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The Bioclimatic Design Strategies, and the Application in the Traditional Courtyard Buildings in the Climate of Middle East

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Abstract
During last decades, bioclimatic architecture appears as an essential means for the environmental improvement of the built environment, while the contribution of the bioclimatic approach to outdoor design for the achievement of better living conditions has not been evenly accentuatedTherefore, the aim of this study is to enable architects to re-understand the lessons of tradition, because the way towards bioclimatic architecture should start by understanding vernacular architectureThis research increases the importance of bioclimatic design and application of its strategies on traditional buildings. Recognition the role of traditional courtyard buildings types, materials, techniques and strategies of keeping a healthy surrounding environment, finally realize the important of bioclimatic design and its positive impact on the environment.
Keywords: bioclimatic design, traditional buildings, Courtyard buildings.

1. Introduction

The traditional buildings are believed to embody numerous intelligent design features, emerged and refined through the historical process of adjustment to local climate conditions and social functions. And these buildings include strategies that are technically, environmentally, socially and economically valid.

Middle east is rich source of traditional examples from history can teach us many architectural concepts

The Bioclimatic design employs appropriate techniques and design principles based on thoughtful approach to climate and environment. So it is open to the climate advantages and closed to the climate disadvantages.

2. So what is bioclimatic architecture:

Bioclimatic Architecture is any design that takes climate in its process in order to achieve thermal comfort. It can be noticed that it follows traditional Architecture principle . So, the bioclimatic techniques could offer the control needed to the development of traditional architecture methods.

In Middle East countries, larger strategies are used to cool the house. For example Mashrabiyas were used in humid areas for privacy and ventilation through water element while in hot dry areas wind tower and courtyard are used to do the same function.

3. An Overview of Application of bioclimatic strategies on Traditional Architecture:

Traditional buildings were designed according to the microclimate of the specific region because heat and cold control the thermal comfort in the houses and this different from one place to another. The natural technologies applied in these buildings have sustained human life for many decades and are purely for heating or cooling purpose. Examples of these techniques are fire chimneys, courtyards, wind towers and Mashrabiyas. In hot - dry and warm humid zones such as Middle East and North Africa where cooling is more important than heating, ventilation tunnel, wind tower, wind catcher, wind sail, maziara and courtyard are used to achieve thermal comfort. The tower height is almost double the house in order to catch most preferred wind. Since the wind temperature is high because of the hot climate, wind tower catches through vertical openings. Then, air passes through cold pods and wet clothes in order to cool down before it reaches the rooms. In high humid zones, Mashrabiyas were used instead of wind towers because houses are in similar height and to minimize moisture by reducing interaction with water surfaces. Ventilation towers are widespread and can be seen in many countries with different names: Malqaf and wind scoops in Egypt, Bating in Syria, Badgeer in Iran and Gulf countries.

Figure 1. WIND TOWER (BADGIR) IN TRADITIONAL ARCHITECTURE OF IRAN

Figure 2. MASHRABIYAS IN TRADITIONAL ARCHITECTURE OF JEDDAH

4. Analysis of Traditional Architecture:

Recent researchers examined the linking between Cyprus traditional architecture with its climate and modern villas that have traditional elements. A house with cluster of rooms, a patio, a courtyard and a light well was evaluated by using optimization studies and simulation software.

It was discovered that all traditional elements work together cool the house in summer and create a warm environment in winter. As a result, thermal comfort for living is achieved. Courtyards are also an essential traditional element in thermal control. Bagneid in an investigation on almost two identical courtyards of student's dormitory at Arizona University; concrete and grass flooring, it was found that courtyards generate cooling feelings for outdoor seating. Also, they react as a barrier during wind seasons while allowing little air to circulate inside. The experiment revealed that the rooms in the second courtyard with grass flooring were cooler at day time and warmer at night, resulted in thermal comfort.

The two applications of traditional architecture in Cyprus and Arizona State University provide benefits in traditional elements. However, the dependence of natural wind speed can create improper ventilation. Wind speed varies in different climate zones and countries. To avoid this reliance on unpredictable wind pattern, more human control has to be involved in these techniques. Traditional methods have to be developed to suit modern time but with taking the energy consumption in consideration.

Figure 3. COURTYARD IN TRADITIONAL ARCHITECTURE

5. The important of bioclimatic design

As a designer or builder it is important that we are aware of the energy consequences of decisions made in the siting of a building, its form and the material choice. This is particularly important when we consider that buildings in the eastern world consume 40% of all resources and contribute 40% of all pollution created.

Many researchers have evaluated and analyzed buildings which represent an application of traditional techniques. A road in Ghadams, Libya shows a good comparison between old and modern buildings; 600 years old houses are facing young houses. It was found that in summer when the temperature is around 44 C, the degree inside the old ones is 26° C and 38° C in the new houses. This is one example of the negative impacts of the industrial revolution in the middle of the last century. Humans have became more dependent on mechanical devices such as air conditioning to achieve thermal comfort and this caused high energy consumption. In accordance with USEIA, US energy consumption has increased by 28% in the last 30 years and around 40% of energy is used by residential sector. In this sector 52% of the energy goes to heating and cooling the building. This percentage varies between different climates where one aspect heating or cooling is important.

These statistics proves that modern architecture have created unbalanced indoor environment whereas traditional architecture elements had worked together for thousands of years.

6. Conclusion

Bioclimatic techniques are the modern version of traditional technologies. They offer the human control that traditional techniques are missing. Even though developing the traditional methods would help create thermal comfort using less energy, more applications are needed in other bioclimatic technologies. Generally, concern for energy consumption is only marginal in the majority of architectural - design practices, even in the developed countries. Passive solar energy - efficient building design using traditional systems and bioclimatic techniques should be the priority of any building designer, because, in most cases, it is a relatively low - cost exercise that will lead to savings in the capital and operating costs of the air - conditioning plant. Incorporation of traditional and bioclimatic techniques will certainly reduce our dependency on fossil fuel and minimize the environmental problems due to excessive consumption of energy and other natural resources and hence will evolving a built form, which will be more climate responsive, more sustainable and more environmental friendly.

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