

# An Investigation on the Role of Iwan as a Sustainable Element in the Traditional Houses of Different Climatic Regions of Iran

H. Nejadriahi

**Abstract**—This paper focuses on the performance of Iwan as one of the significant spaces in the traditional architecture of Iran. The aim of this study is to investigate on the role of Iwan in sustainability enhancement of traditional houses of different climatic regions of Iran. Iwan is considered as a semi-open space, which its form and location in the building highly depends to the climatic situation of that region. For that reason, Iwan is recognized as one of the sustainable elements in the traditional houses of Iran, which can provide more comfort with less use of energy. In this study, the history and emergence of Iwan in the traditional architecture of Iran as well as the concept of sustainability in architecture are explained briefly. Then, the change of performance or form of Iwan is analysed in different climatic regions of Iran in accordance to the sustainability concepts. The methods used in this study are descriptive and analytic. Results of this paper verify that studying the sustainability solutions in the traditional architecture of Iran, would be a valuable source of inspiration for the current designers to create an environmental and sustainable architecture for the future.

**Keywords**—Climatic regions of Iran, Iwan, sustainability, traditional houses.

## I. INTRODUCTION

FORMATION of the traditional houses of Iran has always been under the influence of several factors. Climate is one of the significant factors that greatly effect designing of these houses in order to create spaces, which users feel more comfortable. However, most of the current buildings are lacking of appropriate use of environmental factors in their design process. This results in buildings, which are not responsive to the climatic situation of the region, and cannot provide comfort for their users without using mechanical devices. On the other hand, sustainability and the ways of reducing energy consumption by taking the advantage of natural and renewable resources are among the most important debates of nowadays. Considering that, as houses consume the energy in urban scale, it is crucial to pay attention to the appropriate use of architectural elements in them, in order to decrease the major use of non-renewable sources of energy and increase the use of natural/renewable ones instead [1]. Iwan is one of the elements that if it is designed and constructed in harmony with climatic principles and conditions of the region, can play a remarkable role in energy saving. Consequently, the present study aims to investigate on the role of Iwan as a sustainable element in the traditional

houses by considering the climatic conditions. Accordingly, it is necessary to have an overview on the history and presence of this architectural element in the traditional architecture of Iran before investigating on its climatic principles.

## II. HISTORY AND PRESENCE OF IWAN IN THE TRADITIONAL ARCHITECTURE OF IRAN

In Persian, Iwan means “portico, open gallery, porch or palace” [2]. Iwan is also described as the projections with walls at both sides, or as the semi-open columned space, which are next to the rooms in different forms [3]. But in general, it can be defined as the semi-open space, which is enclosed at three sides and open at one side.

The way Iwan has been appeared is not certain; however, the scientists who have made investigations in Iran have specified it as an outstanding phenomenon in the Iranian architecture [4]. Iwans were used by the Hakhmanesh's in Apadana and Pasargad palaces and then in the later periods like Ashkani's and Sassani's; but the peak of its use dates back to the periods after Islam specially Safavi's and Qajar's eras [5].

Iwan has been used in various buildings such as mosques, palaces, etc.; but it was one of the significant elements in the traditional houses of Iran especially during and after the appearance of Islam. Iwan in the houses was providing a pleasant space for the dwellers with diversity in performance and a variety of experiences. Iwan is one of the oldest spaces in Iranian houses, which was considered as a necessity until the early twentieth century [1].

Sequential arrangement of spaces in Iranian architecture indicates that entering to any space is along with the preparation that is rooted in the Iranian culture. Considering that, Iwans were usually built as a transition/connecting space to get in or out of a space. Iwan can also be considered as a space ahead, which emphasizes on the entrance. Iwan is sort of an intermediate space between open and close spaces, which creates a continuity of inside towards outside and vice-versa. Its open side usually overlooks to the yard with direct perspective towards trees and greenery. Consequently, in terms of space quality, Iwan causes hierarchy, variety, readability and coherence of outside and inside [6].

In addition, Iwans have significant climatic values, which affect their size, form, etc. In general, Iwan can assist moderating the temperature of indoor spaces adjacent to it [7]. Iwan can also act as a ventilation element, directing the desired wind into the building or as a shadow device to protect

H. Nejadriahi is with the Faculty of Design, OCAD University, Toronto, ON, Canada (phone: 416-977-6000; e-mail: hnejadriahi@faculty.ocadu.ca).

from sunshine, which all can assist reducing the energy consumption [8].

### III. SUSTAINABILITY IN ARCHITECTURE

Sustainability in architecture means conserving constructions for the future, in terms of physical durability and saving energy resources. Sustainability is about the efficient use of available materials and resources, rather than ignoring them. Nowadays, the knowledge of building ecology focuses on its capacity to integrate environmental and climatic parameters into design and thus enhances space qualities such as comfortability [9]. The major goals of sustainable architecture and its resulting sustainable development are to improve the quality of life, better preserve and maintain the ecosystems and natural energy resources and finally to reach a safer future [10], [11]. Consequently, a sustainable design concept means creating the maximum comfort for the users by enhancing the quality of life while making the least damages to the environment. Traditional architecture of Iran is perceived sustainable for possessing sustainable features; it is responsive to the climatic conditions of the region, which highly contributes in energy saving as well as reducing the environmental impacts.

#### IV. CLIMATIC CLASSIFICATIONS OF IRAN AND THE ROLE OF IWAN AS A SUSTAINABLE ELEMENT IN THE TRADITIONAL HOUSES OF EACH REGION

Iran is a vast country, which possesses four different climatic regions: A) mild-humid, B) cold, C) hot-humid D) hot-arid climate [12]. Local builders have used appropriate design strategies for creating desirable environment to live. There had been numerous creative climatic planning in order to use energy efficiently. Studying and combining them with new climatic systems can be a proper way to make current buildings more sustainable.

##### *A. Mild and Humid Climatic Region*

This region is located in the southern shores of Caspian Sea. Its climatic specifications are: Extreme precipitation and high humidity ratio whole the year; Low diurnal temperature changes; Extensive distribution of vegetation [13]. In such climate, in order to protect the building from the rain associated with the wind, semi-open spaces/Iwans formed around it to create a buffer space. Use of natural ventilation is one of the main strategies to deal with the humidity. Therefore, Iwans were used to create airflow and to reduce the moisture. In order to get the advantage of natural ventilation, buildings in this region are extroverted (outdoor dominant). Because of existence of natural ventilation, Iwans were also used as a comfortable place for daily activities or night sleeping during the summer. Moreover, Iwans in these buildings protect the building from direct sunlight during the summer while letting the light come in during the winter [14].

##### *B. Mountainous Region with a Cold Climate*

The climatic characteristics of this region are: Cold winters and moderate summers; Extreme difference between day and

night temperatures; Heavy snows; and low humidity. Investigation on the climatic role of Iwan in the houses of this region shows that Iwan, in most of cases, is located along the main axis of the house to have the maximum advantage of southern sunlight [15]. Iwan also protects the house from the rain and snow. Therefore, the existence of Iwan at the initial layer of the building keeps its aesthetics role as well as the climatic role [16]. In winter, the Iwan acts as a cover, which prevents the penetration of coldness into the building [17]. As in this region, most days of year are cold or extremely cold, most of daily activities are done inside the building. Therefore, the size of yards in this region is slightly smaller than those of central Iranian plateau, and, the depth of Iwans is much lesser than those in the southern regions of Iran; they do not have sitting room usage as those of the Caspian region and they are only used to protect the building from snow and rain.

##### *C. Hot and Humid Climatic Region*

This region, which lies along a narrow and relatively lengthy coastal strip of the Persian Gulf, is considered as hot and humid climate. It has long summers and short winters. In general, this region has the following climatic conditions: Low level of annual rainfall; Very high level of evaporation and air humidity whole the year; Very hot and humid weather in summer and moderate one in winter; Low diurnal temperature changes. Accordingly, in this region, creation of shadow and use of air flow are important strategies for a more comfortable living condition. Iwan is one the important spaces in the houses of this region, since it creates both shadow and air ventilation; almost all houses have Iwan. Wide and high Iwans around the central courtyard are used as living space for most of the year and various activities have taken place in there. Iwan also connects the spaces to each other, and in terms of view and connection with the yard plays a significant role in these houses [9].

##### *D. Hot and Arid Climatic Region*

This region, which covers the most parts of the central plateau of Iran, receives almost no rain for at least six month of the year, therefore it has a very hot and dry climate. In general, climatic characteristics of this region are: Hot-dry summers and cold winters; Very low rate of rain; Less vegetation; Low humidity; High diurnal temperature changes. Iwans in the buildings of this region are opened to the courtyard, which allows summer breeze and light to enter the spaces beyond. They are also used to create shaded and cool living spaces during the day. However, most typically Iwans are located on the southern side of courtyards with the open side toward the north. This allows Iwan to provide an indirect light of the northern sky without having direct light enter in and to control the depth and amount of sunlight into the buildings in summers and winters based on resident needs to solar energy. Especially south and east oriented Iwans are very cool and shady places for summer afternoons [18].

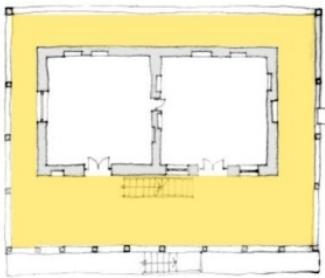

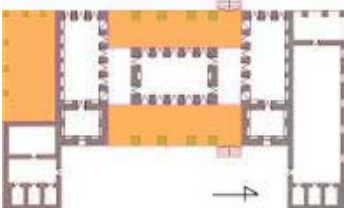

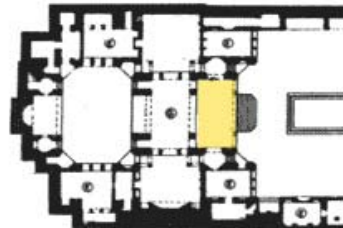

### V. DISCUSSION

According to the explanations above on the climatic

characteristics of different regions of Iran and considering the significant climatic values of Iwan, which can be recognized as a sustainable element in the traditional houses of Iran, a table has been provided to specify the climatic role of Iwan in

each region. In view of that, a typical traditional house has been selected from every climatic region to demonstrate the position and physical appearance of Iwan in each house.

TABLE I  
CLIMATIC ROLE OF IWAN IN THE TRADITIONAL HOUSES OF DIFFERENT CLIMATIC REGIONS OF IRAN

Climatic Regions	Traditional Houses		
	Plan	Figure	
Mild and humid			<ul style="list-style-type: none"><li>-Iwan around the house as a buffer space to protect it from the rain</li><li>-To create airflow and to reduce the moisture</li><li>-To protect the house from direct sunlight during the summer while letting the light come in during the winter</li></ul>
Cold			<ul style="list-style-type: none"><li>- Iwan along the main axis of the house to have the maximum advantage of southern sunlight</li><li>-To protect the house from the rain and snow</li><li>-As a cover, which prevents the penetration of coldness into the building</li></ul>
Hot and Humid			<ul style="list-style-type: none"><li>- Wide and high Iwans around the central courtyard creates both shadow and air ventilation</li></ul>
Hot and Arid			<ul style="list-style-type: none"><li>-Open to the courtyard, which allows summer breeze and light to enter the spaces beyond</li><li>- To create shaded and cool living spaces</li><li>-To provide an indirect light</li></ul>

## VI. CONCLUSION

Iwans have various functions in the traditional houses of Iran; however, the significant role of Iwan is its climatic values; it can assist moderating the temperature of indoor spaces adjacent to it and reducing the energy consumption and subsequently enhancing the sustainability; therefore, it can be a suitable pattern for designing the new houses. Regarding the important role of Iwan in different climatic regions of Iran and its historical continuity in Iranian architecture as an architectural reference pattern, it is essential to consider it as one of the necessities in today's buildings. Therefore, some recommendations, principles and strategies are proposed to enhance the sustainability level of the house by proper use of

Iwan: in design of new houses it is important to make sure that Iwan is not replaced with a simple terrace; its direction, location, width, height and form of Iwan, all should be designed in attention to the climatic characteristics of the region, in order to assist energy efficiency in the house. Moreover, most of the current apartment buildings are suffering from obstruction and lack of flexibility; so elements like Iwan should not be eliminated, since they help creating spatial openness and flexibility of space. Considering the proportion and hierarchy of spaces, a logical connection and continuation between the yard (open), Iwan (semi-open) and closed space must be established. Heating/cooling appliances must not be located in Iwan, as they would interrupt its

performance. Consequently, consideration and development of the above strategies allow current architects and designers to build contemporary houses in a more sustainable, comfortable and self-sufficient way.

## REFERENCES

- [1] N. Najafgholi Pour Kalantaria, M. Singerib, S. RoshanfekrJoursharic, "Investigation of the Relationship Between the Climatic Role of Iwan and Rate of Energy Consumption in Traditional Houses of Tabriz", *Procedia Engineering*, 118 (2015) 711 – 719.
- [2] O. Reuther, *Parthian Architecture, Survey of Persian Art* (1) ed. A.U. Pope, Asia Institute Book, Oxford University Press, London and New York, 1967, pp.411-44.
- [3] M. Zandieh, and S. Parvardinejad, "Sustainable development and its concepts in residential architecture of Iran", *Journal of Housing and Rural Environment of village*, no.130, 2010.
- [4] M. Taghavi, *Architecture of Iranian planning and urbanization over time*, Yasavali, Tehran, 2004, p.91.
- [5] N. Ardalan, and L. Bakhtiar, *Sense of unification*, Khak publication, 1382.
- [6] M.R. Haeri, A research about the using the architecture principles of traditional/ historical houses in design of modern house, vol. 1&3, Tehran. Ministry hous. dev., 1374.
- [7] A. Saremi, and N. Radmehr, *Enduring values in Iranian architecture*, Tehran. Dep. culture. Her. Publ., 1376, p.109.
- [8] E. Prianto, and P. Depecker, "Characteristic of airflow as the effect of balcony, opening design and internal division on indoor velocity: A case study of traditional dwelling in urban living quarter in tropical humid region", *Energy and Buildings*, vol.34, no.4, pp.401-409, 2002.
- [9] M. Shohouhian, and F. Soflaee, "Environmental sustainable Iranian traditional architecture in hot-humid regions", *International Conference Passive and Low Energy Cooling for the Built Environment*, Greece, 2005, pp.173-177.
- [10] K. Yazdi, P. NazeriNaeini, R. Hekmatpanah, "Investigation of Sustainable Architecture in Arid Zones (Case Study: Ardestan City)", *International Conference Sustainable Urban Areas*, *World Applied Sciences Journal*, vol.19, no.10, pp.1523-1531, 2012.
- [11] S. Shojaei, and Z. Khodayari, "Sustainable Architecture in Arid Regions of Iran", 5th symposium on advances in science and technology, Mashhad, 2011, pp.1-8.
- [12] M.H. Ganji, "Climates of Iran", *Bulletin de la Société de géographie de l'Egypte*, Cairo, vol.28, no.19, pp. 195-299, 1955.
- [13] M. Kasmaee, *Climate and Architecture*. 2nd Ed. Isfahan: Khak, 2003.
- [14] R. Hyde, *Climate responsive design : a study of buildings in moderate and hot humid climates*, London New York E & FN Spon, 2000.
- [15] M. Rezaei, and N. NasiriLivarjan, "Life existence in Iwan", *Regional Conference of Persian houses*, Islamic Azad University of Gonbad-e Kavous, 2010.
- [16] A. Mahmoudi, "Review of Iwan importance in traditional houses (with a special consideration of Bam)", *Journal of Honar-haye Ziba*, no. 22, 2005.
- [17] G.H. Memarian, *Introduction of Iranian residential architecture (introverted typology)*, University of Science and Technology, Tehran, 2006.
- [18] N. Najafi, "Iranian Traditional Architecture and Energy Saving (CASE STUDY: Shiraz Ghajar Houses)", *International Journal of Energy and Environment (IJEE)*, vol.4, no.5, pp.871-878, 2013.