

Assessment of the environmental sustainability of hotel buildings in Siwa (a comparative study)

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abstract

Siwa Oasis is one of the most important oases in the world, which includes all the tourist components (cultural - safari - archaeological - therapeutic - natural – environmental), and the residents' preservation of the traditional, heritage and wildlife character in many climates, especially the traditional architectural character. and due to the urban and concrete encroachment, the task of preserving the environmental and heritage tourist character of Siwa Oasis has become a national mission by working on the emergence of Siwa in a suitable manner in terms of civilization, culture, and history.

This research paper studies hotels with a Siwa architectural character, and examples of sustainable hotels in Siwa (Al- babenshal Hotel - Adrere Amellal Hotel - Shali Hotel) are environmentally sustainable compared to concrete hotels, such as the Siwa Oasis hotel, which distorts the Siwa character in terms of (architectural design - interior design - The materials used in furniture - lighting, etc.) that will be detailed in the research. This research also aims at preserving the Siwa heritage and preserving it from the challenges of time, and that the architectural character and interior design are compatible with the surrounding environment.

key words:

Environmental sustainability - Carsheif material - traditional character - local heritage.

1.1 Introduction

Tourist destinations varied and tourism programs varied (scheme 1), and with technological advancement new materials appeared that were not compatible with the Egyptian nature, neglected environmental identities and the deterioration of urban heritage, the trend leading to the use of local materials in architectural designs and interior designs, the soul became inclined to everything that is comfortable and resort to a place To relax away from the hustle and bustle of the city.

In 1998, Environmental Quality International (EQI) initiated the Siwa Sustainable Development Initiative to preserve Siwa's wealth of natural assets and its cultural heritage. It (namely ecotourism, Siwan craftsmanship, sustainable agriculture and renewable energy), the main objective of the initiative was to achieve social and economic benefits through empowering the local community, as well as promoting entrepreneurship while preserving the environmental and cultural stability of the Siwa Oasis and its people.

Egypt is currently moving towards preserving the identity, redeveloping and restoring heritage buildings to be a more attractive area for tourism of all kinds, according to the Egypt 2030 plan, a conflict between a local heritage building and another new armed with all the equipment of the armed concrete revolution that does not fit with the Siwa nature and endangers the traditional architecture in Siwa (Fig. 1). And the need to lack all facilities of modern life such as energy, telephones, and various technological means.

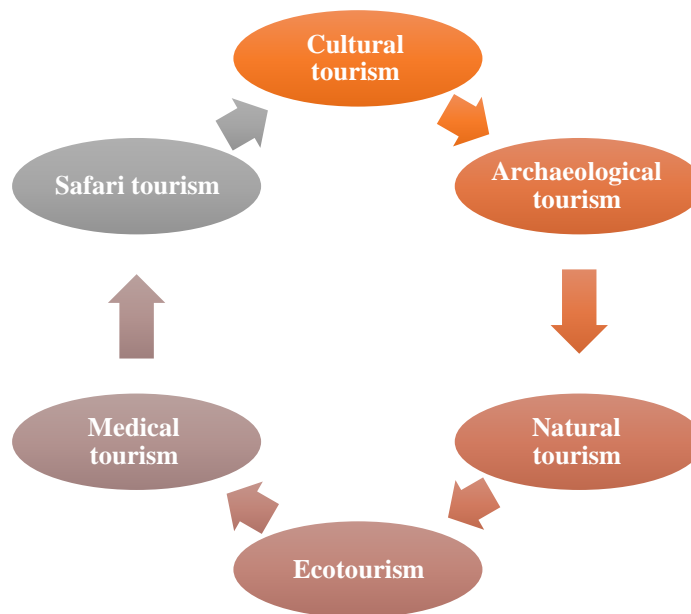


Fig. 1. a- Using the local heritage architecture of the Museum, Documentation Center, and Handicrafts to preserve the heritage and culture of Siwa Oasis.

b - the introduction of the reinforced concrete revolution on the Siwi buildings, which do not provide thermal comfort and have a negative impact on the environment.

Source: A) <https://gate.ahram.org.eg/News/1434061.aspx>

B) <https://www.sciencedirect.com/science/article/pii/S2214509519304139>



scheme 1. Elements of tourism in siwa

1.2 traditional environmental methods

Sustainable hotels in Siwa have relied on traditional environmental methods of construction in various regions, such as:

1.2.1 Building materials:

1. Karshif, which is the most appropriate and cost-effective material, and it is the original and natural building material in the traditional architecture of Siwa, (Fig. 3). The material's hardness comes from a mixture made of clay, salt and other minerals from Siwa Salt Lake, which has been scientifically proven to be an

- effective, heat-degrading building material used by local builders in Siwa over thousands of years to beat the scorching desert heat.
2. Olive tree trunks were used for the roofs and natural stones for the floors (Fig. 4).
 3. Olive wood and palm trees for making doors and windows (Fig. 5).

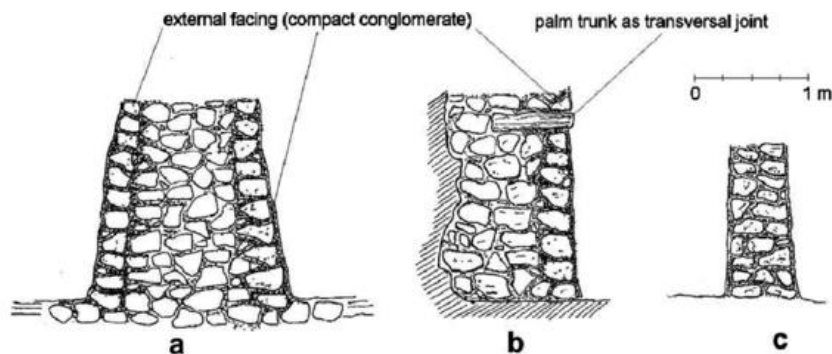


Fig. 2 Karshif Particles and palm trees building technique in Siwa's traditional architecture.
Source: The salt architecture in Siwa oasis – Egypt (XII–XX centuries) Figure on Elsevier . Available from:
<https://www.sciencedirect.com/science/article/abs/pii/S0950061809000592>

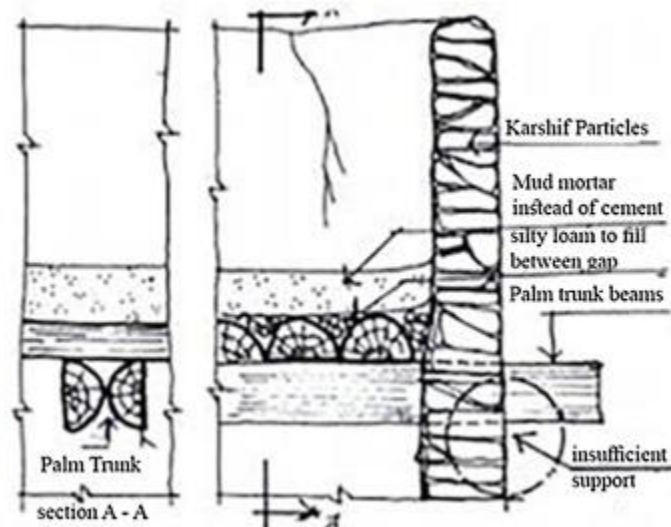


Fig. 3 Karshif Particles and palm trees building technique in Siwa's traditional architecture.

Source: Comparative Study of Traditional and Modern Building Techniques in Siwa Oasis, Egypt - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Karshif-Particles-and-palm-trees-building-technique-6-12_fig3_337297727



Fig. 4 Using Olive tree trunks were used for the roof.



Fig. 5 Using Olive wood and palm trees for making doors and windows

1.2.1.1 the traditional building technology table 1.

Table 1- Traditional building material

Construction	bearing wall	Foundations	grains and stone.
Building the walls	the granules of karshif	Roof	palms (beams and roof).
Floor	Natural Stone	External Finishing	Slotted and Siwan Mortar.

which is the environmentally friendly local materials used in the surrounding environment (Fig. 6).

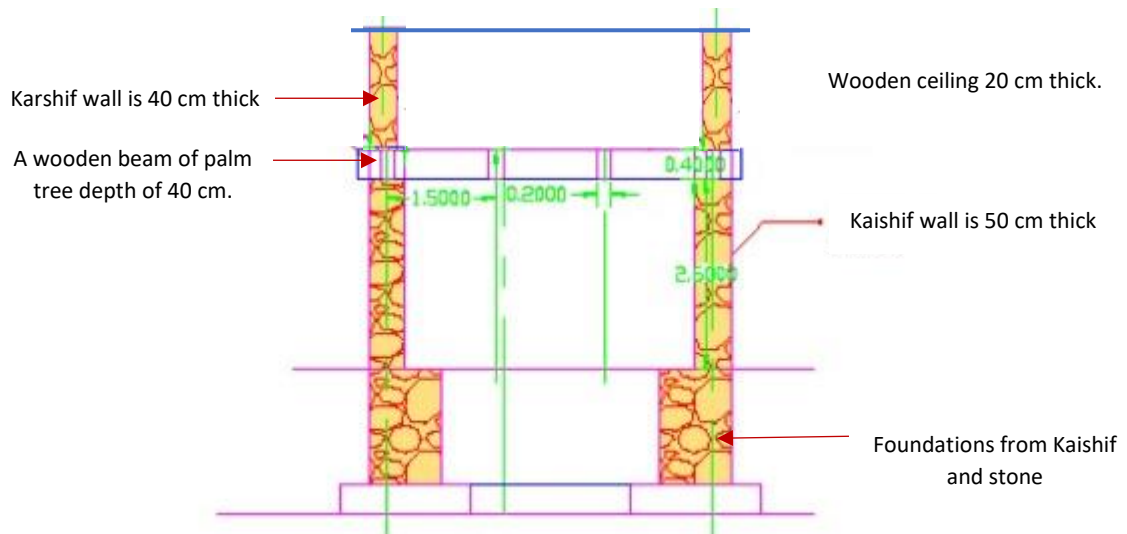


Fig. 6 Section for traditional building technology.

1.2.2 External walls

Made of loops and irregularly selected blocks, bonded to cement mortar, (Fig.7).
The outer walls are painted to emit solar radiation.



Fig. 7 Vernacular builders in Siwa Oasis using (kershef) and mud.

Source:
https://www.researchgate.net/publication/259383562_Earth_vernacular_architecture_in_the_Western_Desert_of_Egypt

1.2.3 windows

The number of windows that open onto the sidewalks is reduced to avoid inappropriate climate penetration into the indoor area (Fig. 8). Most windows open to a central protected courtyard area, which is generally characterized by less harsh conditions and a more favorable environment than those on the exterior of buildings, and the windows are directed against each other to create cross ventilation. Another natural technique used to cool the air during the hot summer is the use of vegetation next to the vents, thus improving the cooling of the air before passing through the windows.

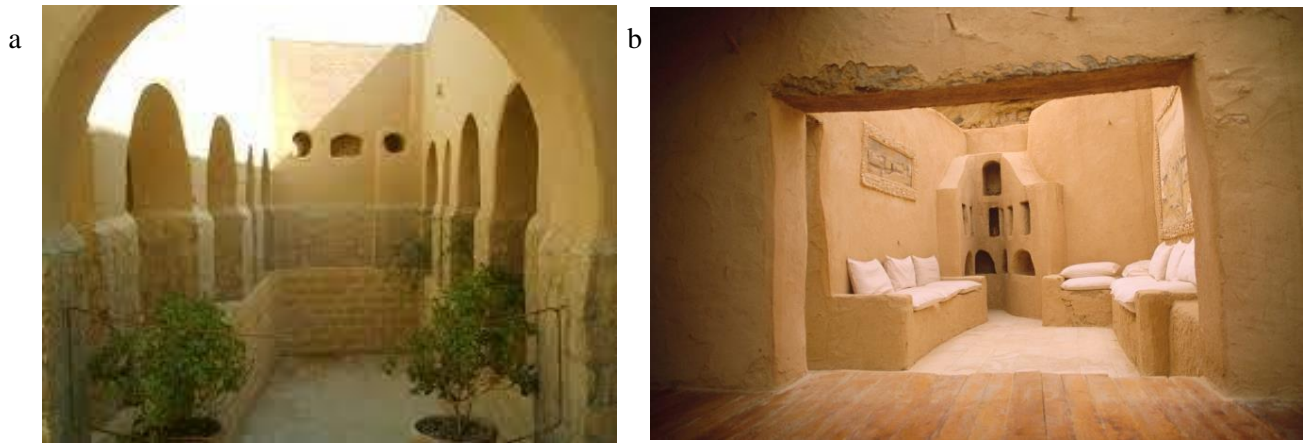


Fig. 8 Reducing hotel windows to control the indoor climate.

Source: <http://192.168.8.1/html/home.html>

1.2.4 the courtyards

In hot, arid regions, courtyards are a valuable, time-tested design pattern (Fig. 9). Hallways have been used, and rooms that open onto the patio are usually protected from the intense summer heat and cold of winter, and from winds, storms and sand in desert



areas.

Fig. 9 The role of the courtyards in moistening the interior spaces in the summer.




Source: a) Farrag, Nermin Mokhtar - Elalfy and Ayman Mahmoud, HARMONIZATION BETWEEN ARCHITECTURAL DEVELOPMENT AND HERITAGE IN SIWA OASIS – EGYPT, ARPN Journal of Engineering and Applied Sciences, VOL. 11, NO. 3, FEBRUARY 2016






b) <https://shop.2021bestcheap.com>

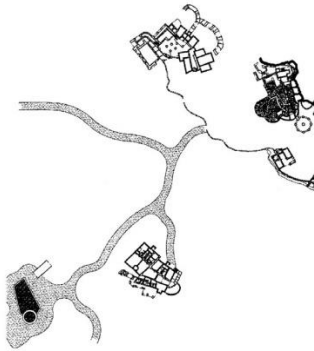
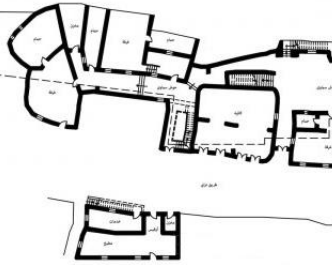
2.1 Environmental Sustainability of Hotel buildings in Siwa

Table 2- A comparative study of sustainability hotel buildings in Siwa


Comparisons	Edrar Emlal	Albabnshal	Siwa Oasis Hotel
2.1.1 Location	Siwa Oasis is located on the banks of the self-bearing lake in Egypt about 50 km. east of the Libyan border - a desert land of rocks and sand inhabited by different	Albabnshal is located outside the ancient ruins of Shali and the castle dating back to the 13th century in the center of Siwa. It offers traditional accommodation in Siwa	The location of the hotel is not as stated on Google Maps (but it is 1.9 km from the city center). It covers a large area and has a pool with

	<p>civilizations more than 10,000 years ago and still bears remnants of evidence. Edrar Emlal Resort is surrounded by seven salt lakes with palm trees embracing them just as bracelets embrace the wrist.</p>	<p>with free Wi-Fi. The hotel is 2 km from Cleopatra Bath. The building is located on a site of historical and cultural significance. The building extends horizontally along the east-west axis, taking advantage of the solar path and prevailing wind direction. There are no parking spaces around the project. Locals and tourists use alternative public transportation.</p>	<p>water from a natural spring (making the water green, but completely safe).</p>
<p>2.1.2 Design Concept</p>	<p>It is a group of ancient Siwan homes, which have collapsed over years of neglect, have been restored and expanded using traditional methods to create a "Edrar Emlal Hotel" (Fig. 10)., an</p>  <p>eco-lodge that is very sensitive to its environment and does not provide Wi-Fi,</p>	<p>The planning and architectural concept entailed transforming a group of five dilapidated houses, linking them together in a logical design in the traditional</p>  <p>construction method into one large house resembling an old Siwan house that would serve as a hotel (Fig. 11).</p>	<p>The use of modern technological materials such as concrete in construction and interior finishes that do not suit the normal nature, the use of</p>  <p>ceramics and tiles, which appears through the thinness of the design (Fig. 12). Fig. 12 using modern technological materials such as concrete in construction and interior finishes in Siwa Oasis Hotel</p>

	<p>phone service, electricity or the usual decorations of contemporary comfort.</p> <p>Fig. 10 "Edrar Emlal Hotel" group of ancient Siwan homes that have been restored and expanded using traditional methods.</p> <p>Source: https://arabic.cnn.com/travel/article/2019/10/29/adrere-amellal-egypt-hotel</p>	<p>Fig. 11 Albabnshal is a group of five demolished homes joined together in a logical design with the traditional construction method.</p> <p>Source: http://hikersbay.com/africa/egypt/hotel/eg/albabenshal.html?lang=ar</p>	<p>Source: https://egyptianshootingclub.com/8689/</p>
The Number of floors	Three floor	Two floor	Three floor
2.1.3 vertical (Fig. 13,14,15) and Horizontal (Fig. 16,17) projections			
2.1.3.1 Facade / architectural form	 <p>Fig. 13 "Edrar Emlal Hotel" facade in harmony with the Siwi nature</p> <p>Source: https://www.ioviaggioblog.it/egitto-vacanze-oasi-di-siwa-tempio-del-dio-sole-e-oracolo-di-amon/17784</p>	  <p>Fig. 14 a) Facade of the Albabnshal Hotel b) An interior section of the hotel</p> <p>Source: E., Hadeel, 2019, THE TRADITIONAL</p>	  <p>Fig. 15 " Siwa Oasis Hotel" group of ancient Siwan homes that have been restored and expanded using traditional methods</p> <p>Source: https://www.tripadvisor.com/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p>


		ARCHITECTURE PHILOSOPHY AND ITS INFLUENCE ON THE INTERIOR DESIGN OF THE REHABILITATION CENTERS, PHD, Alexandria university, p.14.	
2.1.3. 2 Floor plan	 <p>Fig. 16 "Edrar Emlal Hotel" floor plan. Source: https://www.designboom.com/architecture/adrere-amellal-eco-hotel-in-egypt-by-eqi/?utm_campaign=monthly&utm_medium=email&utm_source=subscribers</p>	 <p>Fig. 17 "Albabnshal Hotel" floor plan Source: http://www.siwa-oasis.it/ITINERARIO-progetto/2/it-proj_2.html</p>	
2.1.4 Interior Architecture Design			
2.1.4. 1 Interior Design	<p>The buildings have been renovated according to International Environmental Quality Standards (EQI), and are made of:</p> <ul style="list-style-type: none"> The kershef (mixture of rock salt and clay), stone masonry and carved dwellings from 	<p>50% of the materials used in the building are old materials that have been reused even the doors and windows have been reused. This includes olive tree wood, palm wood, recycled stone, recycled metals, other non-toxic, reusable, renewable, or recyclable products, clay, expanded clay granules,</p>	<p>There is no clear design idea, the hotel has many interiors, which are not compatible with the Siwa nature, and smooth wall finishes are used, which may be affected by the high temperature resulting from the desert heat, and the brick material used completely</p>




	<p>the large mountain that hosts the lodge. Going back to design fundamentals, all aspects of buildings aim to naturally preserve essential amenities. Thick earthen walls absorb heat during the day and keep the interior cool, then radiate the heat at night when the temperature drops. All windows are specially sized and positioned to capture the desert breeze and eliminate the need for air conditioning - heat is obtained through wood burning brazier.</p> <ul style="list-style-type: none"> • The use of sandstone for bathrooms 	<p>and calcium sandstone. The casing has very low embodied energy and is made from a unique building mixture consisting of 60% kerchief, 10% stone, 10% palm trunks, 5% unfinished clay bricks, and 5% olive and clay used as binders</p>	<p>transfers the heat from the outside to the inside (Fig. 20).</p>
<p>2.1.4.2 Number</p>	<p>40 rooms (single - double - private - salt) (Fig. 18).</p>	<p>11 rooms (single - double - triple) (Fig. 19). It overlooks a compact open courtyard without the</p>	

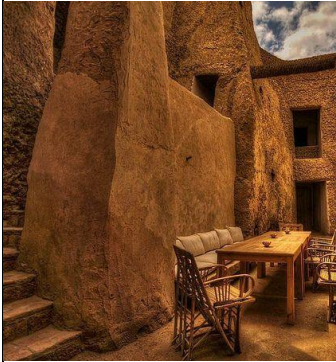


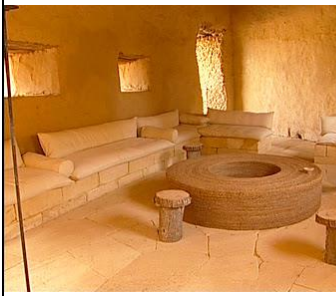


<p>or Rooms</p>	<p>Built in a unique style, it combines distinction and originality where the ground buildings blend naturally with the landscape</p>	<p>use of tiles, mimicking the exterior of a Shali Castle.</p>	
<p>2.1.4.3 Bedroom</p>	 <p>Fig. 18 interior design bedroom for "Edrar Emlal Hotel" using mud-and-salt huts 'karshif'. Source: https://www.tur-hotel.ru/hotels/egypt/north-coast/marsa-matrouh/siwa/adrere-amellal/</p>	 <p>Fig. 19 interior design bedroom for " Alhabnshal Hotel" using mud-and-salt huts 'karshif'. Source: https://eg.wego.com/hotels/searches/6577-64/2021-05-04/2021-05-05/1/2/1042433?open_calendar</p>	<p>Although electricity was brought in to the hotel, it was not working well. The lack of air conditioners to moisten the heat inside the rooms.</p>  <p>Fig. 20 " Siwa Oasis Hotel " using Plastic paints. Source: https://www.tripadvisor.cz/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p>
<p>These are mud-and-salt huts 'karshif'. The rooms feature a spacious bed built on a block of salt with parquet floors and woven carpets. The room is perforated by small windows with wooden shutters. And Egyptian cotton sheets.</p>			
<p>2.1.4.4 Lounge</p>	 <p>Fig. 21 The lounge contains terraces made of</p>		




<p>salt over a floor of stone in Edrar Emlal Hotel. Source: https://www.almasryalyooum.com/news/details/509883</p>	<p>Fig. 22 The lounge contains terraces made of salt over a floor of stone in Albabnshal Hotel. Source: https://eg.wego.com/hotels/searches/6577-64/2021-05-04/2021-05-05/1/2/1042433?open_calendar</p>	<p>Fig. 23 the design of lounge is far from the traditional design. Source: https://www.tripadvisor.cz/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html the design of the lounge is far from the traditional design and used furnishing elements that do not fit with the identity of the place and the heritage of acquaintance with it (Fig. 23).</p>
<p>The lounge contains terraces made of salt over a floor of stone and covered with handwoven fabric (Fig. 21,22).</p>		




2.1.5 The Elements of Spaces

<p>2.1.5.1 Walls</p>	 <p>Fig. 24 using various wall finishes in line with the desert landscape. Source: https://www.designboom.com/architecture/adrere-amellal-eco-hotel-in-egypt-by-eqi/?utm_campaign=monthly&utm_medium=email&utm_source=subscribers</p>	 <p>Fig. 25 walls are completely constructed of Siwan and the clay known as "karshif". Source: https://www.a-hotel.com/ar/msr/131899-sywt/468766-1-albabenshal-lodge-siwa/</p>	 <p>Fig. 26 Use modern materials in interior finishes Source: https://www.tripadvisor.it/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p>
	<p>The use of various wall finishes in line with the desert landscape (Fig. 24). Its walls are completely constructed of Siwan and the clay known as "karshif"(Fig. 25). The resort is</p>	<p>Use modern materials in interior finishes (Fig.</p>	

	<p>surrounded by salt rock walls shaded by many palm trees.</p> <p>The thickness of the outer walls reaches 60 cm - 80 cm, and the thickness gradually decreases in the upper floors, reaching 30 cm - 40 cm. As for the internal walls, their thickness is increasing. To 20-30cm, the walls are built from the corsage mixed with mud, which helps to isolate the outer perimeter and the internal spaces.</p> <p>The use of novice stone and sandstone in internal plating for walls, which are available local building materials.</p>	<p>26) that do not suit the landscapes and climatic nature of Siwa, which also does not correspond to the identity and form of the Siwa architecture.</p>	
<p>2.1.5.2 Roofs</p>			
	<p>Fig. 27 using palm trees for roofs which prevents heat loss during the day once the doors are opened.</p> <p>Source: https://www.designboom.com/architecture/adrere-amellal-eco-hotel-in-egypt-by-eqi/?utm_campaign=monthly&utm_medium=email&utm_source=subscribers</p>	<p>Fig. 28 ceilings are made from the wooden mirrors and palm trunks.</p> <p>Source: https://www.booking.com/hotel/eg/albabenshal.ar.html</p>	<p>Fig. 29 walls are completely with Use gypsum finishes.</p> <p>Source: https://www.tripadvisor.it/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p> <p>Use gypsum finishes that do not correspond to the climate or the Siwi identity (Fig. 29), and thus not to employ the lighting. Stay away from the use of natural lighting in the way it is recognized in the architectural design of the natural landscape.</p>
	<p>The roofs are built with palm trees which prevents heat loss during the day once the doors are opened (Fig. 27). Then on the other hand at night, these roofs redirect the heat inward and avoid the harsh desert cold.</p> <p>there are no external protrusions as for the roofs of large spaces (4 m - 5 m), then compound ceilings are made from the wooden mirrors and palm trunks "(Fig. 28), and the length of the wooden beams is increased, or Palm trunks split in a peripheral fashion</p>		

	Resisting torques for the roof beams. The end is covered with a mixture.		
2.1.5. 3 Floor s			
	<p>Fig. 30 The use of novice stone and sandstone in the flooring. Source: https://travelnetlife.com/2000/</p>	<p>Fig. 31 flooring using stone and sandstone. Source: https://www.hasafer.com/hotels/egypt/siwa-oasis/albabenshal-lodge-siwa</p>	<p>Fig. 32 using ceramic floors Source: https://www.tripadvisor.it/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p>
<p>The use of novice stone and sandstone in the flooring(Fig. 30,31), and the corset is used as the plaster mortar, all of which are local building materials.</p>			
2.1.6 Interior design supplements			
2.1.6. 1 Furnitu-re			
	<p>Fig. 33 Furniture is made of dried palm fronds or solid blocks of salt. Source: https://line.17qq.com/articles/dhghejpbz.html</p>	<p>Fig. 34 furniture is made of olive wood. Source: https://www.priceline.com/hotel-deals/h24933805/EG/Marsa-Matruh/Siwa/Albabenshal-Lodge-Siwa.html</p>	<p>Fig. 35 using leather material that increases the temperature may cause health diseases. Source: https://www.tripadvisor.it/Hotel</p>

	<p>Furniture is made of dried palm fronds or solid blocks of salt (Fig. 33), and the mattress is lined with cotton. furniture is made of olive wood (Fig. 34). chairs are made of palm fronds and hand-woven fabrics for the covers.</p>	<p>_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p> <p>The use of materials that do not correspond to the shape or function with the temperature, such as the leather material (Fig. 35) that increases the temperature may cause health diseases on the user and it is uncomfortable.</p>	
<p>2.1.6.2 Wind ows and doors</p>	 <p>Fig. 36 All doors, windows and fixtures were made of olive wood. Source: https://board.postjung.com/1262036</p>	 <p>Fig. 37 The doors are from trunks of palms. Source: http://hikersbay.com/africa/egypt/hotel/eg/albabenshal.html?lang=ar</p>	 <p>Fig. 38 Maximize the window area. Source: https://www.tripadvisor.it/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p>
	<p>The doors are from trunks of palms (Fig. 37). The use of windows under the ceilings to exchange heat in the space. All doors, windows and fixtures were made of olive wood (Fig. 36) with a mixture of Siwan clay. The openings in the façades are at a rate of 5% of the total of the façade and are distributed in a homogeneous manner and the small area of the opening takes a longitudinal rectangular shape and is defined by a lintel of suede</p>		<p>Maximize the window area (Fig. 38), however it does not perform the same function that windows do in architectural designs.</p>

<p>2.1.6. 3 Light ing</p>	 <p>Fig. 39 using natural lighting and oil lamps. Source: https://www.desdeaquiveomar.com/adre-re-amellal-hotel-un-oasis-en-el-desierto/</p>	 <p>Fig. 40 using lighting desert sky. Source: https://ar.hotels.com/de10515763/hotels-near-fortress-of-shali-sywt-mst/</p>	 <p>Fig. 41 use of poor industrial lighting methods. Source: https://www.tripadvisor.it/Hotel_Review-g303857-d3702382-Reviews-Siwa_Oasis_Hotel-Siwa_Matrouh_Governorate.html</p>
	<p>Relying on natural lighting (Fig. 39), no electricity, and at night the rooms are quietly lit by dozens of beeswax candles, using lighting desert sky (Fig. 40), lanterns and oil lamps.</p>		
<p>2.1.6. 4 Colo urs</p>	<p>Same color as natural soil, the use of paint colors that simulate the color of sand in the walls.</p>		<p>Variety of colors in interior design and materials. Building in the facades. The exterior of the building</p>
<p>2.1.6. 5 Mate rials</p>	<p>4. The main raw material (karshif), which is a clay building material in which it is based (salt blocks). These stones are formed by a kind of child and act as a colorant.</p>		<p>The use of reinforced concrete in the building and the raw bricks that do not suit the Siwa nature.</p>

	<p>5. Olive tree trunks were used for the roofs and natural stones for the floors.</p> <p>6. Olive wood and palm trees for making doors and windows.</p>	
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Table (2) A comparative study of sustainability hotel buildings in Siwa.

3.1 MATERIALS AND METHODS:

The research is based on the comparative approach between the environmental hotels in Siwa and the clarification of their sustainability, namely (Edrar Emlal Hotel - Albabnshal Hotel - Siwa Oasis Hotel) and the comparison is based on a set of basic items:

- Location.
- Design Concept.
- vertical and Horizontal projections (Facade / architectural form - Floor plan).
- Interior Architecture Design (Interior Design - Number of Rooms - Bedroom - lounge).
- The Elements of Spaces (Walls – Roofs - Floors).
- Interior design supplements (Furniture - Windows and doors - lighting - Colours – Materials).

4.1 RESULTS AND DISCUSSION:

1. Restoration and maintenance of the archaeological buildings remaining in the Siwa Oasis, and this requires awareness and a sincere scientific and practical effort to preserve them and allocate financial resources. And the restoration of dilapidated ones according to the principles and rules of restoring heritage buildings, and not touching them and returning them to their original form.

2. Siwa's architectural character since the fifties of the last century is characterized by authority and not superficiality, which was inspired by Arab values and local heritage on the one hand, and the necessities and nature of life.
3. Encouraging the restoration of what remained of the Siwa heritage and opening its doors to the public to benefit from it both legally and materially.
4. Preserving the heritage buildings from the current distortion that we see using modern construction methods that are not compatible with the nature of Siwa and led to the outbreak of psychological conflict for citizens.

5.1 CONCLUSION:

Egypt 2030 plan tends to preserve the environmental identity. Sustainable hotels in Siwa have relied on traditional environmental methods of construction in various regions. In this paper we talk about the environmental sustainability of hotels to preserve the smooth character using environmental materials that are commensurate with the weather factors and the concrete urban sprawl that it does not fit with the Siwa nature and exposes it to danger. I presented a comparison between three models of hotels in Siwa (Edrar Emlal - Albabnshal - Siwa Oasis) through (location - design idea - projections - interior design - interior design complements) and arrived at the end of the research for a set of results including the restoration and maintenance of the remaining heritage buildings according to the principles and rules of restoring historical buildings, and not touching them and returning them to their original form.

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