

The Application of Principles of Green Building in Traditional Housing in Iraq

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Keywords: green building, traditional housing in Iraq, courtyard

Abstract. Green building has become an important issue among architects and urban planners due to the increment in global warming risks and climatic changes which influenced negatively on natural resources. It is also one of measures been put forward to alleviate the significant impacts of the influence of buildings on the environment, society and economy. There have been extensive studies on green buildings, as evidenced in the rapid growing number of papers been published in last decades. These studies have been conducted in both developed countries and developing countries, indicating this is a global issue. However, there is lack of extensive researches on the green buildings in Iraq that is crucial for the future exerts. This paper reports the definition of green building, the environmental, social and economical aspects of green building, and application of green building's principles in traditional housing in Iraq.

Introduction

The definition of green building. Green building is considered one of the trends of modern architectural concepts, which focuses on the relationship between the building and its environment. The interaction between the human beings and the nature has to be continued as the nature is the source of life. Therefore, green building concept confirm that the building is designed in a manner that respects the environment, taking into account the reduced energy consumption, materials and resources and also minimize the impact of construction.

There are many definitions of green building. For instance, Kibert defined green building as: "... healthy facilities designed and built in a resource-efficient manner, using ecologically based principles" [1]. it can be said that the term "Green" is used to indicate buildings that are designed to be highly energy efficient, to meet green building certification systems, [2].

The aspects of green building

According to the literatures, the main aspects of green building can be restricted under technical and environmental aspects, social aspects and economic aspects

Technical and environmental aspects. The focus of green building studies is placed on environmental aspect. According to the studies, it is include energy efficiency, water efficiency, resource efficiency and green house gas emission reduction [3,4]. This will help to improve the

urban biodiversity and protect the eco-system by means of perfect land use [5,6]. Moreover, following green buildings requirements generally provide higher performance reflected from energy efficiency, water efficiency and carbon emission reduction if compared with conventional buildings [7]. For instance, the use precast or prefabrication technologies help to enhance building performance due to reducing the amount of construction and destruction waste to a large extent [8]. Rajago- palan and Leung found in their study that precast panel which is made of concrete waste can be used in sports hall buildings as the acoustic performance is satisfactory [9].

Social aspects. Last decades have witnessed growing concerns on social requirements in green buildings. This is due to the fact that the construction activities are a social process [10]. In the construction context, social requirements include the quality of living and future professional development opportunities. It is also means providing a healthy and safe environment to all stakeholders, e.g. construction personnel, users and operators which should be taken in to account during design process [11]. Zuo et al. further argued that social requirements in construction context should go beyond the individual building level towards the local community [12]. According to Valdes-Vasquez and Klotz, social requirements of green buildings should be taken into consideration in construction projects right from planning stage [13]. They suggested that social requirements include: engaging stakeholders including end users, assessment of social impacts, and consideration of local community.

Economic aspects. According to Economist, green building can save 30% of energy consumption than conventional buildings [14]. The research report released by Davis Langdon showed that extra upfront cost is required for green office building than conventional office buildings [15]. According to Berardi, there are economic requirements of green buildings such as access, education, inclusion, cohesion, affordability, economic value, impacts to local economy, indoor health, cultural perception and inspiration [16]. Popescu et al. pointed out that the benefits of energy retrofitting initiatives are reflected not only the cost savings derived from improved energy efficiency but also the potential value added to the property [17]. This helps to reduce the payback period of investment for energy efficiency measures. The cost savings are also associated with the improved building performance, particularly from the life cycle perspective. As a result, the operation cost is optimized. The cost savings during the operation and maintenance stages will help to offset the upfront cost required for green building features. Construction component (including labor and materials) accounts for the largest proportion of green building cost [18]. In a study carried out by General Services Administration study, from maintenance perspective, green buildings perform better than conventional construction in terms of energy efficiency, water efficiency and cost efficiency [19]. This result strengthened by another study carried out by Lau et al.'s which revealed that low energy office buildings with green features can save more than 55% of energy cost compared to conventional buildings [20].

The application of green building principles in traditional housing in Iraq

The concept of green building in Iraq is not novel. The roots of this principle can be traced through the past cities in Islamic architecture where the smart designs used within the same orientations of green architecture, which is a pioneer in this area through the methods that followed by the planners and popular architects for buildings. These methods came as solutions in response to the environment and characterized by the area according to the privacy climate. Using the central courtyards and thick walls to reduce heat acquisition was the most common solutions in warm climate countries including Iraq.



Fig. 1, The central courtyard

Indeed, Islam principles emphasized on the importance of reducing water consumption, encouraged the implantation and not to harm the environment. Moreover, it can be noticed that the aesthetic perspective in Islamic architecture is not the optimum destination for buildings. What distinguishes Islamic architecture is that it protects itself from external factors that are exposed to and meet the needs of its users [21].

In a study carried out by Ragette [22] explained the thermal performance of the central courtyard of traditional housing. The central courtyard works as a thermal regulator. Its work depends on the large difference in temperature between night and day, and pressure variety between narrow streets and the shaded courtyard. At the beginning of the day, the central courtyard still retained the cool air that gained at night. The courtyard was shaded wholly or partially at that period of day, which provided a comfortable place for use by the occupants. When the sun was getting higher and the temperature rose during the day, the courtyard became hot place and could not be used by the occupants. However, the alleys were shaded at this period of day, and it is retain the cool air. In the evening hours and the night, the occupants used the roof of the house to sit and sleep when the courtyard and the thick walls re-radiated the heat stored during the day to the sky, and the cold air began to fall gradually to the bottom and gathered in the courtyard.

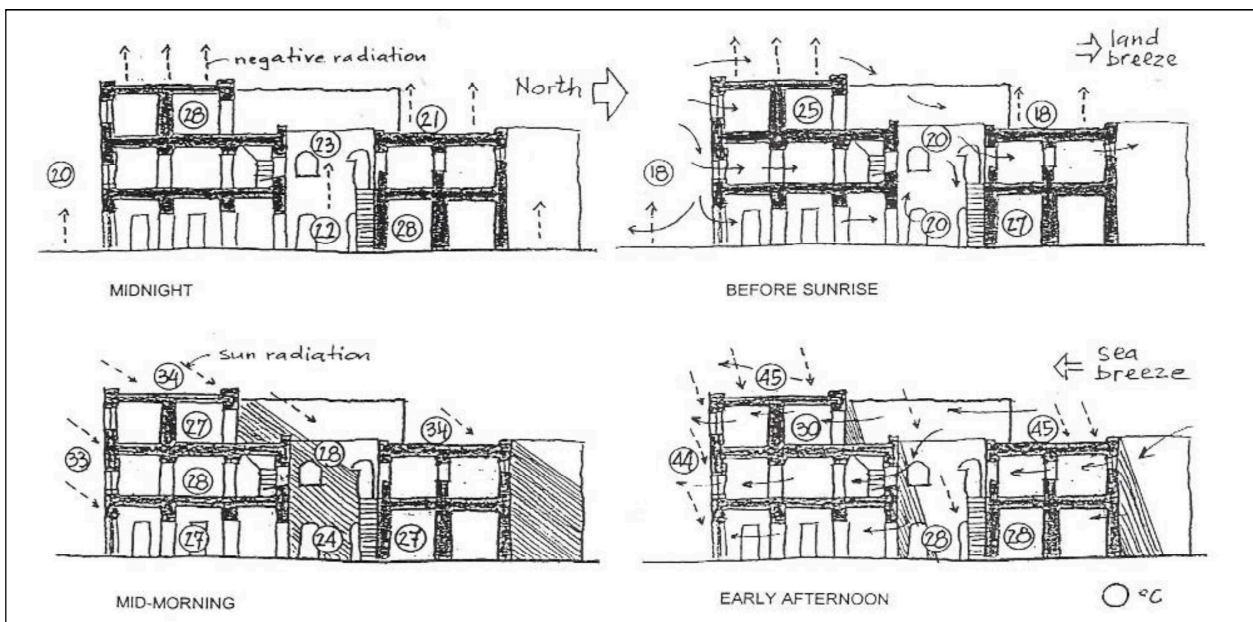


Fig. 2, Thermal performance of the central courtyard of traditional housing, Ragette (2003)

Another study carried out by Al-Zubaidi [23] for a number of traditional houses in the city of Baghdad. Some of which was with open central courtyard and the other was also with open central courtyard, covered with lightweight concrete panels. It was found that the environmental performance of the open central courtyard was more efficient in terms of the convergence of the

daily temperature range and being located within the limits of thermal comfort for humans especially in the early morning hours and in the evening hours. Figure (3) shows temperature range in the open central courtyard of traditional housing.

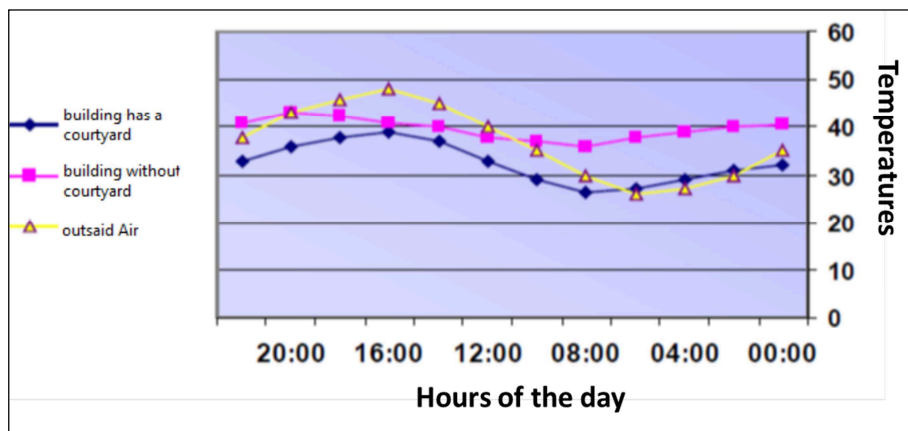


Fig. 3, Temperature range in the open central courtyard of traditional housing

On the other hand, the courtyard that has been covered almost approached the thermal performance of the air temperature outside in the early morning hours, and decreased in the afternoon, while in the evening and after sunset where air temperatures began to fall outside, the closed yard was hotter until after midnight night because it stored the heat gained throughout the day without being able to re-radiate it to the sky as in the open courtyard.

Summary

This study shows that green architecture in different countries has to be designed and built according to local climatic conditions and to suit the requirements of the locals. The open courtyard is the most efficient solution of the dwellings in the warm climate region for being more interactive with the environmental effects. However, it needs to make it more responsive to the requirements of social and contemporary lifestyle with the introduction of some new technologies available that increase the efficiency of the environmental performance of the central courtyard.

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