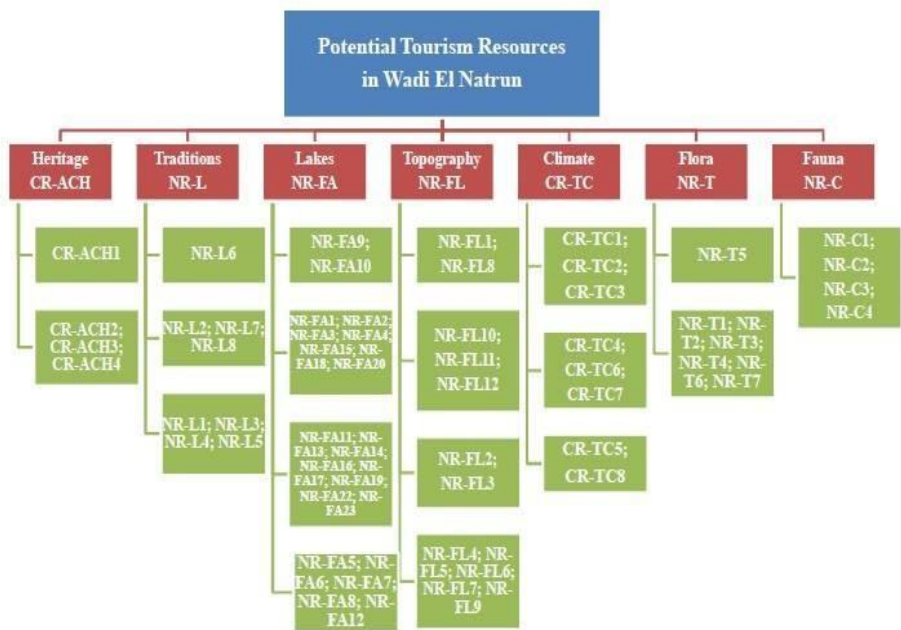
Indicator	Total Weight(%)	Max. Credit	Sub-indicator	Weight (%)	Mean	Max. Credit	Credit (%)
NaturalResources"Fauna"	% 15.6	47	Hares	0.8	4.12	2	0.4
			Egyptian Red Fox	0.9	4.34	2	0.45
			Egyptian Mongoose	0.8	4.22	2	0.4
			Desert Monitor	0.8	4.12	2	0.4
			Egyptian Wolf	0.5	4.08	2	0.25
			Fennec Fox	0.5	4.08	2	0.25
			Grass Loving Lizard	0.3	3.88	1	0.3
			Crocidura floweri	0.3	4.02	2	0.15
			Marbled Teal Duck	1	4.84	3	0.33
			Great Snipe	1	4.68	3	0.33
			Shelduck	0.7	4.12	2	0.35
			Curlew Sand piper	0.5	4.12	2	0.25
			Little Stint	0.6	4.44	2	0.3
			Kittlitz's Plover	0.7	4.12	2	0.35
			Hérons	0.8	4.34	2	0.4
			Shoveler Duck	0.6	4.08	2	0.3
			Garganey	0.7	4.32	2	0.35
			Common Crane	0.8	4.44	2	0.4
			Turtle Dove	0.7	4.22	2	0.35
			Eurasian Coot	0.8	4.18	2	0.4
			Northern Pintail	0.5	4.16	2	0.25
			Greater Flamingo	0.7	4.04	2	0.35
			Eurasian Curlew	0.6	4.12	2	0.3
Total	% 100						

According to the results of the weights and credits analysis of the indicators and sub-indicators of potential tourism resources in Wadi El Natrun as perceived by tourism stakeholders, as shown in previous table 1, the archaeological and cultural heritage indicator has the highest weight in terms of importance, suitability, and priority for exploitation in future tourism development in Wadi El Natrun, with a total weight of 22.8 percent. In terms of sub-indicators, St. Macarius Monastery "Deir Abu Makaria" achieved the highest relative weight of 10.8 percent of all sub-indicators, followed by Al Hamra Lake at 11.8, and the Wadi El-Farigh depression at 2%. To create the final hierarchical structure for the weights analysis of indicators and sub-indicators of Wadi El Natrun's prospective tourist resources as viewed by tourism stakeholders, all indicators and sub-indicators were coded according to the scheme given in Table 2.

**Table 2.** Codes of indicators and sub-indicators

Indicator	Sub-indicator	Codes	Indicator	Sub-indicator	Codes
Archaeological & Cultural Heritage. <u>Code:</u> CR-ACH	Deir Abu Makaria	CR-ACH1	Flora. <u>Code:</u> NR-FL	Cyperus Papyrus	NR-FL1
	Deirel Baramos	CR-ACH2		Worm wood	NR-FL2
	Deires-Souriyan	CR-ACH3		Halfa Barr	NR-FL3
	Deir Amba Bichoi	CR-ACH4		Tamarisk, Salt Cedar	NR-FL4
Traditions and Customs. <u>Code:</u> CR-TC	Traditions of pastoral life	CR-TC1		Juncus Acutus (Al-Sammar)	NR-FL5
	Traditions of nomadic life	CR-TC2		Anabasis (Ajram)	NR-FL6
	Traditions of rural life	CR-TC3		Thymelaea (Al-Muthanan)	NR-FL7
	Bedouin/Rural clothing	CR-TC4		Typha Elephantina	NR-FL8
	Women's Ornaments	CR-TC5		Night-blooming jasmine	NR-FL9
	Handicrafts	CR-TC6		Hyoscyamus (Alsakran)	NR-FL10
	Folkarts	CR-TC7		Colocynth (Hanzal)	NR-FL11
	Home food products	CR-TC8		Hagi Graecorum (Al-Aqoul)	NR-FL12
Lakes. <u>Code:</u> NR-L	AlJa'ar Lake	NR-L1	auna. <u>Code:</u> NR-FA	Hares	NR-FA1
	AlFasidahLake	NR-L2		Egyptian Red Fox	NR-FA2
	AlKhadraLake	NR-L3		Egyptian Mongoose	NR-FA3
	AbuJbaralake	NR-L4		Desert Monitor	NR-FA4
	AlRazinaLake	NR-L5		Egyptian Wolf	NR-FA5
	AlHamraLake	NR-L6		Fennec Fox	NR-FA6
	AlBaydaLake	NR-L7		Grass Loving Lizard	NR-FA7
	Om AlRisha Lake	NR-L8		Crocidura floweri	NR-FA8
Topography. <u>Code:</u> NR-T	North and north east plain	NR-T1		Marbled Teal Duck	NR-FA9
	Dahr El Tashasha ridge	NR-T2		Great Snipe	NR-FA10
	El Washika ridge	NR-T3		Shelduck	NR-FA11
	Wadi El-Natron depression	NR-T4		Curlew Sandpiper	NR-FA12
	WadiEl-Farigh depression	NR-T5		Little Stint	NR-FA13
	Wadi El-Tarfaya depression	NR-T6		Kittlitz's Plover	NR-FA14
	El-Alam/GebelEl-Hadid	NR-T7		Hérons	NR-FA15
Climate. <u>Code:</u> NR-C	Winter Climate.	NR-C1		Shoveler Duck	NR-FA16
	Spring Climate.	NR-C2		Garganey	NR-FA17
	Summer Climate.	NR-C3		Common Crane	NR-FA18
	Autumn Climate.	NR-C4		Turtle Dove	NR-FA19
				Eurasian Coot	NR-FA20
				Northern Pintail	NR-FA21
				Greater Flamingo	NR-FA22
				Eurasian Curlew	NR-FA23

Figure 16 shows the final hierarchical structure for the weights analysis of indicators and sub-indicators of potential tourism resources in Wadi El Natrun as perceived by tourism stakeholders according to the general consistency of data, pair-wise (bilateral) comparisons, total weights, and total credits of indicators, and the detailed weights and credits of sub-indicators.



**Figure 16.** The proposed hierarchical structure for potential tourism resources in Wadi El Natrun. Source. ByAuthor.

**Discussion and implications**

The purpose of this article is to identify and appraise possible tourism resources in Wadi El Natrun for future tourism development, as well as to prioritise their exploitation based on their relevance to tourism stakeholders. This study contributes significantly to the tourism literature by shedding light on an area rich in untapped cultural and natural resources and paving the road for policymakers, planners, investors, and stakeholders in Egypt to begin efficiently harnessing this vast tourism potential.

This study identified seven major indicators for classifying the potential tourism resources available in Wadi El Natrun, according to the Gunn classification (2002), and these major indicators included a total of 102 sub-indicators, which were filtered following the pilot study into 66 sub-indicators of greatest importance, for which the relative weights were determined later in the study, in order to determine the most significant indicators and sub-indicators and t The study's findings were disseminated to tourism professionals and government officials, who noted their utility in tourist planning for Wadi El Natrun and the fact that it supplied a wealth of information in an easily-accessible manner for planning and management of potential tourism resources.

The study confirmed that Wadi El Natrun is rich in a variety of diverse and unique natural and cultural tourism potentials, which is consistent with what was mentioned by [Ahmadi et al. \(2018\)](#); [Baldwin \(2012\)](#); [Dincu et al. \(2015\)](#); [Guo et al. \(2001\)](#); [Habitat \(2013\)](#) who all provided an account of a number of the area's natural and cultural components, albeit in a non-systematic and non-commercial manner. The tourist potential of Wadi El Natrun places it at the top of the list of sites where tourism resources must be quickly utilised before deteriorating and losing their current value. This paves the way for scholars to investigate the effects of human activity on Wadi El Natrun's tourism potential. Additionally, this outcome is critical for policymakers and planners, as it aids in formulating policies and plans that are compatible with the area's resources and enable successful and sustainable tourism development.

The study's findings indicate that the area's archaeological and cultural heritage, as represented by the monasteries of Wadi El Natrun, are the area's most valuable tourist resources, having achieved the highest value in terms of relative weight, importance, and suitability for tourism exploitation across all seven major indicators, which is consistent with what UNESCO stated in its report on the monasteries of [Soliman et al. \(2021\)](#). Additionally, this finding indicates that the area's archaeological and cultural heritage, as represented by the

The study's findings indicate that Al Hamra Lake is the most significant tourist resource in Wadi El Natrun (among all sub-indicators), as it gained the highest value in terms of relative weight, relevance, and suitability for tourism exploitation among all sixty-six sub-indicators. This result corroborates previous research on water resources and vegetation cover in [Kamel et al. \(2017\)](#); [Soliman et al. \(2021\)](#); [Zahidah et al. \(2017\)](#). In terms of practical implications, this finding is critical for policymakers and planners as they develop policies, strategies, and plans for sustainable tourism development in Wadi El Natrun; it is also critical for investors looking for a location suitable for non-traditional tourism projects and activities. This also enables academics to conduct in-depth studies of Al Hamra Lake's natural qualities and the tourism activities that may be based on them.

Finally, this study offered a hierarchical framework for Wadi El Natrun's prospective tourism resources, in which all resources are categorised and prioritised according to their relative relevance, suitability for tourism exploitation, and priority for tourism exploitation. Which can be viewed as the guiding principle for policymakers and planners when considering how to use the area for tourism purposes and building strategies and plans for sustainable tourism development.

Additionally, it is critical for academics who are looking for difficulties for future research projects that may be related to all of the study's primary and sub-indicators.

## Funding

The author acknowledges that this work was supported by the Deanship of Scientific Research, King Faisal University, Saudi Arabia (Grant No. NA00054).

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