*JSDSES.***Volume 3**, Issue 2, pp.117-133 (September, 2024)

Journal of Sustainable Development in Social and Environmental Sciences

Journal Homepage: **https://jsdses.journals.ekb.eg/**

P-ISSN: 2812-6335 E-ISSN: 2812-6343

Natural Potential for Sustainable Tourism Development in Port Said Governorate: A Study in Tourism Geography Using Geographic Information Systems and Remote Sensing

Nourhan Ahmed Hassanein Ramadan El-Masri*

* Department of Geography and Geographic Information Systems, Faculty of Arts, Port Said University, Egypt.
Email address: nourhanelmasry1995@gmail.com

doi 10.21608/jsdses.2024.310831.1035

ARTICLE HISTORY

Receieved: 8-8-2024
Accepted: 19-8-2024
Published: 24 -8-2024

KEYWORDS

Tourism movement
Spatial models
Natural resources
Tourism planning
Development methods

ABSTRACT

The study confirmed that Port Said possesses a variety of natural geographical potentials, which have recently enabled it to achieve noticeable development and growth in all its economic fields. Tourism has been prioritized in the current developmental programs. The natural geographical potential is closely linked to the tourism development process in Port Said Governorate. Tourism depends on investing natural potential in recreational tourism activity, and the importance of the geographical location is highlighted in giving Port Said its rightful place on the tourist map and making it a local and international tourist pole. The study revolves around the possibility of utilizing Port Said's natural resources when selecting the most suitable locations for tourism development, relying on the informational expertise gained from studying natural characteristics, measurements, and standards. This process considers the qualitative and quantitative changes in the demand and supply of tourist services, the variety of tourist attractions, and the intense competition among different tourist destinations. This is achieved by adhering to the appropriate planning standards for moderate services set by the General Organization for Physical Planning under the Egyptian Ministry of Housing, Utilities, and Urban Communities.

1. Introduction

Tourism has become an important economic activity that many countries rely on to develop their economies. The tourism industry in developed countries has seen significant progress and diversity in its performance and methods, enabling these countries to achieve high economic growth rates. In contrast, some developing countries still face challenges in achieving a balanced share of their tourism potential. Among these countries is Egypt, which, despite having the world's largest tourism capital, receives relatively low tourism revenue (Hamdan, 1984, p. 517).

Natural characteristics are essential components that shape the tourism map. The natural tourism potentials of Port Said have placed it at the forefront of local, regional, and global attention. These potentials are diverse and attractive, forming the foundation on which tourism institutions and activities are built.

It is the one that controls the patterns of tourism and the flow of tourists, as well as the distribution of recreational sites and locations. It constitutes the capital of tourism development and is one of the primary and essential factors that attract tourists. Therefore, it can be said that the first steps in tourism development in Port Said involve understanding the potential of its natural environment and how suitable it is for the development and support of tourism. In light of studying the geographical natural potentials of Port Said, a comprehensive proposal will be developed on how to exploit these potentials for tourism in both the present and the future.

Optimal service locations are considered one of the most important geographical phenomena that have distinctive distribution characteristics and are associated with various spatial relationships. Geographers and decision-makers are concerned with the topic of measuring tourism distribution to achieve a balance in tourism services across many areas.

This process involves three main aspects: centrality, proposed locations for building services, and accessibility to these sites (Jordan et al., 2004).

All of these areas require the application of advanced spatial analytical processes within a Geographic Information System (GIS) environment. This advancement is reflected in providing an interactive repository of spatial and descriptive information, which supports logical decision-making processes. In the last ten years, the importance of GIS in spatial analysis and supporting decision-making has become prominent, especially in planning and resource management.

Tourism development is one of the essential pillars of the Egyptian economy. Tourism plays a crucial role in achieving sustainable development, improving economic resources, and utilizing them optimally. The study aims to monitor and analyze the characteristics of tourist movements and tourist nights, understand the different characteristics of tourists, and identify the obstacles they face during their visit to Port Said. The goal is to find solutions that align with tourists' desires to increase the level of tourism flow and to determine the main course of action adopted in the strategic vision to achieve tourism development.

Port Said Governorate is located in the northeastern corner of the Delta region, at the northern gateway to the Suez Canal. It lies between latitudes 30° 55' 30" and 30° 16' 31" North, and longitudes 32° 27' 0" and 32° 6' 0" East. The geographical location plays a crucial role in tourism development and activity, influencing both the tourist supply and demand environments. It directly affects the nationality of tourists and their length of stay in the study area.

Both the location and spatial relationships, which are considered important natural factors, significantly shape the tourism infrastructure and determine the tourism map of Port Said Governorate. Their influence extends to natural and human resources, which are key components of tourism attraction in the study area. They also have a positive and impactful role in identifying tourism development axes, highlighting major tourism patterns, and clarifying tourism activity volume. The location is the primary factor in selecting suitable sites for tourism projects, making it a critical phase in the preliminary studies for successful sustainable tourism development.

The unique geographical location of Port Said gives it significance in tourism development due to its position at the crossroads of historical trade routes between the East and the West, connecting Asia, Africa, and Europe. It is bordered to the north by the Mediterranean Sea, to the south by the Ismailia Governorate, to the east by North Sinai Governorate, to the west by the administrative boundaries of Damietta and Dakahlia Governorates, and to the southwest by Sharqia Governorate. Its small area, measuring 1,345 km², and its borders with five governorates contribute to its strategic importance.

Despite its attractive natural resources that enhance its global and national tourism profile, Port Said's tourism income remains minimal compared to other Egyptian governorates. Since the beginning of efforts to promote Egyptian tourism, there has been significant focus on developing specific areas without adequately considering Port Said's unique location and tourism potential. Consequently, Port Said has

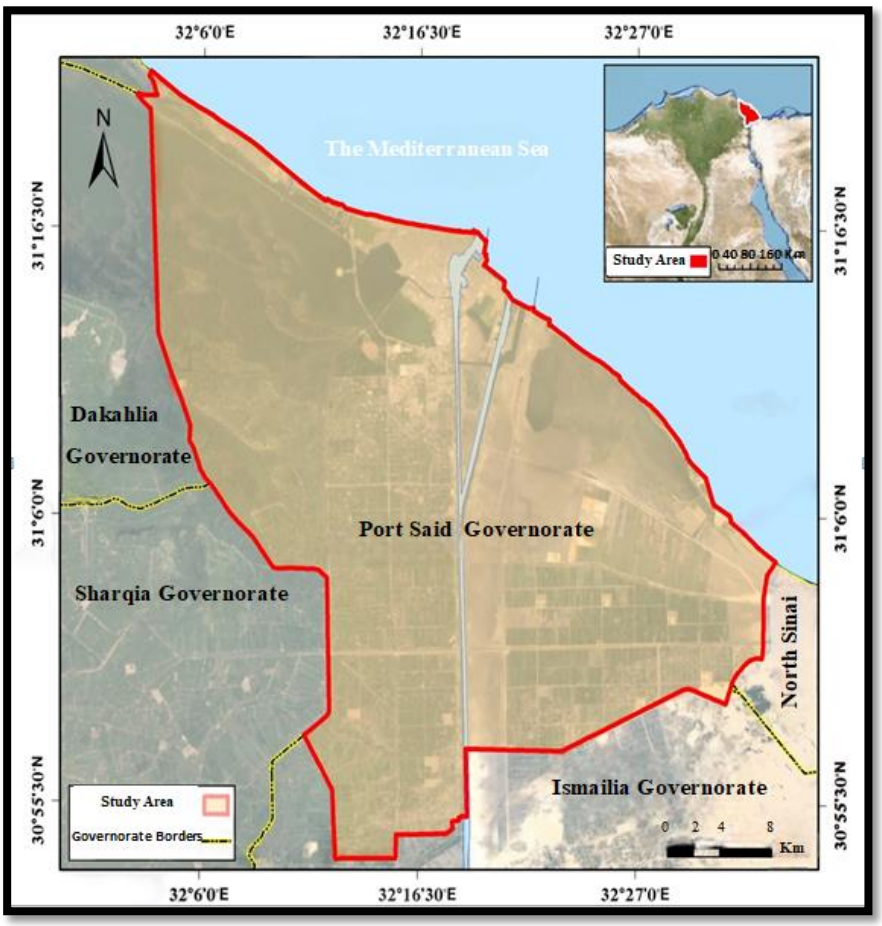
not received the level of attention that matches its rich tourism assets.

1.1. Importance and Objectives of the Study

The importance of the study lies in being one of the applied studies concerned with improving spatial tourism planning as well as enhancing the quality of land use and services in some areas of urban expansion. This is achieved by focusing on analytical studies related to sustainable natural tourism development and using the best analysis methods to evaluate and select the most suitable locations spatially. This is done according to the natural criteria of the study area, helping specialists and decision-makers in taking appropriate steps for comprehensive development. The location of Port Said Governorate significantly contributes to determining its spatial relationships and the potential for developing the ongoing economic activities. The location helps reshape future development plans.

1.2. Data Used in the Study

To achieve the research objectives, the study relies on documentary sources represented by statistical data and figures from the Central Agency for Public Mobilization and Statistics, data from the Egyptian General Authority (Conoco), including the Geological Map of Egypt at a scale of 1:500,000, the ASTER Global DEM elevation model, as well as data from Geographic Information Systems and digital transformation in Port Said Governorate. Additionally, it uses various monthly information bulletins from the Ministry of Tourism Office and data from the Tourism Promotion Authority, as well as data from the General Authority for Meteorology in Cairo for the period from 1979 to 2018. This is in accordance with the planning standards for moderate services defined by the General Authority for Urban Planning of the Ministry of Housing, Utilities, and Urban Communities of Egypt.



Source: Figure prepared by the student based on the American Landsat satellite image with a resolution of 15 meters, 2021, using the ArcGIS 10.8.1 program.

Figure 1. Port Said Governorate Location

2. Research Methods and Study Approaches

The student relied on the applied methodology and quantitative analytical methodology in this study. The applied methodology depends on cause and effect as a means to achieve a specific goal and is used to address the problems faced by tourists during the study. The quantitative analytical methodology, on the other hand, employs quantitative methods that are consistent with addressing study changes and adds an accurate analytical dimension.

This includes the current conditions of tourism, the stages of development of incoming tourist movements, and identifying the most significant developmental processes that have affected the volume of tourist flows. Additionally, the student utilized various statistical methods to analyze diverse tourism data and indicators.

The descriptive analytical methodology was also employed, and the study touched on the strategy of integration and merging between modern methods and techniques in information systems. This was aimed at understanding spatial patterns and variations. Furthermore, the inductive methodology was used to analyze the imagery from the American Landsat satellite with a resolution of 15 meters for the year 2021. This was aimed at testing locations by obtaining appropriate maps that illustrate this process, to evaluate the most suitable sites for tourism development in Port Said.

3. Previous studies

Studies that addressed the study area or its topic include the following:

- Khorshid (1993): The study discusses the basic features of tourism development in the Red Sea Governorate, as well as the importance of tourism nature, human and cultural resources, the basic environment, and services from the tourist destination. It also discusses tourism development and its links to the first five-year national plan, the achievements of the second five-year plan and the objectives of the five-year plan, then focuses on Sahl Hasheesh area.
- Abdel Aal (1994): The thesis consists of three chapters. The first deals with the natural and human potential of the Red Sea Governorate. The second deals with the economic potential. The third includes a study of services, educational and health and problems, land, sea and air transportation, housing, drinking water, electricity and sanitation.
- Gamal (2000): His study focuses on the importance of both geographical and astronomical locations in the development of tourism centers along the Red Sea coast.
- Siraj El-Din (2008): Her study emphasizes the significance of Port Said Port as a major gateway for transient tourism, highlighting the influence of geographical and astronomical locations on tourism activities in the area.
- Abu El-Ela (2013): Her research explores the application of Geographic Information Systems (GIS) in evaluating and enhancing economic development in the Suez Canal governorates, focusing on geographical and natural factors.
- Kamel (2016): His study examines the importance of tourist accommodation centers and the use of GIS in improving and developing these centers based on geographical variables.
- Saber (2022): His study entitled “Wetland Quality for Sustainable Development Northwest of the Suez Canal: Components and Constraints” addresses the fact that wetlands northwest of the Suez Canal are exposed to various constraints that have a negative impact on ecosystems, and thus the principles of sustainable development require proper planning and management so as to preserve wetlands. The study also emphasizes the economic importance and benefits of wetland biodiversity that are evident in many fields including recreation and tourism.

4. Study Variables

The studies collectively analyze various geographical and natural variables to assess the efficiency and significance of both old and new urban establishments, and how these variables can be leveraged for tourism development. The analysis results are utilized to construct spatial models that determine the suitability of

development efforts and the achievement of standards in the study areas.

4.1. Location and Site

The studies highlight the positive impact of both astronomical and geographical locations on natural environments, particularly in Port Said. The moderate climate, rich biodiversity, and presence of natural reserves contribute directly or indirectly to the flourishing of tourism activities. These geographical characteristics aid in defining the type and nature of tourism movement and enhance tourism promotion in the region.

In summary, these studies underscore the critical role of geographical and natural factors in tourism development in Egypt. The application of modern tools such as GIS significantly contributes to sustainable development and the improvement of tourism services

Geographical location is a significant factor influencing tourism development and tourism activity. It is one of the most crucial natural potentials of the tourism environment. Its importance is highlighted in defining the geographical framework of Port Said Governorate, in addition to studying the relationship of the location with both the prevailing natural and economic resources.

It plays a primary and important role in tourism development and the movement of tourism activity between the supply and demand environments.

The geographical proximity of certain governorates and countries to Port Said reduces travel costs due to the shorter distances, which in turn may decrease the likelihood of extended stays. Conversely, greater distances between Port Said and tourism-sending regions increase travel costs, encouraging longer stays to compensate for the higher time and space costs. Thus, the geographical location creates an important economic dimension for the study area, fostering various tourism patterns such as day trips, conference tourism, transit tourism, and recreational tourism.

The positive impact of the geographical location is evident in the thriving tourism industry in Port Said. The ease of connectivity with the outside world and proximity to major tourism demand regions contribute to this prosperity. Port Said is an urban governorate located in the northeast of the Nile Delta in Egypt. It occupies a distinguished position at the northern end of the Suez Canal and the Mediterranean coast, given its location in the northern part of the Suez Canal. This geographical location grants Port Said significant importance in tourism development.

Port Said Governorate occupies a strategic location at the crossroads of historical trade routes between the East and the West. It bridges Asia and Africa and overlooks Europe. The governorate is bounded to the north by the Mediterranean Sea, to the south by the borders of Ismailia Governorate, to the east by North Sinai Governorate, and to the west by the administrative borders of Damietta and Dakahlia Governorates, with the southwestern border adjacent to Sharqia Governorate. Despite its relatively small area of 1,345 km² (Egyptian Cabinet, Information and Decision Support Center, Description of Egypt with Information, Area Data 2019, 12th edition, 2021, p.5), it shares borders with five governorates.

This location has enabled Port Said to serve as a transit point between the Sinai Peninsula in the east and the governorates of eastern, central, and western Delta in the west, particularly with the presence of the Northern Coastal International Road linking Mediterranean ports (Arish, Port Said, Damietta, and Alexandria). This contributes to urban development and attracts economic activities such as the industrial zone in East Tafriaa and agricultural development in Sahl El Tina, in addition to promoting tourism development. The location has endowed Port Said with a Mediterranean coastline and access to the Suez Canal, thus enhancing its potential for diverse recreational and economic tourism activities (Mohamed, 2010, p.15).

Port Said Governorate is distinguished by hosting two of Egypt's most important ports for tourism: East Port Said and West Port Said. Their strategic location on the Eastern Mediterranean sea route allows them to provide services to tourist ships and yachts. Consequently, the governorate has gained global economic significance and has become a focal point for increasing tourist activity. The geographic

concentration and accessibility of these ports have significantly boosted tourist inflows to Port Said and promoted tourism development within the governorate.

The geographical setting of Port Said has facilitated the establishment of tourist villages along its coasts, the expansion of fishing activities, and fish farming, given the abundance of fishing grounds such as the Mediterranean Sea, Lake Port fouad, and Lake Manzala. The southern part of the governorate, characterized by its clay plains and sand dunes, has been utilized for land reclamation covering 135,000 feddans, especially after the provision of water through the Salam Canal. The geographical location has also enabled the establishment of East and West Port Said ports on the Mediterranean, boosting maritime trade and promoting the industrial zone in East Tafriaa, alongside facilitating the movement of tourist ships for one-day tourism (Abu El-Ela, 2013, p. 6).

The location plays a crucial role in guiding commercial tourism development, which is one of the main attractions of Port Said Governorate. This importance stems from its strategic maritime commercial entity, the Suez Canal, which continues to be a significant source of national income and economic activity for the governorate. The Suez Canal attracts investments from neighboring countries due to its strategic position, accommodating both commercial and tourist vessels.

Additionally, the geostrategic location of the East Port Said hub port contributes to the integration of international transport in the Eastern Mediterranean region and the Arabian Gulf. The port's prime position at the crossroads of global trade between the East and the West has made it a comprehensive maritime transport system and a vital economic hub.

Port Said is one of Egypt's key ports, attracting a substantial share of large container trade from the Middle East and European countries, as evidenced by the 2777 ships it received in 2015 (Port Said General Authority, Passenger and Cargo Traffic Department, unpublished data, 2015). This, in turn, has fostered the growth of commercial tourism in Port Said.

The significance of the location also lies in the natural formation processes of Port Said Governorate, emphasizing the importance of its unique geographical position in directing tourism development. This is evident in the comprehensive transportation networks (roads, railways, maritime, and air transport), which play a pivotal role in shaping tourism development and determining the flow and distribution of tourists. The ease of mobility within Port Said encourages both domestic and international tourism, with the governorate welcoming approximately 193,972 tourists, totaling 263,941 tourist nights (Port Said Governorate General Information Systems and Digital Transformation Administration, Monthly Information Bulletin of the Ministry of Tourism Office, unpublished data, December 2019).

The significance of Port Said's location is evident in determining the placement of events, services, and tourism facilities. This location influences urban centers by highlighting historical tourist attractions, which in turn dictate the establishment of key sites for various types of tourism, contributing significantly to the economic revenue of Port Said. Additionally, it helps identify the most suitable locations for archaeological tourism, such as the historically significant houses in Port Fouad, which have a unique architectural and cultural heritage distinct from other Egyptian governorates.

Moreover, Port Said's location positively impacts domestic tourism activity by creating an optimal environment for receiving tourists and vacationers, particularly through its beach tourism, which is a major attraction and contributes to the increase in tourism traffic in the governorate.

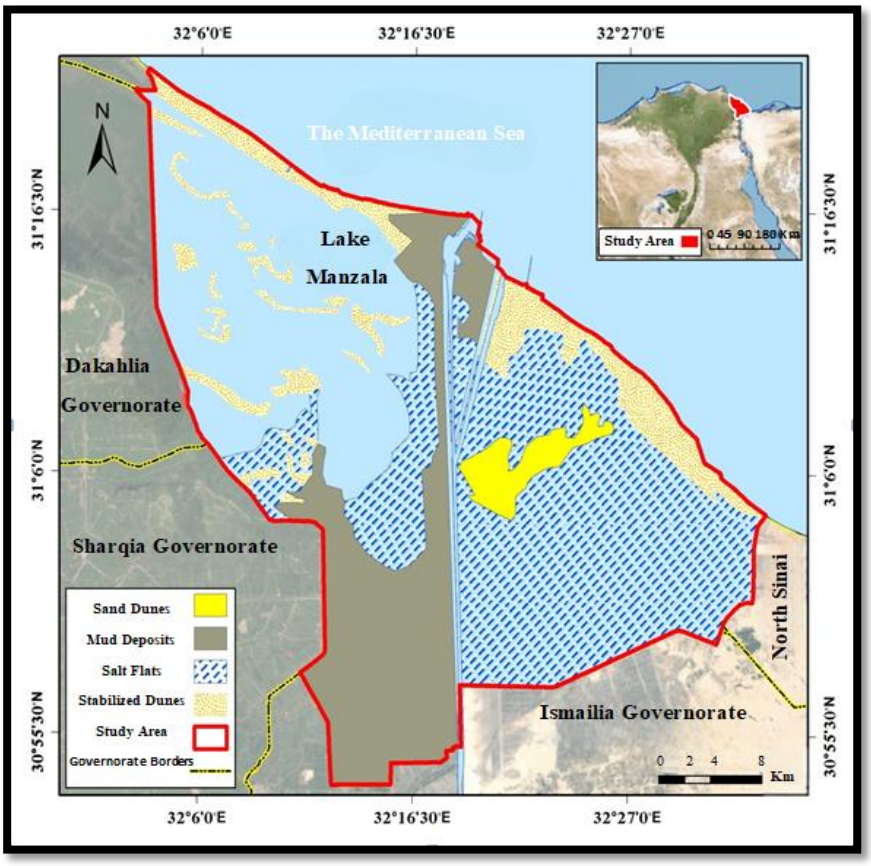
4.2. Geological Formations

Geological characteristics represent a branch of geological tourism, which is a major aspect of tourism involving a scientific yet entertaining and recreational approach. This type of tourism is a significant internal tourism trend that highlights the potential for natural tourism development in Port Said. It aims to preserve natural landmarks and geological diversity by raising awareness about their importance and promoting sustainable development in preserving geological features.

Together with historical and cultural tourism potential, geological characteristics make Port Said a distinguished tourist destination that can attract tourists and those interested in environmental and scientific heritage. It also helps develop a comprehensive and diverse tourism infrastructure in the region. The study of geological characteristics forms the foundational basis for geographical and environmental studies.

The geological formations are considered one of the most important natural components for tourism development. They are one of the elements of geological characteristics that must be studied for their direct impact on Port Said Governorate. These formations reflect the nature and distribution of sediments and clarify the soil's suitability and readiness for various constructions. They are a fundamental and important element in identifying different sedimentary environments affecting the topographical characteristics of Port Said Governorate. The geological structure determines the characteristics of the topographical map (Hamdan, 1980, p. 102), which is one of the most important pillars of the tourism offering within the study area. It also controls the determination of the best sites for establishing various types of tourist facilities and accommodation centers.

The geological formations played an important role in influencing the Port Said port, which represents an integrated maritime transport system. The coast on which Port Said was established had a special effect on the state of the port (El-Gamal, 1954, p. 7). Despite the fact that "the site in which Port Said was established and developed was nothing but a coastal strip ranging in width between forty and fifty meters between Lake Manzala and the Mediterranean Sea. Water sometimes flooded it, as it was characterized by its flatness and the absence of heights" (Saber, 2024, p. 61). In some places, the zero contour line lies south of the coastline itself, as is the case south of Lake Manzala.



Source: The figure is prepared by the student based on data from the Egyptian General Corporation Conoco, Geological Map of Egypt, Scale 1:500,000, Cairo Sheet, 1987, using ArcGIS 10.8.1.

Figure 2. Geological Formations in Port Said Governorate

Table 1. Numerical and Percentage Distribution of Geological

M	Geological formation	Area (km^2)	Area (%)
1	**Clay deposits**	239	17,7
2	**Sand dunes**	20	1,5
3	**Salt flat**	535	39,8
4	**Stable dunes**	105	7,8
Water bodies		446	33,2
Port Said Governorate		1345	**100**

Source: The table and ratio calculations prepared by the student based on the data in Figure 2.

They are classified according to their morphological characteristics as elongated, irregularly shaped salt flat, taking a longitudinal shape parallel to the coastline from east to west. They spread along the eastern side of Port Said Governorate along the length of the Suez Canal and on the western side of the canal south of Port Said. They are also found in the south and east of Lake Manzala. The accumulation of Nile water in a low area in the northeast of the delta and the mixing of Nile water with seawater, driven eastward by the northern, northeastern, and northwestern winds in winter, led to the emergence of a large series of salt marshes and ponds on the shores of Lake Manzala. These areas have a high groundwater level, either due to seepage from the lake's waters or the proximity of Mediterranean waters through the porous sandy soil (El-Said, 1995, p. 22).

Salt flat one of the most important coastal geomorphological phenomena that positively impact tourism. The appearance of salt flat in a low and nearly flat area has played an important role in providing wide beaches that can be utilized for coastal recreation, placing coastal recreational tools, and planning various sports fields (Khattab, 2007, p. 279). There is a close connection between salt flat and the development of eco-tourism within the study area, as they are integrated ecosystems with numerous plants growing on their surface and various animals and birds living on these plants.

The spread of salt flats over a large area in Port Said Governorate reflects on economic development processes, whether urban, industrial, or tourist. The study area targets economic planners, making it essential to find the best ways to use salt flat lands in various development processes without compromising the natural environment of the study area. Human intervention has played a significant role in the evolution of salt flat shapes, cutting large areas of salt flat lands for various development purposes in Port Said Governorate, including urban expansion and the establishment of tourist facilities, accommodation centers, and recreational, health, educational, and commercial services. This is evident in the many projects established on salt flatlands, such as the East Port Said Port project in the northwest part of the Tina Plain and the project to create the million-city east of Port Said, which has appropriated a large area of salt flat in the Tina Plain.

The coastal salt flat in the study area are characterized by numerous natural resources that can be exploited and developed to increase their economic importance. This can be done in several ways, starting with treating the salt flat soil by filling it with salt-free clay soils to make it suitable for agriculture or continuously washing the soil to reduce salt concentration as much as possible. Alternatively, the soil can be planted with salt-tolerant plants that can withstand drought conditions and have high economic value, such as plants that protect the shores from erosion. Additionally, the salt flat areas can be developed and utilized by constructing urban buildings. It is known that salt flat soil is fragile and salty, unsuitable as a foundation for any building. Therefore, salt flat deposits must be excavated to depths consistent with the building. Accurate scientific studies must be conducted to understand the properties of the salt flats, and no tall buildings should be erected on them to prevent collapse. The areas occupied by salt flats should be made suitable for establishing coastal tourist villages, chalets, and cafes consisting of at least one floor.

4.2.1. Clay Formations

They are represented as clay deposits and occupy the second-largest area of geological formations in Port Said Governorate, covering an area of 239 km², which is 17.7% of the total area of the governorate. Clay deposits are spread in the north of the governorate, north of Port Fouad, and

Port Said city, along the western side of the Suez Canal, and in the south of Port Said Governorate. The abundance of clay deposits has positively impacted tourism, as they are used in the building materials for constructing tourist facilities and accommodation centers.

4.2.2. Sand Formations

The sand formations are among the most important geological formations in the study area and significantly influence developmental activities within it. This is evident from studying and analyzing the geological history of Port Said Governorate. The natural environmental influences on this geomorphological form are divided into two types: stable dunes and sand dunes. They are distributed on the geological formation map of Port Said Governorate as follows:

4.2.2.1. Stable Dunes

They spread along the strip extending west of Port Said city and are also found within Lake Manzala. They cover an area of 105 km², accounting for 7.8% of the total area of Port Said Governorate. These are longitudinal dunes parallel to the sea barrier, with edges and sand hills without a specific shape. These edges are connected and extend over long distances. Their negative impact on tourism development in Port Said Governorate is evident, as the wind speed carrying dust, sand, and sandstorms poses a danger to existing tourist facilities and urban tourist centers in Port Said, as well as historical and heritage sites. This necessitates the establishment of windbreaks to mitigate the risk of sand encroachment.

4.2.2.2. Sand Dunes

These are represented as sand deposits, formed in shallow coastal waters, usually parallel to the coastline, and often submerged under water. They appear on the surface during the ebb tide and result from the waves starting to break as they reach shallow waters, forcing them to deposit some of their sand load.

They occupy the smallest area of geological formations in Port Said Governorate, distributed on the eastern side of Port Fouad city. They cover an area of 20 km², accounting for 1.5% of the total area of Port Said Governorate. The small percentage of sand deposits in Port Said has had a positive impact on the beach, helping to restore balance to the beach and protect it from increasing erosion to maintain its touristic value. It also helped protect the seaside tourist villages from erosion and danger, thus having a positive effect on beach tourism in Port Said Governorate.

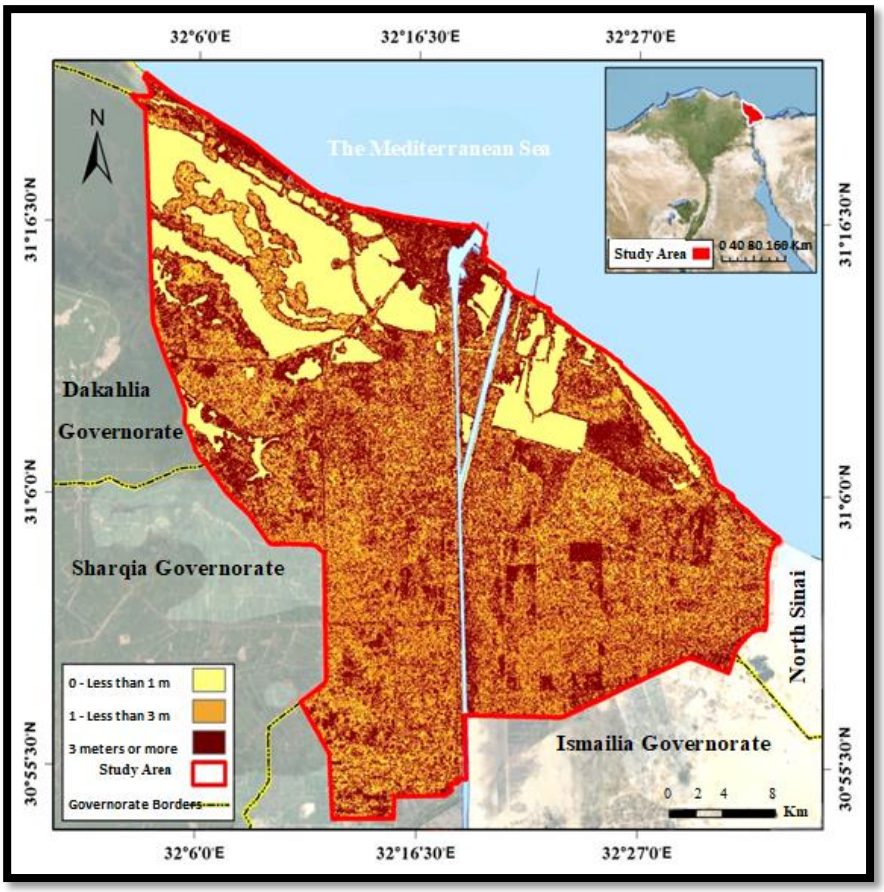
4.3. Topographical Characteristics

Topographical characteristics are among the most important natural potentials for tourism development, playing a positive and influential role in the tourism industry and the evolution of tourism activities. They govern the determination of tourist attractions and the various tourism activities that can be practiced in Port Said Governorate. These characteristics create numerous tourist destinations with varying appearances, forms, and distribution patterns, affecting their features and advantages that determine the locations for establishing the most important diverse tourist facilities.

The study of topographical characteristics aims to identify the general features of Port Said Governorate's topography by analyzing elevations and slopes. The topographical characteristics of Port Said differ from those of other Egyptian governorates due to its geographical location, characterized by simplicity and lack of geomorphological complexities and natural contradictions. The significance of the intersection boundaries between the surface features of Port Said lies in attracting tourists; the boundary between water bodies and land is considered the best tourist site in the governorate. The surface of the study area is characterized by low elevations, making it suitable for various tourism development projects.

The impact of studying and analyzing topographical characteristics is reflected in the tourism infrastructure and its forms, extending its influence on the axes of urban tourism growth. It is one of the most important geomorphological studies, based on the precise analysis of surface features, such as analyzing elevations, slopes, and their directions. Accordingly, the student worked on studying and analyzing the general features of

different surface characteristics, their topography, and levels, which determine the types of existing tourism activities in Port Said Governorate. This was done using a Digital Elevation Model (DEM) with a resolution of 15 meters.



Source: The figure was prepared by the student based on the Digital Elevation Model (DEM) from Aster Global, 2021, using ArcGIS 10.8.1.

Figure 3. Digital Elevation Model of Port Said Governorate

Table 2. Numerical and percentage distribution of elevation categories and their areas in Port Said Governorate

M	Elevation Categories (meters)	Area (km²)	Area (%)
1	0 - Less than one meter	562	41,8
2	1-Less than three meters	530	39,4
3	Three meters or more	253	18,8
Total		1345	100

Source: Table and ratio calculation prepared by the student based on the data in Figure 3.

The analysis of both Table 2 and Figure 3 shows that Port Said Governorate is generally characterized by its flat surface and lack of rugged terrain, along with very low elevation categories compared to other coastal governorates. The surface elevations range from 0 to more than 3 meters. The area is dominated by water-saturated lands and water-covered areas, often with an elevation between 0 to less than 1 meter, concentrated in the extreme north and featuring many geomorphological phenomena. From this, the study area can be divided into the following limited elevation categories:

- **Elevation Category (0 - less than 1 meter):** This is the largest elevation category in Port Said Governorate, covering most of the water-saturated lands. It spans an area of 562 km², accounting for 41.8% of the total area of the

governorate. It is located in the extreme north and extreme southwest and includes ponds, salt pans, islands, and lakes.

- **Elevation Category (1 - less than 3 meters):** This is the second largest elevation category in Port Said Governorate, covering an area of 530 km², which is 39.4% of the total area of the governorate. It is found in the southeast and southwest, with parts extending to the extreme north. In this category, land and water intermingle along the coastline, creating varied and diverse marine tourist environments. This has resulted in a suitable environment for numerous recreational and service activities that can be utilized to boost tourism in Port Said Governorate.
- **Elevation Category (3 meters and above):** This is the smallest elevation category in Port Said Governorate, covering an area of 253 km², which is 18.8% of the total area of the governorate. It is scattered in varying and small percentages in the extreme north and northeast, gradually decreasing towards the southeast and northwest. Parts of the south and west can be utilized for various economic establishments, industrial or tourism-related.

4.4. Climatic Characteristics

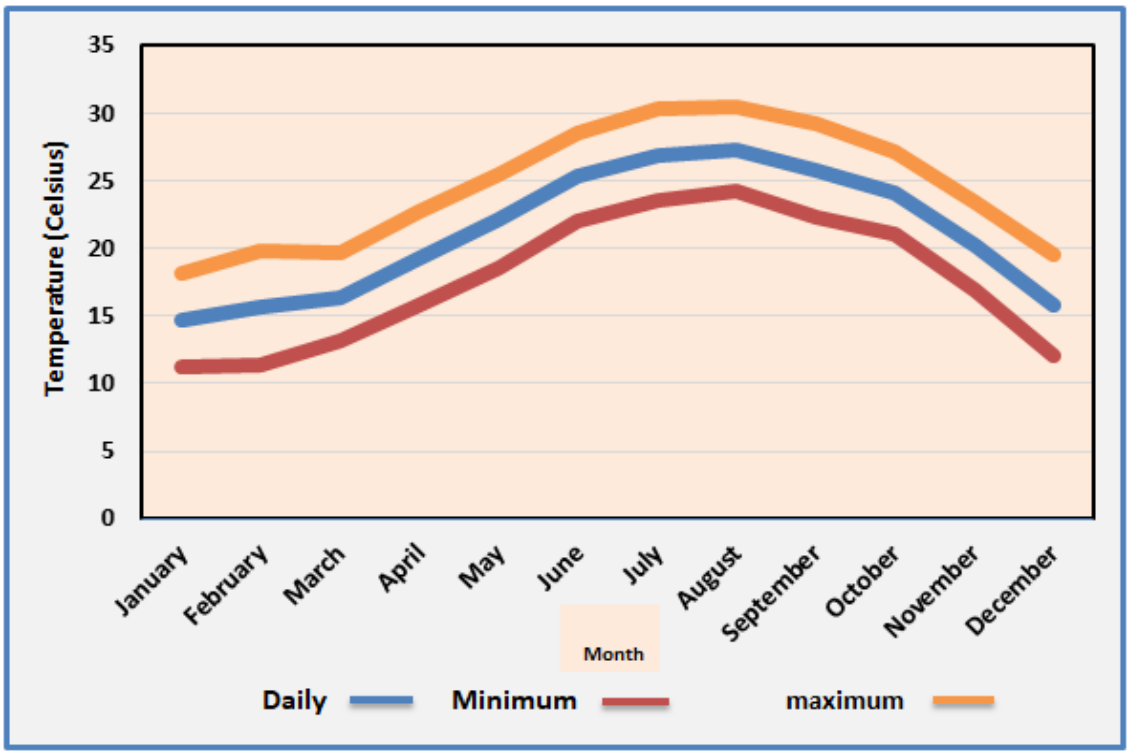
Climatic characteristics are among the most significant natural attractions impacting tourism development in the Governorate of Port Said, either positively or negatively. The climate is a crucial natural resource for any tourist destination and represents an intangible asset for many recreational sites. The climatic influence varies depending on global climatic regions (Abdel Hakim & El-Dib, 2001, p. 49).

In general, Port Said experiences moderate climatic conditions during the spring, summer, and autumn seasons throughout the study area. As a coastal governorate, Port Said benefits from the Mediterranean Sea's effects, which is a key ecological attraction. The Mediterranean significantly moderates temperatures during the summer, making Port Said an ideal destination for various recreational and service-oriented tourism activities. In the light of this fact, it is essential to examine the temperature element. This analysis will cover maximum and minimum temperature values on a monthly, seasonal, and annual basis based on data from the Port Said meteorological station from 1979 to 2018.

Table 3. Monthly, Seasonal, and Annual Average Temperatures at the Port Said station from 1979 to 2018

DATA		Average Temperature (Celsius)		
		maximum	Minimum	Daily
Month	January	18.1	11.2	14.7
	February	19.8	11.4	15.6
	March	19.6	13.2	16.4
	April	22.7	15.8	19.3
	May	25.5	18.6	22.1
	June	28.5	22	25.3
	July	30.3	23.5	26.9
	August	30.4	24.2	27.3
	September	29.2	22.3	25.8
	October	27.1	21.1	24.1
	November	23.4	16.9	20.2
	December	19.5	12	15.8
Season	Winter	19.1	11.5	21.1
	Spring	22.6	15.9	15.3
	Summer	29.7	23.2	19.2
	Autumn	26.6	20.1	26.5
Annual Averages		24.5	17.7	23.3

Source: Prepared by the reliable student based on data from the General Meteorological Authority, Cairo, unpublished data from (1979-2018).



Source: Figure prepared by the student based on Table 3.

Figure 4. Average monthly, seasonal and Annual Temperatures at Port Said station from 1979 to 2018

The analysis of both Table 3 and Figure 4 reveals a significant reduction in temperature range throughout the year, primarily due to the influence of the Mediterranean Sea. The maximum temperature does not exceed 30.4°C in summer and does not drop below 18.1°C in winter. Consequently, the temperature in Port Said is highly conducive to summer tourism compared to winter tourism, making it more suitable for tourism activities during the summer months than during winter months. Furthermore, the minimum temperature ranges between 11.2°C and 24.2°C. The lower temperatures during the winter result in a shorter tourist season, which, in turn, reduces hotel and resort occupancy rates.

Determining climate comfort zones is beneficial for the development and utilization of any tourist area. Accordingly, quantitative methods have been employed to study the relationship between air temperature and relative humidity in Port Said and their effects on human comfort, including feelings of comfort or discomfort. The quantitative methods aim to identify optimal times for recreation and to illustrate the level of tourist activity. One of these methods involves the study by Adolph (Adolph), which measures the body's sweat secretion. This study is used as a criterion to assess human comfort or discomfort with the surrounding weather conditions. The equations are as follows (Tolba, 2004, p. 182):

- Daytime sweating equation: (720 + 41 (T - 33))
- Nighttime sweating equation: (400 + 39 (T - 33))
- where (T) represents the air temperature in degrees Celsius.

Applying these equations to the study area yields Table 4 which illustrates the relationship between the average maximum and minimum temperatures and the rate of sweat secretion.

Table 4. Sweat Quantity for Humans during the day and night in Port Said (1979-2018)

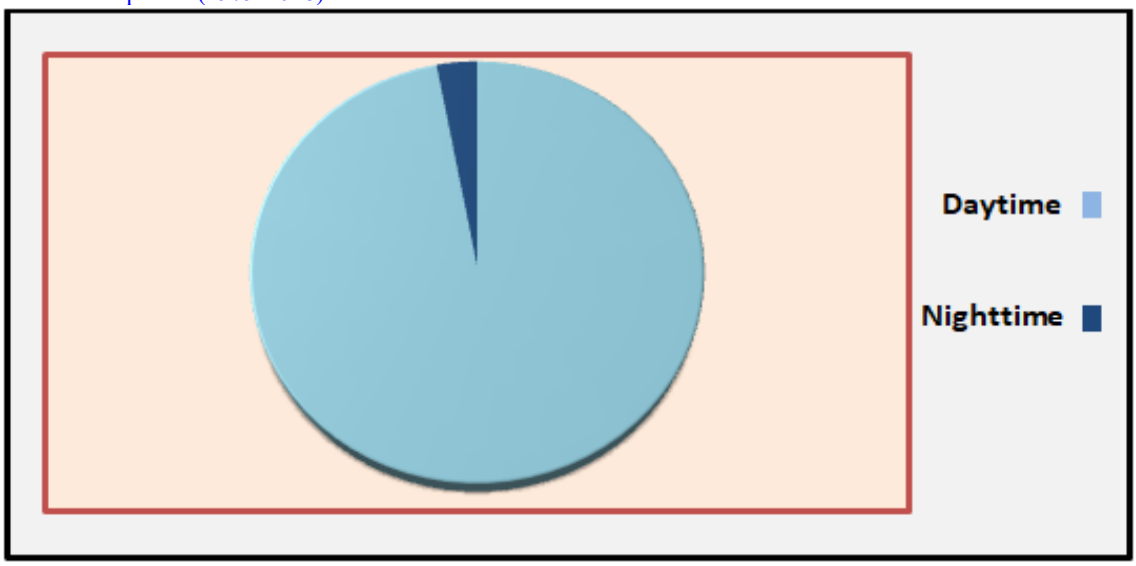
Daytime Sweat Volume (g/hour)				(Nighttime Sweat Volume (g/hour)			
Maximum Temperature (°C)		Sweat volume (g/hour)		Minimum Temperature (°C)		Sweat volume (g/hour)	
Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
19.1	29.7	150.1	584.7	11.5	23.2	438.5 -	17.8

Source: Prepared by the student based on data from the General Meteorological Authority, Cairo, unpublished data for the period (1979-2018).

Table 5. The Relationship between Average Bone Temperature and the Amount of Sweat in Humans during the Winter and Summer Months in Port Said Governorate (1979-2018)

Month	Maximum Temperature (°C)	Daytime Sweat Volume (g/hour)
December	19.5	166.5
January	18.1	109.1
February	19.8	178.8
June	28.5	535.5
July	30.3	609.3
August	30.4	613.4

Source: Prepared by the student based on data from the General Meteorological Authority, Cairo, unpublished data for the period (1979-2018).



Source: Figure from the student's work based on Table 5.

Figure 5. The Perspiration Levels in Humans during Day and Night in the Governorate of Port Said from 1979 to 2018

The analysis of Tables 4 and 5 and Figure 5 indicates an increase in perspiration rates in Port Said during summer months, particularly during the day. This increase results in decreased comfort levels for individuals, heightening their sense of discomfort and necessitating the use of air cooling systems to achieve significant thermal comfort. Conversely, perspiration rates decrease during winter months despite the presence of sunlight. This is attributed to the reduced duration of sunlight and solar radiation in winter, leading to greater comfort and less discomfort for individuals. Consequently, Port Said has become a destination for winter tourism and relaxation. The analysis further reveals a linear relationship between perspiration rates and temperature values in Port Said, confirming a positive correlation between them for winter tourism and relaxation. The analysis further reveals a linear relationship between perspiration rates and temperature values in Port Said, confirming a positive correlation between them.

5. Environmental Context

The environmental context encompassing both wildlife and protected areas in the study area is represented through the Lake Manzala region, which includes two protected areas: the Aashtom El-Gamil Protected Area, located west of Port Said and encompassing the El-Gamil Lagoon, and the Tinnis Island Protected Area, situated southwest of Port Said within Lake Manzala and featuring the Tinnis archaeological mound. The primary purpose of the Aashtom El-Gamil Protected Area is to safeguard the Lake Manzala environment from degradation and to promote its development by preventing illegal fishing at the lagoon, which serves as the sole entry point for fish larvae from marine species and the exit for mature fish to the sea for a conducive growth and breeding environment. It also aims to prevent pollution from all sources and protect the natural habitat of migratory birds. The Tinnis archaeological mound, on the other hand, represents a breeding ground for certain bird species, adding significant scientific, tourist, and historical value (El-Said, 1995, p. 250).

5.1. Wildlife

Wildlife attracts various types of tourists, such as eco-tourism. This sector includes tourists seeking knowledge from areas different from their original environment. This type includes activities like wildlife photography, bird watching, and observing wild animals (Khattab, 2007, p. 263). This is evident in the Ashtoum El-Gamil Reserve, which serves as a breeding refuge for both resident and migratory birds. The reserve also features various plant species that have adapted morphologically and environmentally to the high water levels, making it a significant factor in tourism development in the study area.

Wildlife encompasses natural plants, birds, and wild animals, and these natural biological resources play an active role in tourism activities in the study area. The impact of each biological source on tourism varies based on its type, number, area, density, and location. As a result, wildlife becomes more attractive to different segments of tourists. Wildlife in the study area is considered a national wealth and a rich, unique natural heritage that must be preserved, developed, and its resources safeguarded from depletion. Some rare biological resources are of great interest to scientific researchers who are enthusiasts of knowledge and nature.

5.2. Natural Reserves

Natural reserves are among the most attractive areas for eco-tourism in the Port Said Governorate. This is due to their rich flora and fauna, which draw nature enthusiasts. The importance of natural reserves lies in their abundant biodiversity of wild species that must be preserved and protected from extinction. They also maintain the ecological balance between different species and human activities that might be harmful in many cases (Ahmed, 2007, p. 5). Natural reserves play a crucial role in preserving biodiversity, encompassing natural heritage, scenic beauty, and geological features. The external shape of the reserve's boundaries reflects the interaction and adaptation of diverse wildlife to the reserve's environmental conditions. The characteristics and forms of natural reserves, with their biological diversity, vary from one place and environment to another. Additionally, they provide a range of direct and indirect services to both residents and tourists. The economic return from these services constitutes the natural capital of the Port Said Governorate.

The reserve aims to preserve biological diversity, genetic diversity, and the ecological processes associated with all rare and endangered species, which are vital for the sustainability and development of eco-tourism in Port Said. The natural environmental resources of the reserve vary between flora and fauna, highlighting its importance in providing a suitable environment for resident or migratory birds and preserving historical and national heritage by investing in and maintaining renewable natural resources spread within Lake Manzala, such as fish stocks and vegetation cover, within the framework of sustainable tourism development.

Attention to the natural reserve is justified by its economic importance, serving as a strategic reservoir of biodiversity and a crucial source for sustainable tourism development. It generates significant financial returns through organized eco-tourism, demonstrating its positive impact

through various economic values. This is evident from the direct and indirect revenues generated from tourism investment, employment in tourism activities, increased tourist attraction, and boosted domestic tourism activity. The reserve is a strong pillar supporting tourism in Port Said.

The natural and biological environment sources enhance the tourism appeal of the Ashtum El-Gamil Reserve. The plant significance within the reserve is represented in several main habitats, each containing a number of distinctive plant species. These habitats include salt marshes, sandy formations, beach deposits, islands within the lake, and the lake's shore and water. The total number of plants in the reserve is estimated at about 77 species, including 23 annuals and 54 perennials, belonging to 30 families. The plant species in the reserve show various forms of morphological, anatomical, and environmental adaptation for growth and reproduction in water-rich soils. The Ashtum El-Gamil Reserve is also a source of rest, food, and reproduction for all types of resident and migratory birds, especially waterfowl. The animal importance in the reserve is represented by 263 bird species, distributed among 52 genera and 27 families, with water birds making up 64% and terrestrial birds 36%. The fish stock in the reserve is estimated at about 25,000 tons, including freshwater and saltwater fish. The terrestrial cover of the reserve includes several species of mammals, reptiles, and insects. The reserve also has historical significance, increasing its economic value and making it a tourist destination, exemplified by the archaeological site of Tennīs Hill, an important historical landmark from the Ayyubid era. It is located southwest of Port Said, about 7 km inside Lake Manzala on the navigation route linking Port Said with Mataria and Dakahlia. It gradually rises from the lake shore to end in its center at a height of 4.5 meters above the lake surface (Ashtum El-Gamil Reserve in Port Said Governorate, pp. 2-3).

6. Results and Recommendations

6.1. Results

- Port Said Governorate possesses a variety of natural geographical features that shape its tourism map and are closely linked to ongoing and future tourism development activities.
- The natural criteria unique to Port Said are significant factors affecting the level of tourism supply and demand, and they influence the diversity of motivations attracting tourists.
- The natural characteristics dictate the tourism patterns specific to the study area, as well as the flow of tourist movement and the optimal distribution of recreational sites.
- When determining the best locations for tourism services and facilities in Port Said, it is essential to consider appropriate natural criteria and conduct spatial modeling to understand their proximity to tourism accommodation centers.
- The location and spatial relationships are among the most crucial natural components shaping the tourism infrastructure and the tourism map of Port Said in Egypt.
- The importance of geomorphological features influencing tourism development is evident, showcasing significant beauty and richness in the coastal plain environment. These features are among the key topographical characteristics that enhance tourism attractiveness due to their coastal areas, which serve as a major attraction for tourists, increasing the demand for various tourism establishments. These features are also critical when selecting the best sites for future tourism development.
- Climatic characteristics are important criteria to consider when planning diverse tourism establishments. Studies on human comfort criteria indicate that Port Said is suitable for tourism and recreational activities for most months of the year. The Mediterranean climate positively affects the coastal area, increasing tourist flow and occupancy rates in tourism accommodation centers. Despite this positive impact, some climatic risks could threaten the safety of tourism establishments and hinder tourism activities, requiring appropriate measures to address and mitigate these risks.

- The environmental dimension is vital for ensuring the sustainability of tourism and recreational activities and should be relied upon in future tourism planning. Biodiversity in natural resources plays an essential role in developing ecotourism and increasing the economic value and revenue for Port Said. The most important natural environmental components are the Ashtum El-Gamil Nature Reserve and the archaeological Tinnis Island.

6.2. Recommendations

- Relevant authorities in the tourism sector should focus on Port Said due to its unique location on the Egyptian tourism map and work to exploit its rich tourism potential.
- Efforts should be made to increase tourist flow and economic returns for Port Said through effective tourism marketing in Arab and international markets.
- Optimal analysis methods should be used to evaluate and select the most suitable locations based on Port Said's natural criteria, aiding specialists and decision-makers in sustainable tourism development.
- Coastal geomorphological phenomena unique to the Port Said beach area should be considered due to their positive impact on tourism and increasing tourist flow.
- The widespread salt flats in Port Said should be utilized by economic planners for urban, industrial, and tourism development, with ongoing studies of elevation and slope in the area and attention to tourism infrastructure.
- Effective spatial tourism planning should be implemented, focusing on the quality of recreational, commercial, and other services that attract domestic tourism demand.
- Coastal salt flat areas should be developed into coastal tourist villages and uniquely designed one-story chalets to prevent collapse.
- Annual monitoring and evaluation of erosion and sedimentation levels are necessary to predict natural hazards, manage tourist movement, protect coastal tourism establishments from erosion, and develop existing and future projects.
- Sustainable tourism development in Port Said should focus on how to develop and preserve the natural environment of the Ashtum El-Gamil Reserve. Optimal use of the reserve's tourism components should be ensured, balancing tourism development with nature protection, determining the carrying capacity and maximum number of visitors without harming the sensitive environment, and designing measures to control visitor numbers and movements. Reducing the impact of tourism on the environment and minimizing resource depletion will help achieve sustainable tourism activity.
- Entry centers should be established at the reserve site to manage visitor movement, with visitor centers providing comprehensive site information and essential guidelines on interacting with the natural environment. Laws and regulations should be enforced to control visitor numbers and ensure safety without causing environmental harm. Proper management of natural and human resources through trained personnel and environmental and tourism awareness programs for local residents is necessary to preserve these assets for future generations.

7. References and Sources

7.1. Sources

Ashtoum El-Gamil Reserve in Port Said Governorate, Ministry of State for Environmental Affairs, Nature Conservation Sector, General Administration of Northern Region Reserves.

Cabinet, Information and Decision Support Center. (2021). Description of Egypt by Information (12th Edition).

Central Agency for Public Mobilization and Statistics.

Egyptian General Corporation. (1987). (EGPC) data, Conoco's Geological Map of Egypt, scale 1:500,000.

Environmental Description of Port Said Governorate (2007).

General Administration for Information Systems and Digital Transformation in Port Said Governorate. (December 2019). Monthly Information Bulletin of the Ministry of

Tourism Office, Unpublished Data.
General Authority for Meteorology, Cairo.
General Authority for Port Said, General Administration for Passenger and Cargo Movement. (2015). Unpublished Data.

7.2. References

Abdel Aal, F. A. (1994). Potential for Regional Development in the Red Sea Governorate: A Geographical Study (Master's Thesis). Department of Geography, Faculty of Girls, Ain Shams University.

Abdel Hakim, M. S., & El-Dib, H. A. (2001). *Tourism geography*. Anglo-Egyptian Library.

Abu El-Ela, N. F. (2013). *Economic development in the Suez Canal governorates using geographic information systems* (Ph.D. Thesis). Cairo University.

Ahmed, M. A. (2007). *Natural reserves in Egypt*. Family Library.

El-Gamal, M. G. (1954). Port Said: The Meeting Point of East and West, Cairo University Library, Dar Al-Fikr Al-Arabi.

El-Said, M. A. R. (1995). *Lake Manzala: A study in economic development geography* (Master's Thesis). Zagazig University.

Gamal, H. M. (2000). Tourism Centers on the Red Sea Coast in Egypt (unpublished phD dissertation). Department of Geography, Faculty of Arts, South Valley University.

Hamdan, G. (1980). The Personality of Egypt: A Study in Genius of Place, Vol. 1, Al-Alem Al-Kutub, Cairo.

Hamdan, G. (1984). *Selections from the personality of Egypt*. Cairo: Madbouly Library.

Jordan, H., Roderick, P., Martin, D., & Barnett, S. (2004). Distance, rurality and the need for care: access to health services in South West England. *International Journal of Health Geographics, 3*(21). https://doi.org/10.1186/1476-072X-3-21

Kamel, M. K. (2016). Tourist accommodation centers in the Suez Canal governorates: A study in tourist geography using geographic information systems (unpublished PhD dissertation). Department of Geography and Geographic Information Systems, Faculty of Education, Ain Shams University.

Khattab, M. I. M. (2007). *Geomorphology of the Red Sea Coastal Plain between Quseir and Marsa Alam and its impact on tourism* (Master's Thesis). Cairo.

Khorshid, T. H. A. (1993). *Tourism development in the Red Sea governorate with application to one of its western coast areas* (Master's Thesis). Faculty of Tourism and Hotels, Helwan University.

Mohamed, W. A. E. (2010). *Development in Port Said governorate* (Master's Thesis). Al-Azhar University.

Saber, A. I. M. (2022). Wetland quality for sustainable development northwest of the Suez Canal: Components and constraints. *Journal of Sustainable Development in Social and Environmental Sciences, 1*(1), 45-61. https://doi.org/10.21608/jsdses.2022.157404.1000

Saber, A. I. M. (2024). The origin and development of Port Said city between determinism and possibilism. *Journal of Sustainable Development in Social and Environmental Sciences, 3*(1), 56-70. https://doi.org/10.21608/jsdses.2023.247976.1020 .

Siraj El-Din, A. I. (2008). Geography of transient tourism at Port Said Port. *Egyptian Geographical Society, Arab Geographical Journal, 40*(52).

Tolba, S. S. A. (2004). Natural Tourism Resources in the Yanbu Area of Saudi Arabia. The Arab Geographical Journal, No. 42, Egyptian Geographical Society, Cairo.