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

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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
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.](image-url)
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.

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 of 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.

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 northeastern 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.

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.

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.

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 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.

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.

1.3.2. Characteristics of the built environment in nature reserves
Natural reserves vary greatly in their nature and characteristics, and the buildings in natural reserves are characterized by a unique natural identity and character that developed from the fusion of influences such as natural desert terrain, climate and geography, along with cultural, social, religious and historical factors. All of these factors affect the way of life there and add distinction to the building styles and shapes as well (Dabaieh, M., 2011). Understanding the characteristics of the built environment is the first step towards achieving integrated landscape design. It entails understanding the ecological activities of nature, the ecosystem and its actions and reactions that will be linked to building designs. Thus, it includes four types of buildings built in natural reserves: residential, hotel, tourist, educational, and museum buildings, which were studied in detail at the global and regional levels to extract the most important design characteristics of the built environment in natural reserves and evaluate the extent to which they fulfill the building requirements.

With an explanation of one of the tables, Table 2. Through previous monitoring and evaluation of examples of buildings and their design characteristics of the built environment, the results showed the extent to which the projects fulfilled the building standards and requirements, as shown in Figure 9.

2. The role of architectural form in achieving sustainability

2.1. Architectural formation in concept, creations and underlying values

The concept of architectural composition lies in the importance of composition through basic principles, which is similar to a book in a language with its own vocabulary and rules. The oldest written text in the theory of architecture is De architectura, in which it says that a good architectural composition should fulfill the three basic principles of durability, utility (functionality), and enjoyment (aesthetics). Now architects around the world prefer to believe that aesthetics in architecture does not have an independent existence and that it comes as a natural result of achieving the greatest amount of functional benefit as structural expression. Figure 10.

An example of aesthetics in postmodern architecture, The new nature preserve and aquarium is designed to build popular support for ecological conservation. The project features undulating and fluid forms that take cues from the rippling surface of the river and the iconic landscape of the Upper Yangtze.

2.1.1. Creations of architectural formation

A number of principles must be taken into account for organizing building blocks and spaces, including shape, repetition, rhythm, proportion, scale, texture, and color, which can be used to organize an architectural formation. Organization does not simply refer to formal order, but rather to a state in which each part of the whole is precisely organized in relation to the other parts and to its purpose, ultimately producing a harmonious system, as shown in Table 3.
2.1.2. The values inherent in the architectural formation

Table 3: Creations of architectural formation

<table>
<thead>
<tr>
<th>1- Shape</th>
<th>2- Repetition and rhythm</th>
<th>3- Ratio and Proportionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>(a)</td>
<td>(a)</td>
</tr>
<tr>
<td>(b)</td>
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<tr>
<td>(c)</td>
<td>(c)</td>
<td>(c)</td>
</tr>
</tbody>
</table>

2.2. Principles of sustainable architectural formation

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: The values inherent in the architectural formation

<table>
<thead>
<tr>
<th>1- Shape</th>
<th>2- Climatic value</th>
<th>3- Construction value</th>
<th>4- Social value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The built environment harmonizes with the natural surroundings in the village houses unified in the landscape of Madagascar’s central highlands and are the region’s most humble expressions.</td>
<td>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.</td>
<td>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 sandstone mausoleum 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.</td>
<td>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 sandstone mausoleum 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.</td>
</tr>
</tbody>
</table>

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.

2.2.1. Requirements and criteria for achieving sustainability

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 façade, 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.

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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>
<thead>
<tr>
<th>Table 6: Nine principles of sustainability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Passive design</td>
</tr>
<tr>
<td>It is a building design to make the most of natural light and cooling towers, and 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.</td>
</tr>
<tr>
<td>2. Energy efficiency</td>
</tr>
<tr>
<td>Buildings should be 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.</td>
</tr>
<tr>
<td>3. Life-cycle carbon footprint</td>
</tr>
<tr>
<td>This involves considering all relevant phases such as extraction of raw materials, transport, installation, maintenance, inspection, and disposal, and investigating the environmental impact. A life-cycle assessment (LCA) is referred to as a carbon footprinting, as the focus is specifically on greenhouse gas emissions.</td>
</tr>
<tr>
<td>4. Reductionism</td>
</tr>
<tr>
<td>Reductionism is one way to reduce the carbon footprint of a building. Every square metre of house has environmental and financial consequences; therefore, the renewed necessity of every square metre, material and product is questioned and considered.</td>
</tr>
<tr>
<td>5. Material impact and waste</td>
</tr>
<tr>
<td>This principle urges designers to consider the use of new materials when designing new buildings or to use them in design buildings when it makes sense or if they are better suited for the intended use. It is the use of sustainable and recycled materials.</td>
</tr>
<tr>
<td>6. Local environment</td>
</tr>
<tr>
<td>The economy 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 questioning the environment.</td>
</tr>
<tr>
<td>7. Longevity</td>
</tr>
<tr>
<td>Buildings should be designed and built to last, having in sustainable architecture is an investment in the longevity of a house. Buildings last for a long period of time, and the embodied energy of a building is the energy used in the construction phase. The embodied energy is a significant portion of the total energy used over the lifetime of the building.</td>
</tr>
<tr>
<td>8. Budgeting and affordability</td>
</tr>
<tr>
<td>Planning sustainability in the budget will result in a better, more economical and energy-efficient house that costs less money to build, operate, and maintain. The cost of building a sustainable house is lower than the cost of building a conventional house.</td>
</tr>
<tr>
<td>9. Health and wellbeing</td>
</tr>
<tr>
<td>A sustainable home is also a healthy home, with spaces that nurture and support physical and mental wellbeing. The design of the house, building materials, and landscape surrounding the building also help enhance the wellness. Choosing sustainable building materials can mean no more chemical emissions, and the landscape is aligned to support healthy living.</td>
</tr>
</tbody>
</table>

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 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>
<thead>
<tr>
<th>Table 7: Characteristics of sustainable architectural formation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Compatibility with the surrounding environment</td>
</tr>
<tr>
<td>Sustainability in the architectural formation is not only directly related to the immediate environment, but also to the broader context in which it is located. The architectural formation is considered to be a part of the natural landscape and contributes to the overall aesthetic of the site.</td>
</tr>
<tr>
<td>2. Using local building materials.</td>
</tr>
<tr>
<td>The sustainable architectural formation is environmentally friendly and minimizes the use of non-renewable resources. The use of local building materials reduces transportation costs and helps preserve local ecosystems.</td>
</tr>
<tr>
<td>3. Compatible construction techniques</td>
</tr>
<tr>
<td>Sustainable architectural formations use techniques that are compatible with the local environment and climate. The use of traditional construction techniques is emphasized to ensure the longevity of the building and minimize the impact on the environment.</td>
</tr>
<tr>
<td>4. Emboldened by local cultures (distinguished personality)</td>
</tr>
<tr>
<td>The unique aesthetic in the architectural formation is reflected in the use of local building materials and traditional construction techniques. The architecture of the building reflects the cultural heritage of the region and the local people, and contributes to the identity of the building.</td>
</tr>
<tr>
<td>5. Dominant visual character</td>
</tr>
<tr>
<td>The sustainable architectural formation is a blend of the natural landscape and the architecture of the building. It creates a visual identity that is specific to the region and the building.</td>
</tr>
<tr>
<td>6. The design reflects the climate</td>
</tr>
<tr>
<td>The design of the building reflects the climate of the region, taking into account the local climate, weather conditions, and the impact of the building on the surrounding environment. The design is focused on minimizing energy consumption and reducing the impact on the environment.</td>
</tr>
</tbody>
</table>

2.2.2. Characteristics of sustainable architectural formation in nature reserves

2.3. Formulation of sustainable architectural formation using traditional architectural 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

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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 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>
<thead>
<tr>
<th>Table 8: traditional architecture techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Clay construction and formation techniques</strong></td>
</tr>
<tr>
<td>Clay material is an important raw material in the traditional architectural formation, and it is used according to the available resources and local conditions. It should be noted that in some regions, clay is used in the form of bricks, and in others, it is used in the form of earth, where tree trunks are used as supports, and the construction technique is adapted according to the characteristics of each soil.</td>
</tr>
<tr>
<td><strong>2. Stone construction and formation techniques</strong></td>
</tr>
<tr>
<td>Stone material is an important raw material in the traditional architectural formation, and it is used according to the available resources and local conditions. It should be noted that in some regions, stone is used in the form of bricks, and in others, it is used in the form of earth, where tree trunks are used as supports, and the construction technique is adapted according to the characteristics of each soil.</td>
</tr>
<tr>
<td><strong>3. Timber construction and formation techniques</strong></td>
</tr>
<tr>
<td>Timber material is one of the most important raw materials used in traditional architecture. It is used according to the available resources and local conditions.</td>
</tr>
<tr>
<td><strong>4. Bamboo construction and formation techniques</strong></td>
</tr>
<tr>
<td>Bamboo material is one of the most important raw materials used in traditional architecture. It is used according to the available resources and local conditions.</td>
</tr>
</tbody>
</table>

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:

1. 

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>
<thead>
<tr>
<th>Criteria for achieving sustainable architectural formation using traditional architecture techniques</th>
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<tbody>
<tr>
<td>Characteristic of sustainable architectural formation</td>
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<tr>
<td>The foundations and values inherent in the architectural formation</td>
</tr>
<tr>
<td>Traditional building techniques</td>
</tr>
<tr>
<td>Plastic elements and characteristics</td>
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\[ \text{Symbols Semantics:} \]

- Strong influence
- Medium influence
- Weak influence
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](image)

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...
comparing the evaluation results of the experiments to find out 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 22.

| Criteria for achieving sustainable architectural formation using traditional architecture techniques |
|-----------------------------------------------|---------------------------------------|---------------------------------|---------------------------------------------|
| Characteristics of sustainable architectural formation | Characteristics of traditional architecture techniques | Characteristics of sustainable architectural formation in nature reserves | Characteristics of sustainable architectural formation in nature reserves |
| General description of the project. | Characteristics of traditional architecture techniques | Characteristics of sustainable architectural formation in nature reserves | Characteristics of sustainable architectural formation in nature reserves |

Therefore, the focus is on these experiences in the applied study in the fifth chapter to achieve the objectives of the research in order to reach 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 for 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 in natural reserves.

5. An applied study on natural reserves in Egypt

5.1. Application of the Remal al Rayan Resort project as a case study in Egypt

The project is analyzed through the proposed methodology as follows:

- General description of the project.
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.

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.

![Figure 23. Criteria for achieving sustainable architectural formation using traditional architecture techniques](image)

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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