

The Role of Traditional Architecture Techniques in the Formulation of Sustainable Architectural Form in the Natural Reserves in Egypt

Esraa Abdulalim^{1,*}, Ehab Okba¹, Mohga Embaby¹

¹Department of Architecture, Faculty of Engineering, Fayoum University, Egypt

*Corresponding author: Esraa Abdulalim (eaa13@fayoum.edu.eg).

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Abstract

This research is based on shedding light on the techniques of traditional architecture in natural reserves and their relationship to sustainable architectural formation. God Almighty has appointed man on earth to build it, granted him intelligence and strength, subjugated all creatures to him, and provided him with the means of living to fulfill this message.

And Allah says: "We have made that which is on the earth adornment for it that We may test them which of them is best in deed" [verse 7 of Surat Al-Kahf].

Therefore, it was necessary to put forward a theoretical framework in five chapters, the most important theories that explain the relationship between the characteristics of the natural and built environment in natural reserves in Egypt, where the focus was on building restrictions in natural reserves at the forefront of the topic. Then It's dealt with the role of architectural formation in achieving sustainability by knowing the principles of sustainable architectural formation through compatibility of requirements and criteria for achieving sustainability with the characteristics of sustainable architectural formation in natural reserves. Then, at the end of the theories, It's dealt with the formulation of sustainable architectural formation using traditional architecture techniques, with knowledge of traditional architecture in terms of concept, characteristics, techniques, and standards. In the fourth chapter, the analysis of international and Arab experiences in natural reserves and the reasons for choosing these experiences were dealt with. The experiments were analyzed and evaluated in the light of the proposed methodology, with deriving the criteria that must be met in order to reach the role of traditional architecture techniques in serving the marketable architectural formation of "sustainability". Thus, in the fifth chapter, the case study was applied and evaluated in the light of the proposed methodology, while extracting the criteria that must be met in order to reach the role of traditional architecture techniques in formulating sustainable architectural formation in nature reserves in Egypt.

Keywords

Building restrictions in nature reserves, Natural and built environment, Principles of Sustainable Architecture. Sustainable architectural form, Traditional architecture, Traditional architecture techniques

Introduction

The scientific concept of the research is due to the importance of developing and developing natural reserves and applying models for sustainable tourism in them and the need to establish buildings for tourism, administrative and environmental services that have environmentally friendly characteristics and features that achieve integration between: preserving the characteristics and features of the biological diversity inherent in natural reserves and establishing facilities that are compatible in their architectural composition with the principles Sustainability and ecological architecture.

Hence the importance of the research lies in monitoring and highlighting the role of traditional architecture techniques in achieving sustainable architectural form that is compatible with the environmental characteristics and ecological features of natural reserves on the one hand, and meeting the needs of building service facilities necessary to achieve sustainable tourism development in them on the other hand.

RESEARCH PROBLEM

Two main axes form together the research problem of this study, namely:

The first axis: the scarcity of research and scientific theses that dealt with traditional architecture techniques in nature reserves without delving into sustainable architectural formation, given the importance of formation in discussing the results to determine the best environmental treatments and the best in traditional techniques.

The second axis: the deterioration of traditional architecture and the failure to use appropriate architecture techniques to develop traditional architecture and limit the use of inappropriate techniques. Traditional architecture throughout the world provides useful examples of sustainable solutions to building problems.

Since nature reserves are one of the important means to maintain the ecological balance, preserve the environment and prevent the depletion and deterioration of natural resources in a way that guarantees the survival and preservation of biological diversity necessary for the continuation of life.

Any form of design works to reduce the destructive effects of the environment through its integration and integration with living processes. The sustainable architectural formation reinforces the emphasis on preserving the biodiversity of the planet.

Thus, the research problem confirms the deterioration of some buildings that negatively affect biodiversity in nature reserves. Illustration of some dilapidated buildings with Figure 1.

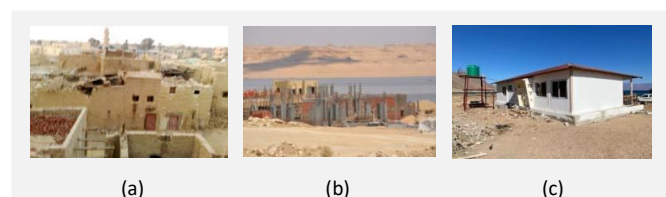


Figure 1. Illustration of some dilapidated buildings (a) The deterioration of some traditional buildings due to the lack of awareness and the migration of the population to them - Siwa Reserve in Matrouh Governorate (b) Establishing tourism projects that are not compatible with the environment, but rather destructive, on the shores of the lake - Lake Qarun Reserve in Fayoum Governorate (c) Establishing a service building that is not compatible with the environment - Abu Galum Reserve, South Sinai Governorate.

METHODOLOGY

The research is based on relying on the integrated approach that combines the theoretical framework with the practical reality, as this approach helps in the applied study (methodology - evaluation tool), as it allows the study of the factors and variables affecting it, and thus the research depends on four axes:



1. Characteristics of the natural and built environment in natural reserves

1.1. Natural reserves in concept and importance

The concept of natural reserves in its current legal form is relatively recent, although it has been known since ancient times, but with other concepts and names, and in its current concept it came into existence in 1970 through the Man and the Biosphere Program (MAP) as the map shows in Figure 2. as well as in the first conference On the human environment of the United Nations, held in Stockholm in 1972, when the conferees approved a recommendation stipulating the need to establish a global network of nature reserves.

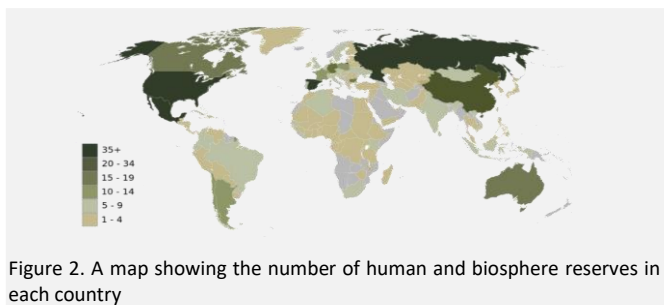


Figure 2. A map showing the number of human and biosphere reserves in each country

The importance of these natural reserves lies in what they achieve in preserving living natural resources and maintaining the health of environmental processes in the ecosystem, conducting research, education, training and environmental media, as well as tourism and trying to make profits from visits and deepening human awareness of the agricultural, desert, marine and coastal environments, fresh water and their ecosystems, and providing forms Entertainment and tourism so that visitors and tourists can enjoy these natural resources.

Nature reserves are classified into different categories, and many countries have adopted the International Union for Conservation of Nature (IUCN) classification system, which has classified protected areas according to their intended purpose into seven categories. The fig.3. shows the classification of nature reserves according to the International Union for Conservation of Nature.



Fig. 3. the classification of nature reserves according to IUCN (a)Strict Nature Reserve (b)Wilderness Area (c)National Park (d)Natural Monument or Feature (e)Habitat/Species Management Area (f)Protected Landscape/Seascape (g)Protected area with sustainable use of natural resources.

1.2. Characteristics of the natural environment in nature reserves in Egypt

The Egyptian environment has many capabilities and components that, through optimal exploitation, can make Egypt at the forefront of tourism countries in the field of ecotourism. This is due to the diversity and spread of these capabilities and components throughout the Republic. Below we address six features:

1- Geographical characteristics

Egypt is located in the north-eastern corner of the continent of Africa, and has an Asian extension, as the Sinai Peninsula is located within the continent of Asia, as it is a transcontinental country. Geographical location has a major impact on giving the environment some of its characteristics, and the characteristics of natural reserves differ in their geographical environment. Figure 5.



Figure 5. Egypt's geographical borders

2- Geological characteristics

Geology includes everything related to the Earth, including its phenomena, layers, properties, and phenomena related to it, such as earthquakes, volcanoes, the path of valleys, and everything related to surface water and the water cycle in nature. Figure 6.



Figure 6. White Desert Reserve

3- Climatic characteristics

The climate in Egypt in general is a desert climate, which is hot in the summer and moderate in the winter. The prevailing winds are coming from the Mediterranean.



Figure 7. Taba Reserve, South Sinai Governorate.

4- Ecological characteristics

The ecological (natural) environment includes several elements: climate, land, living biological creatures, and the natural components of the earth. Figure 7.

5- Natural resources

Egypt is full of unique and diverse natural resources, whether on its coasts, deserts, or between its mountains and valleys, with moderate weather throughout the year.

6- Importance, rarity and environmental sensitivity

Examples of natural reserves in Egypt, as



Figure 8. Mount Hamata:

shown in Figure 8, include the Wadi El Gemal Reserve. The most important natural elements to be preserved due to their importance and scarcity are discussed.

one of the highest mountains in the eastern desert, which hosts a wide variety of plants and wildlife. The region also has several islands of international importance for breeding birds and sea turtles.

1.3. Characteristics of the built environment in natural reserves in Egypt

The research presents building restrictions in natural reserves at the forefront of the topic in order to know the international and local laws and legislation regulating construction in natural reserves. Then it presents the characteristics of the built environment in natural reserves in achieving compatibility of the building with the environment, and it includes four types of buildings built in natural reserves: residential and hotel buildings, tourist buildings, educational buildings, and museum buildings.


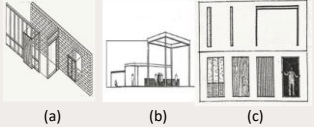


1.3.1. Building restrictions in nature reserves

Knowing the restrictions on building in natural reserves necessarily requires identifying the laws and legislation regulating construction in them, as international and local law regulates the categories of natural reserves, the use assigned to them, and the system of protection, use, designation, and management of the aforementioned areas. These global and local laws and legislation are detailed in Table 1.

Table 1. Permitted construction requirements in nature reserves		
Local laws and regulations governing construction	International laws and regulations governing construction	Construction restrictions and requirements
<p>The activities related to the nature reserve area have three management levels:</p> <p>A- Management within the natural reserve area</p> <p>The administrative authority to be determined by a decision of the Prime Minister is considered with implementing the provisions of this law and the decisions implementing it, with the aim of preserving and protecting reserves.</p> <p>b- The administration for carrying out activities in the natural reserve area</p> <p>In the Arab Republic of Egypt, environmental laws are legislation, in particular Law No. 102 of 1983 in the matter of natural reserves and Law No. 4 of 1994 as amended by Law No. 9 of 2009 in the matter of environmental protection stipulate Prime Minister's Decree No. 204 of 1994 and amended by Decree No. 2728 For the year 2015 regarding the conditions, rules and procedures for practicing activities in the areas of natural reserves.</p> <p>C- Administration outside the natural reserve area</p> <p>The natural resources are inviolable and are the basis for national development and tourist attractions in Egypt. And that the one who caused any damage to it bears the cost of restoring it, and the value of the environmental damage it caused, in addition to the penalties stipulated in environmental laws.</p>	<p>The activities related to the nature reserve area have three management levels:</p> <p>A- Management within the natural reserve area</p> <p>Temporary stipulations to maintain the status quo where a protection area has been identified, but designation takes time when nature reserves are divided into use areas.</p> <p>b- The administration for carrying out activities in the natural reserve area</p> <p>Requirements applied by the tourism-related administration that allow activities in nature reserves.</p> <p>C- Administration outside the natural reserve area</p> <p>Requirements applied outside nature reserves to prevent or reduce negative impacts due to outside activities that may be harmful to nature reserves are prohibited.</p>	<p>environmental laws</p>
<p>The role of reserves management in providing tourism objectives and facilities must be developed in close coordination with the region and the National Tourism Authority. The Tourism Board may sometimes provide financial assistance for the development of tourism facilities in nature reserves.</p>	<p>According to the National Park Tourism Management Act, strategic elements will be integrated into the management plan. The main purpose of a management plan is simply to describe how tourism and related services will be managed and organized.</p>	<p>Tourism management laws</p>
<p>Biodiversity of natural origin lies in the promotion of sustainable development. Egypt's future depends on the sustainable management of its natural, physical and human assets. The most serious challenges facing Egypt are poverty eradication, food security, provision of fresh water, soil conservation, and human health, all of which</p>	<p>Preserving biodiversity is the primary goal of IUCN-designated protected areas. Other types of protected areas, such as historical parks, monuments, sacred sites, tribal reserves, etc., which have no content relating to the conservation of nature or natural resources in any of their manifestations, will be pursuant</p>	<p>Laws for the Convention on Biological Diversity (CBD)</p>

1.3.2. Characteristics of the built environment in nature reserves

Table 3: Creations of architectural formation

<p>1- Shape</p>  <p>Figure 11. Foundations of Shape (a) Regular form: the example of the Laayoune School of Technology in Morocco, a group of breakers formed in a regular and sustainable iterative manner. (b) Irregular shape: the example of the library and learning center of the University of Economics Vienna, the formations are irregular in shape, and they are formed sustainably. (c) The look is inspired by nature: An example of a house inspired by nature in Norway. This glass-walled house has been specially restored and is linked to the rocky landscape of Larvik, Norway.</p> <p>3- Ratio and Proportionality</p>  <p>Figure 13. Foundations of Ratio and Proportionality (a) Example material ratios for iron and wood (b) Structural proportions example (c) An example of manufacturing ratios for materials with fixed proportions.</p>	<p>2- Repetition and rhythm</p>  <p>Figure 12. Foundations of Repetition and rhythm (a) Regular Rhythm: An example of Canterbury Cathedral, the library is characterized by regular recurring bays of brick buttresses (b) Flowing rhythm: an example of a cultural center designed by the architect Zaha Hadid, where the rhythm of all the curves and flowing spaces in it (c) Progressive Rhythm: The Australian Opera House example, a sequence is created in which the elements change slightly each time they are repeated.</p> <p>4- Texture and color</p>  <p>Example texture and color at home in Argentina. The "lower" house enjoys a more harmonious relationship with the surrounding topography and scenery, the meeting point of the house, the environment that seeks to focus its creation with the hill in color and texture. The materials used are low maintenance and respond to structural and project logic that balance their existence with their environment.</p>
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2.1.2. The values inherent in the architectural formation


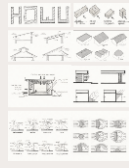


2.2. Principles of sustainable architectural formation

The formation of the architectural building is like the formation of writing, where the formation of the components tells the story of the formation of the building and determines its structure. Also, through the formation of the architectural facade, the architectural function of each of the functional formations of the building (Al-Rawashdeh) can be determined, and the formation can also be defined with sustainable foundations. In the following, the requirements and criteria for achieving sustainability are first addressed. Secondly, the characteristics of sustainable architectural formation in nature.

2.2.1. Requirements and criteria for achieving sustainability

The values of architectural formation are the main reason for its preservation. However, most researchers agree that natural and climatic values are the most important reasons for preserving the architectural formation. Researchers Nigel Dunne, Derek Worthing, and Stephen Bond highlighted that the importance of preserving architectural formation lies in the continuity of its function (social and structural values) and the culture it contains. Furthermore, identifying heritage assets according to natural and climatic values contributes to "appreciating the relevant social and construction aspects." However, the values inherent in the architectural formation that must be analyzed in order to determine the importance of the architectural formation and the importance of preserving it can be classified into four categories, as shown in Table 4.

Table 4: The values inherent in the architectural formation

<p>1- Shape</p>  <p>The built environment harmonizes with the natural surroundings in the village houses nestled in the landscape of Madagascar's central highlands and are the region's most humble expressions.</p>	<p>2- Climatic value</p>  <p>The formation is considered one of the important aspects that are affected by the climate of the prevailing conditions. It is better to know the climatic factors that affect this shape and how the architect chooses the appropriate solutions in a manner that is associated with human comfort inside the building. It is affected by several factors: the shape and direction of the building bishop Walls openings.</p>
<p>3- Construction value</p>  <p>An example of aesthetic functional elements in the Architectural Heritage Center in Diriyah. The building envelope is constructed from a double façade inspired by the sand dunes as thick as the earthen masonry of the historic Diriyah buildings: a perforated outer layer that protects the building from sunlight and an inner curtain wall to preserve the surrounding landscape.</p>	<p>4- Social value</p>  <p>An example of aesthetic functional elements in the Architectural Heritage Center in Diriyah. The building envelope is constructed from a double façade inspired by the sand dunes as thick as the earthen masonry of the historic Diriyah buildings: a perforated outer layer that protects the building from sunlight and an inner curtain wall to preserve the surrounding landscape.</p>




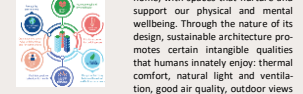
The architectural formation plays a major role in supporting the sustainability of the building, as it can contribute significantly to raising the efficiency of the environmental performance of architecture and urbanism, and it can also negatively affect them. Form directly on the costs of supplying services and infrastructure. There are organizations that support sustainability, as these organizations seek to organize projects to encourage the foundations and principles of sustainability, such as (American LEED), (British BREEAM), (Australian GREEN STAR) and (Japanese CASBEE), from which the most important requirements and standards have been drawn, which have been clarified In Table 5.

Table 4: Requirements and criteria that have been extracted from the systems supporting sustainability

CASBEE	GREEN STAR	BREEAM	LEED	Foundations and principles extracted from organizations supporting sustainability
✓	✓		✓	Passive design
✓	✓		✓	Energy efficiency
✓	✓	✓	✓	Life cycle carbon footprint
			✓	Reductionism
✓	✓		✓	Material impact and waste
✓	✓			Local environment
✓		✓		Longevity
✓	✓			Budgeting and affordability
✓	✓	✓		Health and wellbeing

There are some guidelines in the field of sustainability, which include nine main principles and represent the foundations and principles of sustainability. Even though the word ‘sustainable’ is now used to describe many things, some are inherently more sustainable than others. In architecture, true sustainability requires a holistic approach, encompassing every element of a building — from design, materials and construction to energy resources, technology and the local environment., and nine principles can be clarified As follows in table 6.


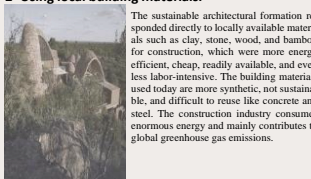

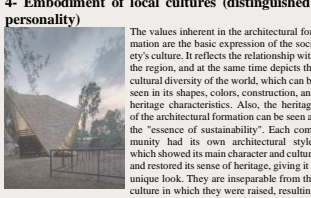
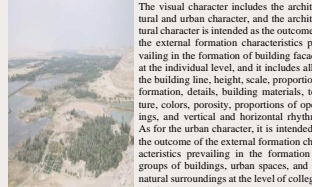
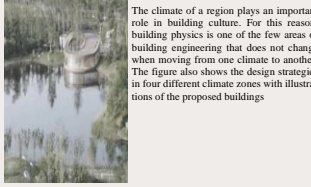
Table 6: Nine principles of sustainability

<p>1- Passive design It is a building design to make the most of natural light and cooling breezes, and to use appropriate shading, orientation and building materials to minimize heat gain and storage. The use of passive design principles results in a comfortable, energy-efficient building and results in significant savings in operating costs, thus avoiding or reducing the need for mechanical heating or cooling.</p>  <p>Figure 14. Principles of passive design.</p>	<p>5- Material impact and waste This principle urges designers to consider reducing the use of new materials in the buildings they design and calls on them to design buildings in a way that makes them or some of their elements – at the end of the life of these buildings – a source and resource for other buildings. There is another important way to reduce the use of new resources and materials: In recycling materials, waste, and building remains.</p>  <p>(a) (b) (c)</p> <p>Figure 18. For example, buildings built according to the system of the state of Nebraska in America, which are made of compressed straw bales and covered with plaster, have benefited. In addition to the abundance of straw, it is easy to use and is a first-class heat insulator. Here, (a) Complete construction inside the building. (b) The method of finishing the walls (c) Straw baling method for walls.</p>
<p>2- Energy efficiency Sustainability is based on a philosophy that encourages energy efficiency. This is done through designs that reduce energy consumption including the use of passive design and renewable energy sources such as solar and wind.</p>  <p>(a) (b) (c)</p> <p>Figure 15. Use of renewable energy sources (a) Right: installing the wind turbines on site, Left: installing them on the roof of the building. (b) Installing solar cells on these auxiliary structures to shade car parks (c) On-site installation of solar cells at the Los Angeles Postal Processing Center.</p>	<p>6- Local environment The necessity of harmony between the shape of the building, the nature surrounding it, and its climate must also be taken into account, and the site should be respected by inviting designers to use methods and ideas that would preserve the features of the building site by not making fundamental changes to it.</p>  <p>(a) (b) (c)</p> <p>Figure 19. The Waterfall House in Byron, Pennsylvania, which was built on the rock at different levels with the waterfall and achieved the strong horizontal and vertical lines of the distinctive feature of the waterfall out of respect for the site, which led to the creativity of the formation's consistency with the natural surrounding environment (a) Strong horizontal and vertical lines (b) Trail to the entrance to the waterfall (c) The building overlapped the waterfall.</p>
<p>3- Life cycle carbon footprint This involves considering all relevant phases such as extraction of raw materials, transport routes, manufacturing processes and disposal, and investigating the environment impact. A life cycle assessment at product level is referred to as carbon footprinting, as the focus is specifically placed on the greenhouse gas emissions generated (product carbon footprint PCF).</p>  <p>Figure 16. A CO₂ balance at product level (product carbon footprint) is an application of the LCA methodology that focuses specifically on greenhouse gas emissions.</p>	<p>7- Longevity Buildings should invariably be designed and built to last. Investing in sustainable architecture is an investment in the longevity of a house. Quality construction, durable materials and versatile design not only reduce the cost of a building over time, they also help ensure that it ages well.</p>
<p>4- Reductionism Reductionism is one way to reduce the carbon footprint of a building. Every square metre of house has environmental and financial consequences; therefore, the need and necessity of every space, material and product is questioned and considered.</p>  <p>(a) (b)</p> <p>Figure 17. Internal Trapped heat (a) Natural ventilation is the most effective way to reduce trapped heat in the room. It creates a passive stack effect and pressure difference which brings in fresh cool air. The air change makes the internal environment comfortable for the occupants. (b) The landscape surrounding the building also helps enhance the ventilation. Choosing deciduous vegetation creates an inexpensive form of shading. Strategic placement of Trees and bushes divert fresh air into the building, reducing the need for a mechanical system.</p>	<p>8- Budgeting and affordability Prioritising sustainability in the budget will result in a better, more economical and energy efficient house that yields greater savings over time. A building with good passive design and a well-insulated and airtight envelope is cheaper to operate and will rationalise the ongoing cost for the building's life. A smaller, smarter floor plan reduces material and construction costs, and can offset higher upfront investments, such as double glazing, solar PV arrays and durable materials that require less maintenance and repair.</p> <p>9- Health and wellbeing A sustainable home is also a healthy home, with spaces that nurture and support our physical and mental wellbeing. Through the nature of its design, sustainable architecture promotes certain intangible qualities that humans innately enjoy; thermal comfort, natural light and ventilation, good air quality, outdoor views and a connection to nature.</p> 

As mentioned in the previous chapter, buildings in nature reserves are characterized by a unique natural identity and character that evolved from the amalgamation of influences such as natural desert topography, climate, geography, and cultural factors, which influence the way of life there and add distinction to building styles and forms as well. There is harmony and harmony between buildings and nature due to the use of local natural resources as building materials. As architect Hassan Fathi used to say: “The building lives in the land it belongs to” (Dabaieh, M. 2011). For example, buildings can be fashioned into mountains, roofs are forests, and columns are trees, something akin to man-made "ecosystems," in service of the marketable architectural formation of "sustainability."

The following are some of the characteristics and features through which the sustainable architectural formation in nature reserves is distinguished from other patterns, and six characteristics can be clarified as follows in table.7.

Table 7: Characteristics of sustainable architectural formation

<p>1- Compatibility with the surrounding environment Sustainable architectural formation depends on the harmony of the building with the surrounding environment, climate, geography, and landscape. Architectural formation is not always about regular or irregular shapes. Designers can find inspiration from anywhere, especially nature. This specific type of inspiration is actually called biomimetic architecture. The shapes are so inspired by nature that what seems so simple in nature can actually translate into a better design solution by the designer. These design solutions are generally more efficient, sustainable, healthy and aesthetically pleasing.</p> 	<p>2- Using local building materials. The sustainable architectural formation responded directly to locally available materials such as clay, stone, wood, and bamboo for construction, which were more energy efficient, cheap, readily available, and even less labor-intensive. The building materials used today are more synthetic, not sustainable, and difficult to reuse like concrete and steel. The construction industry consumes enormous energy and mainly contributes to global greenhouse gas emissions.</p> 
<p>3- Compatible construction techniques The sustainable architectural formation in building techniques still exists today and has proven to be more durable by merit. The use of local materials allowed for easy preparation, and the possibility to create the composite allowed for thermal efficiency, recycling, biodegradability, and sustainability. Building techniques were changed on the basis of trial and error and building materials were changed or added depending on the survival of the building. The building techniques were the result of those attempts to shape the best sustainable building.</p> 	<p>4- Embodiment of local cultures (distinguished personality) The values inherent in the architectural formation are the basic expression of the society's culture. It reflects the relationship with the region, and at the same time depicts the cultural diversity of the world, which can be seen in its shapes, colors, construction, and heritage characteristics. Also, the heritage of the architectural formation can be seen as the "essence of sustainability". Each community had its own architectural style, which showed its main character and culture and restored its sense of heritage, giving it a unique look. They are inseparable from the culture in which they were raised, resulting in their regional and economic aesthetics.</p> 
<p>5- dominant visual character The visual character includes the architectural and urban character, and the architectural character is intended as the outcome of the external formation characteristics prevailing in the formation of building facades at the individual level, and it includes all of the building line, height, scale, proportions, formation, details, building materials, texture, colors, porosity, proportions of openings, and vertical and horizontal rhythms. As for the urban character, it is intended as the outcome of the external formation characteristics prevailing in the formation of groups of buildings, urban spaces, and the natural surroundings at the level of collegial relations among them.</p> 	<p>6- The design reflects the climate The climate of a region plays an important role in building culture. For this reason, building physics is one of the few areas of building engineering that does not change when moving from one climate to another. The figure also shows the design strategies in four different climate zones with illustrations of the proposed buildings</p> 

3. Formulation of sustainable architectural formation using traditional architecture techniques

3.1. Traditional architecture in concept and characteristics

Construction probably began with simple forms of masonry used as shelter from wind, sun and rain. Gradually, as the desire for better shelter increased, suitable materials were

identified and construction skills developed. Traditional architecture throughout the world is usually characterized by the appropriate use of readily available local materials and an experiential understanding of climate and site. These building forms evolved over generations, and since the requirements were relatively simple and change was usually very slow, design, building materials, and construction techniques evolved according to needs and available resources (Sayigh, A. (Ed.. 2019). In the following, the concept of traditional architecture is dealt with with its concepts and characteristics.

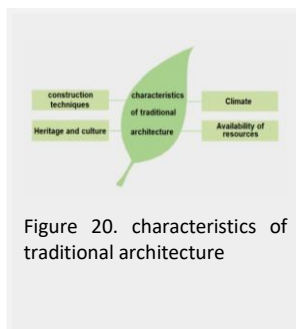
3.1.1. Concept of traditional architecture

The concept of sustainability was present in the way of living of traditional societies and their lifestyle because the surrounding environment was the source of their life, and therefore they did not use the term sustainability as an expression of their way of living and how to provide sources of livelihood and the way they build, but rather lived the concept and applied it spontaneously and automatically. Brian Edwards, one of the most important specialists in sustainability and green architecture, defines it. He emphasizes the foundations of sustainability in traditional architecture: that it was able to blend the dimensions of social sustainability with environmental requirements to form sustainable architecture compatible with the environment.

3.1.2. characteristics of traditional architecture

Traditional architecture is affected by a wide range of different factors of human behavior and the environment. The factors that affect traditional architecture vary from one region to another, but they share many characteristics, which include the four most important characteristics of traditional architecture, as shown in Figure 20. These characteristics

Overlapping in some way, as studies have shown that climate, building techniques, and availability of resources are the most important characteristics that influence most traditional architecture in Arab models. However, in global models, climate, heritage and culture are the most prevalent characteristics.







3.2. Traditional architecture in sustainable architectural techniques and formation

3.2.1. traditional architecture techniques

The traditional building techniques have influenced the visual elements in a strong way, and contributed to changing the features of the architecture, as it provided a great deal of freedom and flexibility in the architectural formation, so we must study these plastic elements in a thorough study and increase the architectural awareness towards them, in order to keep pace with the traditional architecture techniques that are compatible with them. Traditional construction techniques that enabled builders to build traditional architecture with ancient and sophisticated methods around the world with sustainable architectural formations are presented, by focusing on the most important materials used in the techniques: clay, stone, wood, and bamboo. As shown in table 8. Since there are no perfectly straight lines in nature where tree trunks are round and branches are flexible, creating curved wooden structures requires clever designs and details to combine traditional craftsmanship with contemporary techniques.

Table 8: traditional architecture techniques

<p>1- Clay construction and formation techniques</p> <p>Clay material is no longer the traditional material known in the past, but has been developed to be more contemporary, more solid, durable, and more environmentally friendly, as researchers delved into the properties of this material. It should also be noted that we are accustomed to calling this material clay, and in fact, clay represents part of the components of the earth's soil. The ratio of these components varies from one site to another, and the construction method differs according to the components of each soil.</p> 	<p>2- Stone construction and formation techniques.</p> <p>Building with stone in the past was costly and required great effort when cutting, preparing and transporting, so its uses in ancient times were limited. Today, the difficulties in this, as well as the weldable materials, have become easy to obtain with the civilization of modern technology, which has developed with changes in people's lifestyles and modernization in construction, and its uses have taken many forms in construction and finishing works. There are different types of stones used in construction work.</p> 
<p>3- Timber construction and formation techniques</p> <p>The Timber Framing Technique is one of the most important techniques of building and shaping with wood, which later deals with methods of building it according to sustainable architectural formation and harmony with the surrounding natural environment functionally and aesthetically. Before discussing the timber frame technology, examples of ways to support timber frames are shown.</p> 	<p>4- Bamboo construction and formation techniques</p> <p>Bamboo is versatile and has notable economic and cultural importance in South Asia, Southeast Asia, Indonesia, and East Asia. In its natural form, bamboo as a building material is traditionally associated with the cultures of South Asia, East Asia, and the South Pacific, to some extent in Central and South America, and thus in the aesthetic of Tiki culture. In Japan, bamboo is used primarily as a complementary or decorative element in buildings, largely due to its ready abundance of high-quality wood. Not only is bamboo good for the environment, but it also helps people connect with nature resulting in an improved quality of life. Bamboo is the future.</p> 

3.2.2. Traditional architecture in sustainable architectural techniques and formation

The techniques of traditional architecture emphasize the principle of simplicity in formulating sustainable architectural formation and the depth of its expressive contents, which came as a result of the accumulation of knowledge of a series of characteristics, influencing factors, and the basics of achieving sustainability. through its unified language. In this part, the study presents an explanation of the extent to which sustainable architectural formation is achieved by taking advantage of traditional architecture techniques in turn in formulating sustainable architectural formation, which

was previously studied in this chapter, through evaluation tables for a set of criteria for achieving sustainable architectural formation using traditional architecture techniques that can be clarified In the following points:

Criteria for achieving sustainable architectural formation using traditional architecture techniques													
Characteristics of sustainable architectural formation				The foundations and values inherent in the architectural formation									
● This design reflects the climate	● demand for local character	● Emphasis on local culture (disregarded previously)	● Compatible construction techniques	● Use of local building materials	● Compatibility with the surrounding environment	● Ability to adapt to future changes in energy	● Theoretical research in building construction techniques	● Strongly building according to the available local resources	● The measure of building and its compatibility with the local climate	● Attention to building methods in cost and materials	● Follow the principle of site and context	● Selection from appropriate materials and systems	● Mixture of the complementary elements of the form
●	●	○	○	○	○	○	○	○	○	○	○	○	○
climate													
Availability of resources													
construction techniques													
Heritage and culture													
Clay construction and formation techniques													
Stone construction and formation techniques													
Traditional construction and formation techniques													
Bamboo construction and formation techniques													
Symbols Semantics: Strong influence				Medium influence				Weak influence					

The table shows the impact of traditional architectural techniques on sustainable architectural formation, expressing the foundations, underlying values and their characteristics. Traditional building techniques strongly influenced the plastic elements and contributed to changing the features of architecture, as they provided a great deal of freedom and flexibility in sustainable architectural formation through their characteristics and techniques. Therefore, we must provide adequate attention to these plastic elements and increase architectural awareness of them, so that architecture can keep pace with the technologies that are compatible with them.

4. Analysis of experiments in the light of sustainable architectural formation in nature reserves

4.1. Analytical study methodology

It reviews the components of the methodology used in analyzing experiences and begins with identifying the reasons for selecting global experiences. Through these reasons, the proposed methodology is formulated by defining, arranging and organizing basic data on the project according to a set of criteria that must be available when selecting international and Arab architectural projects to be analyzed and determining data analysis, followed by designing Tables used in data analysis to reach the results of trial analysis.

4.2. Analytical study methodology

International and Arab experiences are analyzed through three projects, namely the Visitor Center project in Canada, the Royal Academy for Nature Conservation project, and the Visitor Center project in the United Arab Emirates, through the proposed methodology as follows:

- General description of the project.
- Characteristics of the natural and built environment.
- Characteristics of sustainable architectural formation.
- Analyzing the role of traditional architecture techniques in achieving sustainable architectural formation.
- Conclusion.

The most important strategies for designing the project have been demonstrated in the criteria for achieving sustainable architectural formation using traditional architecture techniques in nature reserves, in the design of the table for project data with defining building standards and requirements in nature reserves, and defining criteria for achieving sustainable architectural formation using traditional architecture techniques, which can be clarified in Tables 9, 10 and 11, in order.

Table 3: Plans national to Lac-Témiscaouas Discovery & Visitor Centre Project

The table is organized into several main sections:

- Project Description:** Overview of the project, its location, and its goals.
- Site Characteristics:** Detailed analysis of the natural and built environment, including topography, climate, and existing infrastructure.
- Building Systems:** Description of the architectural and structural systems used in the project, such as materials, construction techniques, and energy systems.
- Sustainability Criteria:** A series of tables and charts that evaluate the project against various sustainability metrics, including energy efficiency, water management, and social impact.

Table 10: Royal Academy for Nature Conservation Project

	The project consists of two main parts: a main building for general public use and a smaller building for the museum. The main building is a large, modern structure with a central courtyard and a large auditorium. The museum building is a smaller, more traditional structure with a central courtyard and a large auditorium. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly.	The Academy project is built in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly.		The project is located in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly.
Description of the distinctive structural spaces	Description of the building systems of the project	Characteristics of the built environment	Characteristics of sustainable architectural formation	Characteristics of traditional architecture used
The extent to which the project meets the criteria for achieving sustainable architectural formation using traditional architecture techniques	The extent to which the project meets construction standards and requirements in natural reserves	Activity laws	Activity laws	Activity laws

Table 11: Wadi Natural Reserve Visitor Centre Project

	The project consists of two main parts: a main building for general public use and a smaller building for the museum. The main building is a large, modern structure with a central courtyard and a large auditorium. The museum building is a smaller, more traditional structure with a central courtyard and a large auditorium. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly.	The project is located in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly.		The project is located in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly. The project is located in a natural reserve and is designed to be sustainable and environmentally friendly.
Description of the distinctive structural spaces	Description of the building systems of the project	Characteristics of the built environment	Characteristics of sustainable architectural formation	Characteristics of traditional architecture used
The extent to which the project meets the criteria for achieving sustainable architectural formation using traditional architecture techniques	The extent to which the project meets construction standards and requirements in natural reserves	Activity laws	Activity laws	Activity laws

4.3. Analytical study methodology

By analyzing the experiences of a selection of international and Arab models for projects to see the extent to which they meet the standards and construction requirements in natural reserves, as well as the extent to which they meet the criteria for achieving sustainable architectural formation using traditional architecture techniques through criteria for realizing the values inherent in architectural formation and the criteria for achieving sustainability. This is done through the tables used in the analysis of experiments, which are based on extracting the criteria that must be met in order to reach the role of traditional architecture techniques in formulating sustainable architectural formation in nature reserves, which can be explained as follows:

4.3.1. Structural standards and requirements in natural reserves

It is clear that international and Arab experiences adhere to building standards and requirements in nature reserves through the tables used, which achieve the most important laws related to activities, laws related to tourism management, and laws related to the Convention on Biological Diversity. Through previous monitoring and evaluation of international and Arab experiences and their design characteristics of the built environment, the results showed the extent to which projects achieve building standards and requirements, by comparing the experiences. Related to activities and laws related to tourism management and laws related to the Convention on Biological Diversity, then the educational buildings, which is the Royal Academy for Nature Conservation project, with a percentage of 91% in the laws related to activities and 100% for each of the laws related to tourism management and laws related to the Convention on Biological Diversity, as shown in Figure 21.

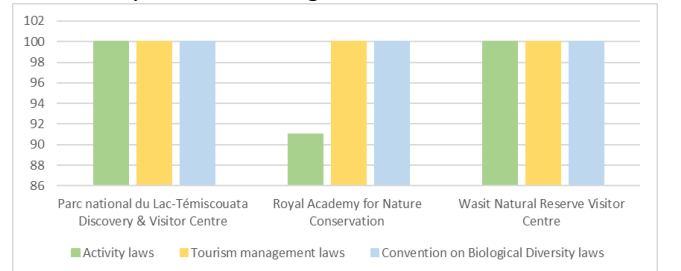


Figure 21. The extent to which building projects are evaluated for building standards and requirements.

4.3.2. Criteria for achieving sustainable architectural formation using traditional architecture techniques

It is also clear that most of the international and Arab experiences achieve the standards of sustainable architectural formation using traditional architecture techniques by

5.2. The results of the case study analysis

Through the application of the case study of the Rayyan Sands Resort project in knowing the extent to which it meets the standards and construction requirements in natural reserves, as well as the extent to which it meets the standards for achieving sustainable architectural formation using traditional architecture techniques through the criteria for achieving the foundations and values inherent in the architectural formation and the characteristics of sustainable architectural formation and the characteristics and techniques of traditional architecture used . This is done through the table summary of the case study, which is based on extracting the criteria that must be met in order to reach the role of traditional architecture techniques in formulating sustainable architectural formation in nature reserves, which can be explained as follows:

5.2.1. Structural standards and requirements in natural reserves

It is clear that the case study adheres to the building standards and requirements in the natural reserves through a summary of the table, which achieves the most important laws related to activities, laws related to tourism management, and laws related to the Convention on Biological Diversity. Through monitoring and previous evaluation of international and Arab experiments and their design characteristics of the built environment, the results showed the extent to which projects achieve building standards and requirements, by comparing the study case in the experiments. Of the laws related to activities and laws related to tourism management in order, as shown in Fig.21.

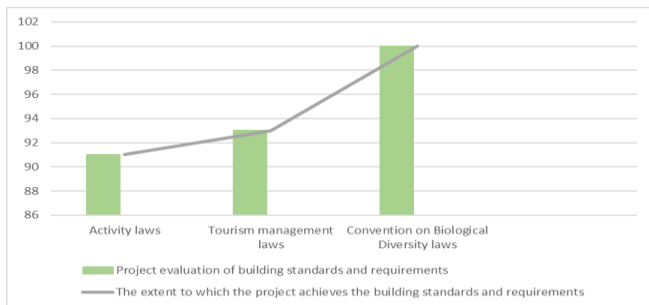


Figure 21. The extent to which the project evaluates the building standards and requirements

5.2.2. Criteria for achieving sustainable architectural formation using traditional architecture techniques

It is also clear that international and Arab experiences achieve the standards of sustainable architectural formation using traditional architecture techniques through the results of the evaluation of the case study to know the criteria for achieving the foundations and values inherent in the

architectural formation, the characteristics of sustainable architectural formation, and the characteristics and techniques of traditional architecture through the tables used. The results can be stated as follows in Figure 23.

Criteria for achieving sustainable architectural formation using traditional architecture techniques														
Characteristics of sustainable architectural formation							The foundations and values inherent in the architectural formation							
The integrative to climate	Eliminate natural elements	Embrace local climate (integrate naturally)	Compatible construction techniques	Use of local building materials	Compatibility with the surrounding environment	Activities when it is enhance	The physical structure of the building according to the environment data	Storage the history according to the architectural conditions	The integration of the building with the compatibility with the natural	Attention to building practices in other local climate	Follow the principles of site and site	The character in an organized manner or a specific program	Adoption of the supplementary data of the form	
●	●	○	○	○	○	●	●	●	○	○	○	○	○	○
○	●	○	●	●	●	●	○	●	●	●	○	○	○	○
●	●	○	●	●	●	●	●	●	●	●	●	○	○	○
○	●	●	●	●	●	●	●	●	○	○	○	○	○	○
●	●	●	●	●	●	●	●	●	○	○	○	○	○	○
●	●	○	●	●	●	●	●	●	○	○	○	○	○	○
●	●	○	○	○	○	○	○	○	○	○	○	○	○	○
●	●	○	○	○	○	○	○	○	○	○	○	○	○	○

Symbolic Semantics: ● Strong influence ○ Medium influence ○ Weak influence

Remade of Rayyan Resort Project
 Characteristics and techniques of traditional architecture used

Figure 23. Criteria for achieving sustainable architectural formation using traditional architecture techniques

It is clear from the results of the statement that the case study focused on the techniques of clay, stone, wood and bamboo, which are more contemporary, more solid, durable and more environmentally friendly, in addition to being the future. It just needs to develop some elements of this evaluation, which achieved the research objectives down to the role of traditional architecture techniques in serving the marketable architectural formation of "sustainability". Where the characteristics of sustainable architectural formation are among the most important foundations and principles of achieving sustainability, which dealt with the foundations of sustainable architectural formation through compatibility of the requirements and criteria for achieving sustainability with the characteristics of sustainable architectural formation and the characteristics and techniques of traditional architecture in nature reserves.

CONCLUSION AND RECOMMENDATIONS

The study concluded a number of results and recommendations that contribute to reaching the role of traditional architecture techniques in formulating the sustainable architectural formation in natural reserves in Egypt, in order to serve the architectural formation that is marketable for "sustainability". Results, general recommendations and recommendations of the Ministry of Environment can be clarified as follows:

First: general results and recommendations

- The importance of the project meeting the building standards and requirements in natural reserves, which include the most important laws, namely the laws related to activities, the laws related to tourism management, and the laws related to the Convention on Biological Diversity.
- The importance of the project meeting the criteria for achieving sustainable architectural formation using traditional architectural techniques, which can be clarified in

three elements: the standards for the foundations and values inherent in the architectural formation, the sustainability standards for six basic principles, and the traditional architecture techniques used.

- The value of the traditional architecture techniques used, which are more contemporary, more solid, more durable, and more environmentally friendly, in addition to being the future.
- Statement of the results in the international and Arab models, which focused on wood and stone techniques and did not focus on clay and bamboo techniques, which are more contemporary, more solid, more durable, and more environmentally friendly, in addition to being the future. Therefore, the focus was on them in the applied study to achieve the research objectives and to reach the role of traditional architectural techniques in serving marketable architectural formation for "sustainability". The table presented the impact of traditional architectural techniques on sustainable architectural formation, expressing the foundations, underlying values and their characteristics. Traditional building techniques influenced the plastic elements in a strong way and contributed to changing the features of architecture, as they provided a great deal of freedom and flexibility in architectural formation through their characteristics and techniques. Therefore, we must provide adequate attention to these plastic elements and increase architectural awareness of them, so that architecture can keep pace with the technologies that are compatible with them.

Second: Special recommendations from the Ministry of Environment

- Not to change the characteristics of the environment so as not to lead, directly or indirectly, to harming human health and affecting the practice of his natural life, or harming natural habitats, living organisms, or biodiversity. Also, do not affect the environment so as not to reduce its value, distort its environmental nature, deplete its resources, or harm living organisms or antiquities.
- Preserving and improving the components of the environment, preventing their deterioration or pollution, or reducing the severity of pollution. These components include the air, seas, and internal waters, including the Nile River, lakes, groundwater, lands, natural reserves, and other natural resources.
- Not introducing any materials whose discharge into the aquatic environment, voluntarily or involuntarily, would result in a change in its characteristics, or contribute to that, directly or indirectly, in a way that harms humans, natural resources, or marine waters, harms tourist areas, or interferes with other legitimate uses of the sea.

FUTURE RESEARCH

The research proposes a set of recommendations and future studies in this field and the research approach to the role of traditional architecture techniques in formulating sustainable architectural formation in nature reserves in Egypt. The following are some important instructions:

- Studying the conservation of natural reserves due to environmental scarcity and sensitivity, including the natural

features and geological features that the region contains distinct geology and landscapes of high aesthetic value. Therefore, it must be preserved and preserved, and the building requirements and standards must be fulfilled in order to be compatible and in harmony with it functionally and aesthetically.

- Studying harmony and homogeneity between buildings and nature by using local natural resources as building materials, as architect Hassan Fathi used to say: "The building lives in the land to which it belongs." For example, buildings can be fashioned into mountains, roofs are forests, and columns are trees, something akin to man-made "ecosystems," in service of the marketable architectural formation of "sustainability."
- Studying traditional building techniques and their impact on the plastic elements in a strong way, and focusing on changing the features of architecture, as it provided a great deal of freedom and flexibility in the architectural formation. Moreover, traditional architecture can be considered sustainable because it respects economic, environmental and social factors. Therefore, we must fully study these sustainable plastic elements and increase architectural awareness towards them, in order to keep pace with the traditional architecture techniques that are compatible with them. Among the most important techniques of traditional architecture in construction and formation are: construction and formation techniques with clay, stone, wood and bamboo, which are more contemporary, more solid, durable and more environmentally friendly, in addition to being the future.

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