Central Courtyard: Iranian Strategy to achieve Local Sustainable Architecture

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ABSTRACT

Since the wide part of the Iranian country is located in the region of arid and desert, the architects of this land have been used the central courtyard as space for provide to the residents comfort of this area. Structure of the central courtyard both in shape (the overall geometry and design elements), and also in the emerging methods (materials and technology), heavily used the feature of indigenous and local empowerment, and thus with minimal manipulation in the environment to create deformation and portion, it has the maximum utilization for users. In addition to, the central courtyard coordinates with the sun moving. In fact, the central courtyard is the organization essence of space in the desert architectural of the Iranian architecture. According to, in this paper, we seek to present that the central courtyard is the best evidence to achieve the sustainable architect in Iran.

Key words: central courtyard, architecture, sustainable, local, performance, Iran.

Introduction

Structure of the central courtyard both in shape (the overall geometry and design elements), and also in the emerging methods (materials and technology), heavily used the feature of indigenous and local empowerment, and thus with minimal manipulation in the environment to create deformation and portion, it has the maximum utilization for users. In addition to, the central courtyard coordinates with the sun moving. In fact, the central courtyard is the organization essence of space in the desert architectural of the Iranian architecture.

In this study, one of the basic elements of cities within the Iranian plateau (or the central courtyard) reviews and evaluates in terms of general stability. Especially in the deserts, the central courtyard is the main space of home. Croft in the central courtyard with trees that need little water, such as pomegranate, grape, fig and pistachio, that not only it provide the fruits and vegetables, but also it reduces dryness of air (providing coolness of air and shadow). In the desert Architecture of Iran, the veil is considered a primary Principle.

So, the main purpose of this paper is reviewing of the central courtyard and its impact on the Iranian sustainable architecture, the structure article includes the seven sections: In the second part, it reviewed the literature review about the central courtyard and sustainable architecture. In the third section, it can be expressed the central courtyard and its structure. In Section IV, it is presented the sustainable architecture. The fifth section is research method. In Section VI, it expressed the central courtyard architecture as Iranian strategy to achieve local

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sustainable architecture. In the seventh, it is examined the discussion and presented conclusions.

**Literature Review:**

Taleb and Sharples [8], have reviewed the sustainable development of residential buildings in Saudi Arabia. This paper assesses the energy and water consumption practices of existing housing in Saudi Arabia, with the ultimate aim of establishing guidelines for delivering sustainable residential buildings in the near future. In order to achieve this aim the current status of a typical Saudi residence (i.e. an apartment complex) is investigated in terms of energy and water consumption using simulation software packages. The paper then examines the prospects for applying various measures to the typical Saudi residence to manage energy and water use more sustainably. This research identifies several design-related faults common to Saudi Arabian house design. These faults contribute to an inefficient use of energy and domestic water resources. Finally, the paper puts forward a set of recommendations and guidelines, design-related and otherwise, to enhance the sustainability of future Saudi residential buildings.

Taleghani *et al* (2011) examine the development of sustainability in architecture education pays. In this research, they compare academic architectural education in the field of renewable energy in two countries, Iran as a developing country in Asia and Australia as a developed country in Oceania. Lessons can be drawn from these case studies in regard to the obstacles and progress in the development of sustainable architecture education.

Moonen *et al* (2011) examine the central courtyard and the streets in new towns have paid. In this study, they introduce the ventilation potential (VP) as a statistical, climate-dependent measure to assess the removal of scalars, such as heat and pollutants, from courtyards or urban street canyons. The VP is obtained following a three-step approach. First, the magnitude of the flux through a horizontal surface situated at the top of the courtyard or canyon is determined by means of computational fluid dynamics (CFD) simulations for various courtyard geometries and ambient wind directions. Then, this exchange flux is normalized with the free-stream wind speed and subsequently parameterized as a function of the courtyard’s length-to-width ratio and the incidence angle of the wind flow. Finally, the combination of the parameterization with site-specific wind data yields the VP.

Mahmoud and El-Sayed (2011) examine the architecture of sustainable urban development in new towns in Egypt. This paper aims to develop a method to maintain ecological balance and organization of the urban green areas, using Geographic Information Systems (GIS) techniques that assist in effective planning of green areas. Land suitability analysis and ecological threshold methods based on GIS techniques are applied on one of the Egyptian new cities in a desert environment (i.e., El-Sadat City). Results revealed that the green ways could be developed to play a more significant role in bringing nature into the city. This paper suggests a method of green network planning that would help in enhancing the connectivity and reduce fragmentation though integrated greenway system. Finally, an ecological base for building an eco-city of El-Sadat City in the future is proposed.

Al-hagla (2010) has study the sustainable development of urban historical areas approach tourists. This paper emphasizes the sustainable development of urban historical areas based on their potential as cultural tourism sites. It argues that to guarantee the sustainability of any development intervention in these areas, a master planning process must be undertaken to balance all of the aspects of development. It tackles the interconnectedness of these aspects as an approach to their simultaneous development. As a focus of study, this paper raises a question about the ability of a ‘heritage trail”—an area of direct interactions between parties sharing in urban development in historic areas—to achieve the sustainability goals of the involved areas. To answer this question, the paper investigates three nodes of interaction stimulated by the heritage trail: conservation and rehabilitation, interpretation, and microeconomic development. To illustrate the validity of the proposed approach, this paper discusses the heritage trail as an approach used in the Cultural Heritage and Urban Development (CHUD) project in the historical core of Saida (Old Saida), Lebanon as a case study.

Guedes *et al* (2009) examines the architecture and sustainable urban design in Portugal. This paper presents a general overview on the subject of sustainable building and urban design in Portugal – within the Southern-European context. It focuses on its evolution, the most striking aspects, present needs and future trends. Various case studies are presented, including the integration of renewable energy systems at urban and building scale.

Tae and Shin (2009), examines the enduring and compatible architectures have paid in South Korea. In this study, Korea, selected as a target nation of the second commitment period for the reduction of greenhouse gases by 2013, is making efforts to reduce the production of greenhouse gases in all industrial fields. In particular, Korea is working hard to prepare for measures on the national level to reduce energy consumption and to limit the creation of carbon dioxide in the construction industry, which is responsible for over 40% of all carbon dioxide production. In order to pursue sustainability in the construction industry, existing development-focused
construction activities must be transformed via a new paradigm focusing on sustainable development through the adoption of sustainable policies by the government and the development and dissemination of sustainable construction technologies. For such reasons, this study examined sustainable policies, research, and education recently used in Korea to identify future trends in the sustainable construction industry toward which Korea should strive in terms of governmental policy, research, education, and projects.

Lu et al (2008) examines the architecture, sustainable architecture focuses on traditional. In this study, Based on the current cultural landscape of the bathhouse and its surroundings, this approach is attempting to localize an informed, balance-seeking, design process in the village and in so doing develop a series of diverse possibilities and beneficial paths. The experiment of the public bathhouse’s design and construction led to two key conceptual questions that need to be examined, the one is to research a village with a dynamic system conception instead of a static one; the other is to research a village with a self organizing system conception1 instead of an organized one. Furthermore, they can give the sustainable path for the future that such naturally evolved Chinese villages evolve into sustainable towns and cities.

Zaragoza et al (2007) examine the architecture and its impact on sustainable agricultural. It consists of the development of a humid air solar collector system that follows the principle of a closed two phase thermosyphon. A combination of evaporation and condensation allows using solar thermal energy in a much more efficient way. The main advantage is not only the reduction of costs in space cooling and heating, but the possibility of water purification, as the system can be fed with low quality water to obtain distilled water. The decentralization of heat and water supply opens the possibility of residential areas where greenhouses fed with low quality water (grey water and brackish water) could be used to produce distilled water as well as heat and fruits. The project contemplates the development of two prototypes: one application for arid climates in Southern Europe with an emphasis on water production in the context of greenhouse horticulture, and another for temperate Central European climate focused on heat and water production for sustainable architecture.

Zhu and Lin (2004) examine the construction of housing and city in order to achieve sustainable architecture in China. Based on an introduction of the current situation of the development of construction industry and the energy consumption of buildings in China, this paper analyses the requirements, characteristics, standards for sustainable housing and urban construction, and recommends series of technical approaches along with different phases of sustainable design and construction, which strengthen a good cooperation among researchers, designers and constructors of different majors including architecture, planning, building physics, building services, and so on. Moreover, some issues, which need further research and especially handling, are pointed out along with the recommendations. Finally, policy issue related with the sustainable development of urban construction in China is discussed.

KRISHAN and TEWARI (1998) review trends in sustainable architectural design. The process presented in this paper develops a logical approach based on quantitative assessment leading to qualitative design decisions. A design tool, enabling decision making both at the conceptual and final stages of design, is developed and presented as a decision making matrix.

HAWKES (1995) reviews strategies for sustainable urban architecture. This paper presents a selection of architectural design projects produced since 1983 by the practice of Stephen Greenberg and Dean Hawkes. Each of these, in some way, incorporates aspects of the research into low-energy design which has followed the increase in energy costs which occurred in the early 1970s. The aim of the paper is to show how these individual projects may be seen collectively as elements of a low-energy city, or as steps towards the idea of a sustainable city. The paper develops a critique of this proposition and concludes with a speculation about the nature of the truly sustainable city.

Central courtyard and its structures:

Central courtyard under the influence of abundance and availability of the four elements of nature, and in the plateau of Iran, the sun always presence on the above the sky, is the most powerful and available element, in addition to, water is the most important factor of life.

The Central Courtyard Form and its Spaces:

All Iranian courtyard is complete rectangle shape, in cases where the corners has the bezel form for entering the light or access to the corner. Basic organizing of Iranian spaces is according to four basic platforms, and to be deployed in four directions as Rood, and the central courtyard or the dome can be placed in the center of this Rood. The main element of the central courtyard structures is Valut. Vault: A Vault (French. voûte, Italian. volta,) is an architectural term for an arched form used to provide a space with a ceiling or roof.[1] The parts of a vault exert lateral thrust that require a counter resistance. When vaults are built underground, the
ground gives all the resistance required. However, when the vault is built above ground, various replacements are employed to supply the needed resistance. An example are the thicker walls used in the case of barrel or continuous vaults. Buttresses are used to supply resistance when intersecting vaults are employed.

The simplest kind of vault is the barrel vault (also called a wagon or tunnel vault) which is generally semicircular in shape. The barrel vault is a continuous arch, the length being greater than its diameter. As in building an arch, a temporary support is needed while rings of voussoirs are constructed and the rings placed in position. Until the topmost voussoir, the keystone, is positioned the vault is not self-supporting. Where timber is easily obtained, this temporary support is provided by centering consisting of a framed truss with a semicircular or segmental head, which supports the voussoirs until the ring of the whole arch is completed.

**Sustainable Architecture:**

Sustainable architecture is a general term that describes environmentally conscious design techniques in the field of architecture. Sustainable architecture is framed by the larger discussion of sustainability and the pressing economic and political issues of our world. In the broad context, sustainable architecture seeks to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy, and development space. Most simply, the idea of sustainability, or ecological design, is to ensure that our actions and decisions today do not inhibit the opportunities of future generations. This term can be used to describe an energy and ecologically conscious approach to the design of the built environment.

Sustainable Architecture aims at producing buildings that are adapted to local social–economic, cultural and environmental contexts, having in mind the consequences to future generations. Within this frame, the top priority must be to minimize energy consumption in buildings (both in terms of maintenance and embodied energy), through the use of passive design strategies, i.e. reducing the use of energy consuming equipment like HVAC or artificial lighting, through a wise adaptation of the building to the local climatic context [7]. Although, on average, the energy consumed by buildings accounts for only 25% of the national total, this figure rises up to nearly 40% in the larger cities, where most of the population lives. The foreseen tendency, if no effective measures are taken, is for the national average to keep increasing in the next few years, and approach the E.U. average of 40%. Considering that more than 80% of the energy source used in Portugal is (imported) oil [8], this means that professionals of the building sector, such as architects, engineers or builders, have a serious responsibility in terms of their contribution for inverting this tendency and promoting a more sustainable development. In Portugal, as in most European countries, research on energy efficiency in buildings emerged in the 1970s, and was pioneered mostly by Civil or Mechanical Engineers. At the time, research was primarily motivated by economic concerns. However, during the past two decades, with the growing awareness of the environmental problems caused by energy consumption, the emphasis of scientific discourse (rightly) shifted from economic to environmental issues [9]. It was mainly during the late 1990s that Architects became aware of the importance of this subject. Many of the passive design strategies, such as natural ventilation, solar orientation, the use of thermal inertia, shading, etc. are basically an adaptation of techniques used in the past, resultant from centuries of accumulated empirical knowledge, to contemporary requirements.

Unfortunately, this knowledge, was progressively abandoned from Architectural practice and teaching since the implantation of the modern movement in the first decades of the 20th century: as energy was cheap and the environmental problems. There are two important concepts that illustrate the distinct ways in which a building relates itself with the surrounding environment [10]: the “Exclusive” mode, in which the building is “self-contained”, i.e. “turns his back” to the outside world – such as in the case of “International style glass towers”; and the “Selective” approach, sought by the so-called Bioclimatic Architecture, in which the building acts like a living organism, in permanent dialog with the surrounding nature, through a careful selection of the goodness it has to offer, i.e. taking advantage of its benefits, such as solar radiation for heating or lighting, wind power and direction for natural ventilation, etc.

**Research Methodology:**

Study method is the type of case study and description of the method is used exploration. This approach to analog for distribution features are used in statistical community. This research based on descriptive analytical research design, and based on target type is applied research. Validity test is simply the ability to measure tool to measure the trait, that the test is made. Validity of the unique features of data collection methods that can be said that information collected and the actual logic that can be achieved the correct results. In compiling the research to overcome the weakness of making aspect of validity, it must be achieved in small volume to test and to interpret its results. Purpose test for
accuracy before its validity has been done and further exploration of the factor analysis for greater accuracy were used. Reliability of a device to accurately measure primarily the result refers to the accuracy of reliable, trusted quality, stability, or repeatability refers to test results. In the present study has been used the comparative method of reliability.

Central courtyard as Sustainable Architecture (Sustainable Building):

In conclusion, we can say the brick structure is synonymous the central courtyard of the Iranian plateau. The central courtyard have many properties, such as "being Heat," "acoustic," "structural," "economic," "simple technology," "non-pollution in production," "non-consumption of fossil energy," "no need of transportation," and finally "the recyclable in the nature".

Central courtyard, not only is the natural environment, but also it creates introspective relationship between spaces. In this regards, the communications spaces minimized and it is valuable in the sustainable architect.

Embedded spaces in the central courtyard building structure are very flexible, and it is compatible with the sustainable architect principles.

How to use the blinded spaces: based on four sections in the central courtyard creates the roof form, in buildings of the central courtyard, there are four blinded structures in the corners, they do not use theirs. Iranian architects for the corners are applied to the following solutions:

Getting lights
Creating various cells
Creating spaces that it getting light in the ceiling of building

Thus, it tries to maximum using of spaces in the central courtyard, so it is main goal of the sustainable architect.

Conclusion:

In this paper attempt was made to suggest a method for achieving of the sustainable architect based on the central courtyard. The central courtyard that it must be capable of creating secure houses or sustainable buildings in the Iranian culture.

We present relations between central courtyard and sustainable architect, and it concluded that the central courtyard is the best strategy to achieve sustainable and economic buildings.

References


