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HARMONIZATION BETWEEN ARCHITECTURAL DEVELOPMENT AND HERITAGE IN SIWA OASIS - EGYPT

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ABSTRACT

To a significant extent, Siwa architecture has been based on climate, geography, available materials, and cultural beliefs. The natural and cultural cycles are about to disappear in many desert vernacular settlements of the world, and in Siwa -Egypt as well. The main concern of this paper is to show the impact of development on society and the built environment, the conflict between man: his traditions, needs and expectations, and his surrounding environment that has become typical of today's life. The paper provides lessons learnt from the environmentally friendly case study buildings in Siwa, and give some suggestions to save desert vernacular architecture. The objective of this paper is to investigate the development of Siwa putting into consideration the space-time relationship. Main problems and constraints facing the future development of both are highlighted. The paper goes on to provide recommendations to ensure the sustainability of architectural development and its initiatives in Siwa and conclude the need for an integrated and comprehensive action plan in the field of cultural heritage preservation, socioeconomic development and basic infrastructure development.

Keywords: architectural development, sustainable development, vernacular architecture, environment, socio-cultural structures, Siwa oasis, Egypt.

1. INTRODUCTION

Siwa Oasis -Egypt lies on the edge of the Great Sand Sea only 300km south west of the Mediterranean and Marsa Matrouh (L. Rovero and others, 2009), and around 70km east of the Libyan border. Siwa is famous for its dates which, along with olives and oranges. Siwa averages 18meters below sea level and has always had more than its share of excess ground water, and the salinity of the ground and the size of the lakes have increased over centuries of agriculture and irrigation run-off. Siwa has been inhabited from earliest times, Figure-1. There are tombs and other remains dating from the Late Dynastic period in Siwa, large number of monuments from the Graeco-Roman era (Hatem T, 2008), which began with the reign of Alexander who was recorded to visit the place, indicates a population boom in the oasis at that time. Today most of the population lives in the town of Siwa, a few other villages are scattered in other parts of the depression. The oasis enjoys a unique environment that combines lush cultivated areas, natural vegetation, and stark desert landscapes. There are several salt lakes in Siwa, and Siwa is also rich in its flowing springs of sweet sparkling water.

Figure-1. A traditional settlement in the west desert in Siwa, Egypt.

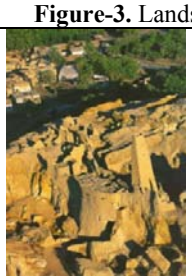
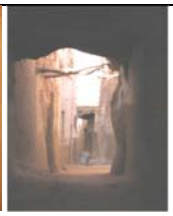
1.1 Research problem

The concern for conserving vernacular architecture has been expanding recently. Development has affected human life and changed his needs as people like to get use of new technologies that can facilitate their life in all fields.

Architectural technology and modern construction methods accompanied by sustainability needs has a great influence on architectural design especially in remote desert vernacular settlements with cultural heritage that has to be preserved.

2. MORPHOLOGICAL ANALOGY

Touring siwa, the following analogy can be:

2.1 Urban Morphology	Siwa still maintains a narrow, compact and irregular pattern that allows for pleasant pedestrian environment while restricting vehicular movement, (Mohamed A. Hanafi and Ahmed Y. Rashed, 2004) Figure-2.	 **Figure-2.** Urban morphology and texture in Siwa.
2.2. Landscape	• Scenic salt lakes • Geological formations along the El-Diffa escarpment • Great Sand Sea • Springs • Agricultural landscape with date and olive trees, (Mervat El-Shafie, 2010), where the original landscape is not being 'developed' yet, Figure-3.	 **Figure-3.** Landscape in Siwa.
2.3. Built up heritage	Historic evidence suggests a very early start, tombs from early pharaonic eras as well as Alexander the Great's temple. It has had a considerable wealth of the traditional housing in Siwa, (Eltawil H, 1989), Figure-4.	  **Figure-4.** Alexander the Great's temple and traditional housing of Siwa
2.4. vernacular architecture	The built environment can be classified as follows; old traditional houses which are mostly in a dilapidating condition, new concrete structures imported from the valley and neo-traditional attempts where traditional elements are cloned, sometimes using completely different materials such as steel,(Marwa Dabaieh, 2011), Figure-5.	  **Figure-5.** Bank constructed using Karshif (above), hospital building with glass windows (below).
	2-4-1 Sidewalks Dwellings are compact in shape for minimizing the amount of building surface exposed to the direct radiation of the sun, shaded and tunneled streets, which protect pedestrians. These tunneled streets also facilitate air current circulation and filtration of sand particles especially during sand storms, Figure-6.	  **Figure-6.** Example of shaded tunneled alleys (left), Tunneled shaded streets with light shafts (right).

2-4-2 Openings

The numbers of windows that open to the sidewalks are minimized to avoid having the unfavorable climate penetrate into the indoor area. Most of the windows open to the protected central courtyard area, which generally has less harsh conditions and a more favorable environment than exist on the outside of the buildings, Figure-7. Also the windows were oriented opposite to each other's for creating cross ventilation. Another natural technique was used for cooling the air during the hot summer is the use of vegetation beside the openings and hence improving cooling the air before passing through the windows.

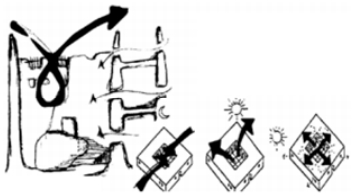


Figure-7. Natural technique for passive cooling.

2-4-3 Materials and building techniques

The architecture of Siwa oasis is characterized by the use of karshif fig. (8). an unusual material made of NaCl salt crystals with impurities of clay and sand. The blocks of irregular shape taken from the salt crust that surrounds the salty lake, are cut in smaller blocks and utilized in the masonry with a mud mortar very rich in salt obtained from two different clays, tafla or tiin. Wood inserts laid inside the wall thickness in order to improve the jointing between the external and the internal parts, especially where the walls are wide, fig. (9),(L. Rovero and others,2009).

Figure-8. Karshif.

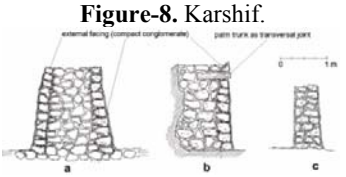


Figure-9. Different typologies of wall: wide thickness (a,b) and partition wall (c).

2-4-4 Facade

The outer walls are made by a badly ordered and selected internal nucleus of karshif blocks, bound by mortar, Figure-10. The external walls are painted for emitting the solar radiations.

Figure-10. Vernacular builders in the Siwa oasis using (Karshif) and mud. Roof construction is palm wood and mud brick.

2-4-5 Courtyard

In hot-arid regions, houses with courtyards are a time-tested and valuable design pattern. Atriums were used inside the houses, The rooms that open to the yard are usually protected against the extreme heat of the summer, the cold of the winter, and from wind, storms, and sand in desert regions, Figure-11.

Figure-11. Courtyard.

	2-4-6 Summer area and winter area Nature is an inseparable part of people's lives. It forces families to move to different parts of the house in different seasons. So, the bedrooms are separated in to roofed rooms for sleeping in winter and non-roofed for sleeping in summer to replace the use of any mechanical modes for cooling during the hot summer, Figure-12.	 **Figure-12.** Different sitting areas for summer and winter.

3. POTENTIALS FOR DEVELOPMENT AND FUTURE PROSPECTS

Due to its geographical isolation, no plans for development in siwa took place for long time. However, in the last ten years, especially after the new road linking with Matrouh and the coast, there have been several but rather random attempts for developments. There have been governmental studies as well as private initiatives. These were all directed towards exploiting economic potentials of the oasis; date, olive and eco-tourism (e.g. the Adrère Amellal project).

Sustainable development is not a new concept. It is the latest expression of a long-standing ethic involving people's relationship with the environment, and the current generation's responsibility to future generations "for a community to be truly sustainable, it must adopt a three -pronged approach that considers economic, environmental and socio-cultural resources. Communities must consider these needs not only in the short term, but also in the long term". Hence, the possibilities and potentials for siwa can be investigated through the following aspects:

Points of analysis			
	Environment	strengths	▪ Several salt lakes. ▪ Sand boards and toboggans of huge dunes. ▪ Rich natural environment, Figure-13 ▪ Vernacular architecture with traditional building techniques. ▪ Using the local availabilities in the building site yield. ▪ The local material having good thermal mass capacity for insulation and having beautiful surfaces as a finishing material
		weaknesse	▪ There is too much water and not enough drainage. ▪ Soil Salinization. ▪ Desertification due to the large consumption of underground water. ▪ Pollution.
		opportunities	▪ The most appropriate building isolative properties for achieving thermal comfort, and the creation of low-cost zero carbon building techniques. ▪ Achieving climatic responsive innovations in the building construction filed. ▪ Limiting the use of air conditioning to be replaced by natural ventilation methods achieves cheaper and a more energy-saving conventional alternative for climate control. ▪ Participation and involvement of the Siwa people in the environmental and developing programs.
		threats	▪ High temperatures during the day in summer.,(Climate Siwa,2014) ▪ replacement the traditional Kershef buildings with typical white blocks and cement which is causing a loss of Siwa's unique architectural identity and negative impact on the environment, (Dumairy, A. ,2005),fig.(14).
	Socio-cultural	strengths	▪ Variety of traditional arts and crafts. ▪ The development of communication means were modernized through railway lines and the introduction of car transport into the Western Desert. ▪ Siwa is one of the few Egyptian oasis communities that have managed to retain most of its traditional characteristics. ▪ Siwans are generally a conservative people and they are proud of their language. ▪ The Siwan building language has its own syntax and peculiar basic technical solutions.

		weaknesses	▪ The urban indiscriminate sprawl of modern buildings. ▪ The local buildings were suffering from many common problems such as structural cracks a bad water supply, drainage systems, shortage of natural gas, unsafe houses in case of rain and earthquakes, insects, smaller spaces inside the houses, not to make use of the land value, build more than two or three stories, losing the tangible heritage, and shortage of electrical appliances (computers and refrigerators). ▪ We have to bear in mind that for example some technical solutions are not realistic like arch, flat arch, or the creation of angle brackets that need the squaring of ashlars.
		opportunities	▪ The presence of programs for developing Siwa oasis, Fig. (15). ▪ By putting a "Building Guideline", a good landscape image could be achieved. ▪ Regular home maintenance. ▪ The construction of asphalt roads connecting Siwa and Qara to Marsa Matruh, some 300km away. ▪ It resorts to palm and olive trunks to bind separated walls or to realize architraves and projecting structures but also it ‘‘thinks” those drawings of the town walls incredibly winding and soft in order to avoid sharp discontinuities.
		threats	▪ An increase in the population of the siwa Oasis, table (1). ▪ The oasis was area of migration; this caused a great disproportion in the distribution of sex in the oases. ▪ it is important to remind that siwa in the middle of the desert, inside a palm grove with few and rare external contacts ▪ Limited services and lack of infrastructure.
	Economy	**strengths**	▪ Fresh water springs. ▪ Plants; date palm and olive,etc. ▪ Healing water, peaceful isolation. ▪ Archeological sites, (Fakhry A, 2004).table (2). ▪ Historical places. ▪ Tourism services (Hotels, Restaurants, commercial, shops, etc.) ▪ The local material in Siwa is cheap, naturally available in large quantities in the surroundings, durable, when applied correctly.
		weaknesses	▪ Cultural and Social Impediments ▪ Geographical Impediments ▪ Urban Impediments. ▪ Regulatory Impediments. ▪ Environmental Impediments
		opportunitie	▪ There are some paved roads which facilitate travel to the hotels, Fig. (16). ▪ A cell phone network which covers the whole oasis, Fig. (17). ▪ Transforming the sustainable development project scope in the low income communities in to a business model would significantly enhance the economic status of the poor. ▪ Emphasis to show the richness of local culture. ▪ Preservation of the architectural and urban patterns and to promote traditional building
		threats	▪ Lack of popular participation in development. ▪ Spatial remoteness to the oasis from the centers of urbanization in the Nile Valley. ▪ Economy development may adversely affect the environment. ▪ Overgrazing was the most activities affect on vegetation diversity and floristic composition.

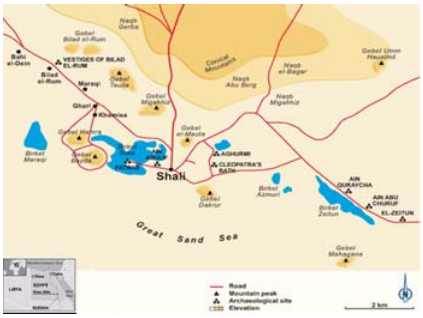


Figure-13. Geographic of Siwa oasis.
Source: http://www.minamar.com/images/map_siwa_oasis.gif

Table-1. The trend of the population in oases between 1882-1986.

year	1882	1897	1907	1917	1927	1937	1947	1960	1966	1976	1986
population	3346	5200	3884	3267	3267	3795	4044	3766	5169	7200	8000

Source: According to Censuses, (Mohamed A. Hanafi and Ahmed Y. Rashed, 2004)

Figure-14. Replacement the traditional Kershef buildings with typical white blocks and cement which is causing a loss of Siwa's unique architectural identity.

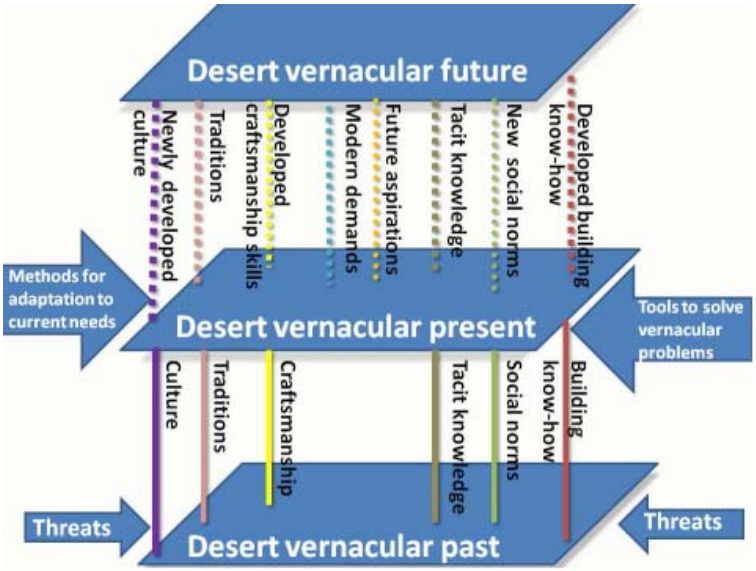


Figure-15. The figure shows that the future of siwa desert vernacular is based on the vernacular past and connected to contemporary needs, (Marwa Dabaieh, 2011).

Table-2. Shows the cultural heritage and Antiquities in siwa.

Cultural heritage	• Traditional communities with unique culture of Berber and Bedouin descent • Interesting customs and local holidays (October feast) • Local handcrafts (pottery, sewing and embroidery, jewelry) • Buildings of traditional architecture and materials (karsheef) • Traditional agriculture of date and olive groves, quality and authenticity of agricultural produce.
Antiquities	**Main antiquities in Siwa** • Temple of the Oracle • Temple of Om Obedah • Tombs of Gabal El Mawta (Mountain of the Dead), including the Tomb of Si Amun, the Tomb of Misu-Isis, the Tomb of Ne-Per-Pa-Thoth, the Tomb of the Crocodile • Ancient fortress mudbrick cities of Shali and Aghourmi **Other antiquities within the Oasis** **Western part of Siwa Oasis**:• Doric Temple • Bilad el Roum • Deheba Site. • Khamisa Site • Timaserain Site • Bahi el Din Site. **Eastern part of Siwa Oasis:**• Khoraishet Site. • Abu Sherouf Site • El Zeitoun Site • Sallam Site • Abu Al Awaf Site.

Figure-16. Paved road in the desert.

Figure-17. Part of the Siwan desert on the way to the Adrere Amellal hotel and Taghaghien Island hotel. This artificial palm tree is the focus of a cell phone network which covers the whole oasis

4. SOME CASE STUDY PROJECTS IN SIWA OASIS - EGYPT

Some case study buildings have made a major contribution to the sustainable architecture. They will be discussed for taking some lessons to be learnt from how the Siwan local people managed to incorporate their social enterprise dimension with the local architectural practices.

1- Case study	sustainable architecture	
House of a Siwan: Haj Ali (It is one of the typical Siwans' Kershef built houses which are in a good condition up to date, Fig. (18), (R.M. Ahmed, 2014).	- It is occupying around 350m2 / floor and 10 meters height. -The building has two stories connected by a central staircase also serving as a ventilation shaft, and a backyard sitting area for men, Figure-19, a guest room for visitors located close to the main entrance with a separate door from outside to insure privacy for the family member. - The external walls are painted for emitting the solar radiations. - Inside the house, a small entrance lobby welcomes the visitors; family members pass through this area to access their private area upstairs. - Storage room is located in the area between the entrance lobby and the kitchen, followed by the family living area so that there is no need for workers or outsiders to penetrate the house, Figure-19. -the stair case tower is used as lighting pipe where mirrors have been installed on the walls to reflect the sun light inside the house, Figure-19, beside acting as a cooling tower as well. -On the upper floor, bedrooms are located with a central living area. Another un-roofed kitchen is located on	 **Figure-18.** External view of Haj Ali's house.

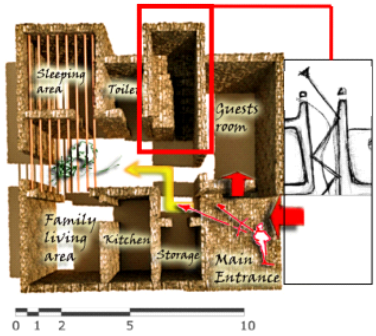


Figure-19. Left: Ground floor plan comprises of: L-shape entrance, guest room, storage, family living area, open roof sleeping area, toilet and a stair case leading up stairs to the bedrooms, Figure-19. Right: the stair case acting as a lighting pipe

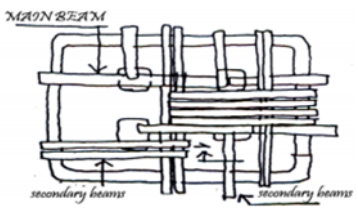
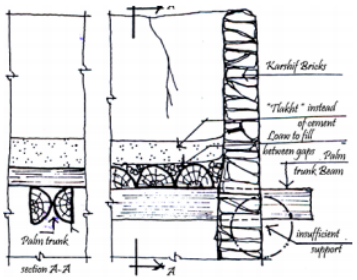
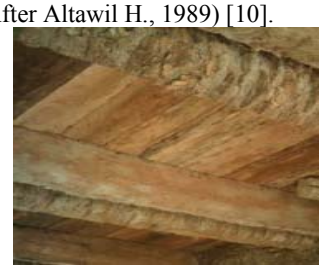


Figure-20. Looking up view of the palm trunks' roof with reference to the layout of the main and secondary

	the upper floor in addition to the one in the ground floor. The upper kitchen is actually the one sued for cooking, equipped with a built-in Kershef cooker for minimising the use of electricity as well. - The house was built first with 50 cm high concrete wall on the ground floor level, which is not costly to build for isolating the ground water from the Kershef blocks. Then they determined the areas of the room and afterwards they started building with the thick Kershef blocks until they reached the desired height. They repeated this for each single room. Following, they supported their walls with palm wood trunks connections on roofs to achieve straight endings of the building's walls, which was used as decorative element for interior design as well, Figure-20, 21, 22.	beams (After Altawil H., 1989) [10].  **Figure-21.** Section showing the palm tree trunks used for roof construction (After Altawil H., 1989) [10].  **Figure-22.** Interior view of the palm tree ceiling.

2- Case study	sustainable architecture	
Adrere Amellal eco-lodge (It has been selected for the remarkable blend of the building with the surrounding natural environment and landscape), Figure-23.  **Figure-23.** Adrere Amellal eco-lodge blended within the mountain and within the surrounding landscape.	-It is considered one of the main touristic eco-lodges in siwa. It is located in a unique place surrounded by sculpted limestone, 75 acres of palm and olive trees, salt rocks and clay, aimed to best use the available local building materials available in the surrounding environment. -The hotel is at the edge of the lake Siwa in the western desert. The building has 39 environmentally friendly rooms, the rooms are designed with a style of comfort and respect to the environment at the same time, Figure-26. -Windows were designed to be very small in size and imbedded in the very thick Kershef walls, Figure-24 Left. -climatic responsive materials used and passive cooling and cross ventilation were achieved for better climatic conditions. -The building was built at the foot of the mountain in order to build on non-arable ground and to appropriately coat the arrangement in a manner that merges the mountain with the building. - The building is characterized with its furniture, made with the local materials of sand blocks, various Kershef patterns, unique sky light roof made of palm tree trunks blended with sand blocks, fig. (25) and the furniture carved from palm tree trunks. -The floors are built with stone. In bathrooms, both walls and floors are built	 **Figure-24.** Left: The small windows imbedded in the thick walls. Figure-24. Right: Bathrooms built with stones on walls and floors.  **Figure-25.** Sky light roof made of palm tree trunks blended with sand blocks

	with stone, Figure-24 right	 **Figure-26.** An example of the dehydrated Kershef textures which added beauty to the interior design in addition to acting as good insulators.

3- Case study	**sustainable architecture**	
Shali Lodge and its extension Al Baben Shali	- They were constructed as the first eco-tourism lodges in Siwa. Shali lodge is situated few meters from the village in Siwa -no electricity was used to promote the awareness of less energy consumption. - The building technique adopted relied mostly on best utilizing the available resources. For instance; both buildings were built with Kershef and the interior walls exposed to the sun were painted in light colors for emitting solar radiations. -Open air atrium between the rooms has been created for passive ventilation, where we can see wide opening arches are surrounding the atrium for enhancing the wind speed, Figure (27, 28). -the windows were orient in an opposite direction for achieving cross ventilation for replacing air conditioners. -different forms of palm trees layout were designed for ceiling construction. - Alcoves were grooved on the walls for storage or decorative purposes inspired by the old Siwan vocabularies. -kershef building technique is creating more job opportunities for many Siwans who obtained training in building with it. - The project attributed to raising the awareness of the local people to the importance of protecting the non-renewable resources of the oasis, water depletion was prevented and agriculturalists started to grow organic pesticide-free crops. -The unique wooden designs inspired by the traditional Siwan vocabularies are also applied in arches' designs, Figure-29. -Lighting lamps, furniture items using dehydrated sand, Figure-30. - A unique pattern of the wooden palm tree ceiling.	 **Figure-27.** An atrium in Shali lodge between the hotel rooms influencing wind movement via passive cooling and creating cross ventilation as well.  **Figure-28.** An open roof gathering area, showing the Siwan bedwin spirit reflected on the interior façades design and integration of palm trees.  **Figure-29.** Decorative arches using palm trees' trunks.  **Figure-30.** A center piece table made from dehydrated salt blocks.

4.1 The results of the case studies

The previous projects provide us some lessons about harmonization between the environmentally friendly architecture and nature in Siwa.

- **Environment**

As shown from these examples, various low cost climatic responsive building techniques have been adopted inspired by the traditional Siwans' houses, summarized as follows:

-Using the stair case tower as an atrium for passive ventilation.

-Creating an affordable lighting pipe for maximum the use of sunlight shaded on the house for long hours during the day.

-Enhancing passive cooling via separating the building with narrow alleys for creating wind currents, besides cross ventilation replaced the use of air conditioners.

-Orienting the windows in a way to promote cross ventilation as a replacement for air conditioners.

-The remarkable blend of the building with the natural environment using the traditional vocabularies, not only on the exterior façades, but also through the interior vocabularies used.

- using the local material for building the cooker to minimize the electrical devices.

-Creating a new and unique practice of dehydrating the salt furniture and lighting units inspired by the best utilization of the natural environment.

-Designing a beautiful yet robust palm tree trunk ceilings, matching with the layout of Kershef building and also as a material for climatic responsive zero carbon emission material.

- **Socio-cultural structures**

- Designing the main entrance in L-shape and locating the private rooms at the back of the house for conserving the local culture and traditions of keeping the privacy of the family and segregation between females and males.

-Encouraging social interaction among the family members by providing central gathering areas.

-The project (The second case study) has respected Siwa's culture, norms, and nature. it used modern technology to enhance the past; referring to not using electricity which was done intentionally to make travelers experience night time and day time to allow them to go back to the natural rhythm of life, and feel harmony with nature. A better quality of life was provided to the people, including: simple, clean, good food, and fusion of state of being, that makes Siwa a unique enterprise.

-The project (The third case study) helped employment of over 45 Siwan which also helped them not only to earn wages but to gain the abilities and techniques of long-established building systems.

-The project encouraged the local people to be engaged in other activities related to tourism, like Kershef construction, palm trees' roof construction, sand furniture and products, the Siwans. Siwan women were given opportunities to gain employment, a prospect that was previously unheard of in the male-dominated society, (Hatem T, 2013).

- **Economy**

-Promoted the awareness of less energy consumption among the society.

-The project (The second case study) enabled the local people to create economic opportunities for themselves while restoring the physical environment, promoting gender equity, marketing local products to the international market, and helping position Siwa on the global stage,(Hatem T,2013).

5. CONCLUSIONS

Harmonizing between development and cultural heritage preservation is an integrated activity that needs to be shared between various parties.

Government	**Future planning** ▪ Document heritage landscape. ▪ Valorize the existing ecological systems for Siwa's unique locality. ▪ Designate conservation areas to maintain and enhance their character and integrity. ▪ Provision of urban extension areas fit with the needs and culture of the citizens. **Design regulations** ▪ Activate design controls and putting guidelines for constructing new buildings and existing buildings restoration. ▪ Preserve relationship between historic settlement and its surroundings natural and manmade settings. **Economic** ▪ Support development activities; social and economic. ▪ Activate Eco-Tourism. ▪ Fund for Local Initiatives.
Investors and Beneficiaries	▪ Enhance future development and maintain environmental, social and cultural qualities. ▪ Participation and involvement of the Siwa people (residents of all age group is of first and foremost importance). ▪ Preservation of historic buildings. ▪ Living in harmony with nature and focusing on recycling and reuse. ▪ Siwa's Artisanship Development Initiative. ▪ Participatory Events.
Research centers	Make studies that help in developing and improving the strength of Siwan mortar to bond the 'Karsheef' particles together, Withstand strong rain. Solve problems regarding palm tree trunks - termites. Construction dependence on local tradition, climate, resources, and materials.
Architects	▪ Architects should allow the infinite variety of human talent to build harmonious and pleasing environments. ▪ Preserve relationship between Architectural Development and heritage. ▪ Appropriate architectural solutions for technological progress.

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