

THE ROLE OF INTROVERTED ARCHITECTURE AND URBAN DESIGN TO REDUCE ENERGY CONSUMPTION IN ORDER TO ACHIEVE SUSTAINABLE DEVELOPMENT WITH EMPHASIS ON WARM AND DRY CLIMATE (CASE STUDY: YAZD)

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ABSTRACT:

In today's world, the increasing population, exceed growth of urbanization and lack of non-renewable resources does not remain nothing more than a way for architects and urban planners to walk towards future developments and sustainable development. According to what mentioned cities in arid areas where natural resources are more limited, further highlights the need for sustainable development. In this study we intend to examine introversion role in energy saving with an emphasis on warm and dry climates from the perspective of sustainable development in two micro and macro levels, the architecture and urban design. With a little exploration in constructive indexes of buildings and cities in dry and warm climates we find that the introversion is the main feature of the architecture and urban design in this climate. If we look at this issue through the lens of sustainable development, finally we have to distinguish two patterns of the central courtyard and compact city model. In this viewpoint first we study the central courtyard pattern in Introverted homes and the compact city model in the city scale of in these regions. The research method in this study is descriptive and analytical so that the approach of review is used in the context of library studies. Finally, we conclude that both models have in common to achieve a reduction in energy consumption that is one of the principles of sustainable development.

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INTRODUCTION

The fast growth of population and inharmonious spread of urbanization in the country, the process of critical environmental issues in dried cities which makes up a significant portion of Iran cities has accelerated. The limitation of natural sources and sensitive environmental conditions in these areas (such as limited suitable land, water, etc.) right management and sustainable use of the resources will require [1].

The research that has been done in the field of sustainable architecture and urban design as Golan Research shows that vernacular architecture of traditional Middle Eastern cities have remarkably consistent with the environmental characteristics of their land [2].

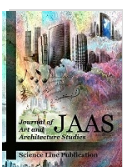
The researchers, including Givoni believe that the main goal of urban design in warm and dry climate is that climate-induced stress on people to work,

shopping, walking, sports and other outdoor city are reduced. The other purpose of urban design in such areas, the ability to provide the interior spaces of buildings that also provide climate comfort, the consumption of energy need minimum [3].

But the question that arises here is that how can use introverted architecture and urban design in warm and dry areas to reduce energy consumption in order to achieve sustainable development?

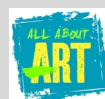
It seems that knowledge of architecture and urban design as a discipline that is responsible for shaping the physical environment of cities can use Introversion criteria derived from popular culture in harmony with environmental characteristics of these areas through savings in energy consumption to achieve environmental sustainability.

First in this study, we will examine the concept of sustainable development and its relation to energy and then will express attention to the principles of



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sustainable development in cities in warm and dry climates. Finally, we discuss about the concept of introspection and its roots and two patterns of introverted architecture and urban design in warm and dry climates introduced and the advantages of the two models in energy efficiency as one of the principles of sustainable development will be examined.

Sustainable development

Sustainable development has been used from the mid -70s and after oil crisis in (1973). Nowadays, discussion about Sustainable development, is one of the most important and common discussion in international level. Popular organizations and organs in the world, and also United Nations (UN) are the most important organs in this issue. Precise and professional discussion about it was started after the oil crisis which was the tipping point of the discussion in the International Sustainable Development Conference (1992), known as Earth Summit in Rio de Janeiro. This conference later was known as the Rio Summit. In this summit, a statement for presenting of strategies to Sustainable development was issued and all of the countries were bounded by the statement. After 10 years, in 2002, another conference in Johannesburg -south Africa- was held with some ministers' countries and Environmentalists. The purposes of this conference were emphasizing on approvals of Rio conference and make them more applicable in the word. The most important definition of Sustainable development, presented in Rio summit is "the Development that meets the needs of the present without compromising of future generations' needs and considers environment and future generations" [4].

Also, according to the Sustainable development definition from United Nations World Commission "development that is responder of the needs of the present without compromising the ability of future generations to meet their own needs" The World Bank defines Sustainable development as "the development that is continuous" [5].

Sustainable development has been defined in many ways, but the most of quoted definition are focusing on future generations, future of Environment and Protect the Global Environment. Considering culture, local features and past experiments, Utilization of Renewable Energy and avoiding from Utilization of non-renewable Energy, are principle of Sustainable development [4].

The necessity of attention to sustainable development in the cities with warm and dry areas

The study of the status of today's cities of Iran indicates that following to the modern physical interventions (that was performed at the beginning of the current Hejri century in the framework of

construction of roads and widening of them in the form of municipal comprehensive plans. The cities of these areas in the country underwent physical changes inconsistent with the natural environment. The comparison of compact urban fabrics and vernacular architecture in harmony with the climate of these areas, which have been manifested in the traditional parts, with new fabrics that were formed around these cities in the form of immethodical development, shows that architecture and urban design of desert cities are increasingly receding from their normal, natural situations. This issue necessitates the search for solutions of confronting with current unfavorable procedure and correction of inadvertent consequences of physical intervention in these cities in a way that urban development will be achieved [1].

Geographical situation and climate of Yazd

Central part of Iran is composed of thousands of square meter of broad desert that is between 500 to 1500 meters from the sea level central desert of Iran is one of the driest areas of the world and in the summer it has the hottest spots on the surface of the earth globe. Nevertheless, during remarkable number of big important cities like Silk Road (400 BC) Kerman Yazd, Kashan, and today's Tehran were formed and flourished.

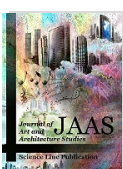
Settlement of human being in desert area was not possible except with smart usage of nature, adjustment and stylizing the circumstances of human being's living in severe weather climate. Some of various problems that the people in warm and dry areas were trying to solve and were creating to new ways were: burning sunshine, day severe warm weather(maximum of summer temperature 40 degrees) , the temperature difference between day and night (this is up to 20 degrees about Yazd), very hot summer and very cold winter (this fluctuation in Yazd is 59 degrees) cool weather little rainfall (annual rainfall of 60mm in Yazd), Dehydration and existing of dusty winds sometimes with sounds [6,7].

The roots of introversion and extroversion

Introversion and extroversion is the theory that was presented by Carl Gustav Jung, Swiss psychologist and thoughtful main 1920. And it was dealing with human's energy absorption form his outside world. Much introversion is known with their silence and shyness versus extraversions that are happy and social. This theory is base d on this principle that introversions receive their energy from the world outside and in contact with others [8].

Introversion and extraversion human

Being (man) a person's mental image of his function in contract with his own environment determines his (ego) and his "function" either this is a person or an organization. Paul Klee states these two kinds of people in two patterns.



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This is an extraversion person, lively, involved, that his strengths and weaknesses are clear. He want more than he has, jumps to the air, and knows that what his potential consequences are, this man dares to be failed (Figure 1).

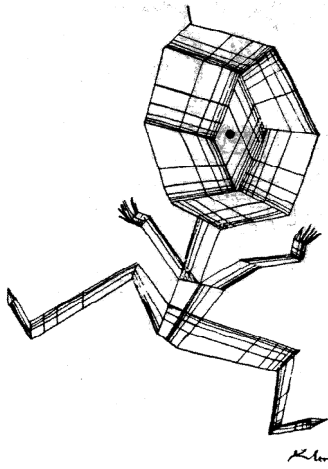


Figure 1: an extraversion person [5].

Here we see a human being that looks into himself, involves in himself and in security that minimized his contraction with the world and avoids failure and involvement (Figure 2) [9].

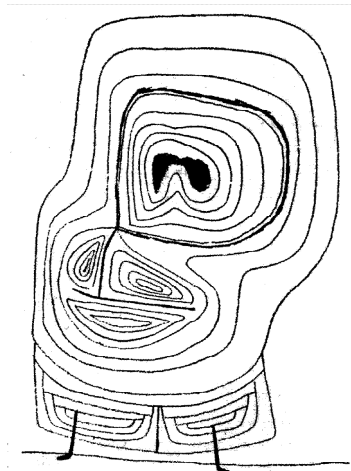


Figure 2: an introversion person [5]

Introversion in architecture

From the term introversion in architecture different meanings can be inferred. As it was mentioned, this term outside architecture from the ethics and spiritual perspectives and views has the meaning of being reserved, orienting to internal states and avoidance of showing the states. The issue of not caring about the appearance and dealing with inside instead, from some expert in architecture discussions, this come to the inside of this area to the point that Iranian architectures were named introversion because in the outside view and in the alley and lanes nothing can be seen except mud and

clay but inside the building you can see a world of work and beauty [10].

This concept is considered a principle in Iranian architecture and it can be seen and known in various forms [11].

In the culture of such architecture, the real value is given to the essence and inner core. And the exterior crust is only a virtual covering that preserves a fact and its inner secret richness is the determiner of its essence and the true existence of this building and it's incomparable with the appearance and atmosphere of outside the building. The undeniable feature of architecture of building and monuments like house, mosque, school, caravanserai, public bathrooms and etc, is related to the feature of introversion. That is originated in social philosophical principles of this area. Introversion seeks the protection and preservation of environmental privacy in which physical conditions with original relaxation inside. Mainly, based on Eastern thought, and in Islamic areas, the essence of space is in conscience and the inner yard, is the creator of basic of the space [12].

Introversion house and reduction in energy consumption

Climate conditions especially in warm and dry areas also affects the introversion house design, because outside the house is neither a garden nor a lawn, grass [13]. In fact introversion houses are good responder to the dry weather, irritating wind, flowing sands, and burning sun [14]. This form of building is created in desert cities in a way that has harmony with the climate and this means reduction in energy consumption for heat supply and cold supply [1]. Features of an introversion house in brief are as follows:

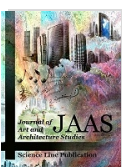
- Lack of direct visual relationship between inside spaces with outside urban part.
- Different spaces are organized by elements like yard and or covered (closed) platforms in a way that holes and doors and windows are opened towards these elements.

Central yard as indicator element in introversion architecture

The central yard is a little world composed with space and in fact from the material of space and hollow that you can understand it with wall structures, floor organizer, and type of material and styles of construction.

Central yard has been affected heavily by the climate of the warm and dry areas [15]. Greenness (verdure) and existence of a pond (little pool) in "Miansara" in some warm and dry areas causes the space to become more favorable. In some areas like in Yazd for optimum atmosphere, weather and water from the yard, garden is used [14].

Houses that has a yard at the center and four sides of the yard is building are called "Charfasl"



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(four-season) (Figure 3). But what is important and is applied in the architecture of the building, is mainly summer sitting part. Summer-sitting part of the house is opposite direction of Mecca (Qeble) that is almost opposite side of south. This part is locally called “Neser”. It takes shade and is cool. The opposite side is side is towards Mecca, takes proper sunshine in the winter for this part [16].

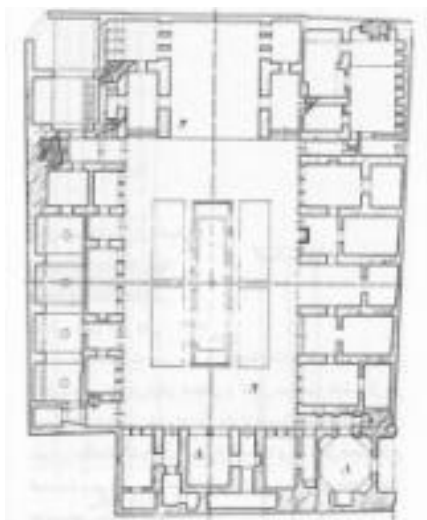


Figure 3: Lariha house in Yazd

Introversion in the urban scale

Outside and inside space in traditional and historical architecture is so contiguous that each one indicates a different figure. But in many today's designs, most of outside space is realized from the way buildings are located, it means it doesn't have origin and value of itself, but when location of buildings is applied in accordance with its principles and basics, the consequent space, whatever it is, will be called exterior space.

In traditional and historical architecture exterior space (outside view) has the rules of interior one. No part of inner or outer is out of the design rule and as building builds the outside space, yard and square itself gives special arrangement to the building. The major part of beauty, relaxation and feeling of unity that is seen in old fabrics (old town) of cities, old

religious, cultural monuments is indebted to the system of inside and outside system of traditional architecture [17].

With all these interpretation and as Henri Stierlin states in the description of design structures of cities in Iran with the concept of “being always inside something” and with referring to the psychology concepts and the human's feeling of need to the shelter is in everywhere even in urban scale [18].

It can be inferred that for example if we suppose a traditional neighbourhood as a kind of interior, we can call big space of the city as exterior [19]. this issue is expandable, for example if we suppose the big space of a city as an interior the broad surrounding can be called exterior.

In other words, compactness and density of Iranian old cities, especially in warm and dry areas, also the shape of the cities that were like castle, fortress and the core of the cities were separated with a fence from “Rabaz”, can be known as a kind of introversion in contrast to the outdoor environment (Figure 4).



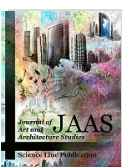
Figure 4: Area enclosed within the old fabric of Yazd known as Qaleh Kohneh (Old Castle)

Compact city

The theory of compact city describes this idea that with the compacting of a city and increasing the density with mixed application action we can lead the cities toward sustainable development [20].

Currently this point is not completely accepted that for attainment to an urban sustainable form specially related to the policy of land function planning is the most effective solution. With the use of compact city pattern (high compactness and mixed function) is performed [21].

Also new researches show that there are meaningful relationship between the concept of “sustainable city” and the concept of compactness and density. The studies achievements regarding to the relationship between population density and physical compactness of the city on one side and reduction in energy consumption and environmental damages on the other side in the urban design



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literature is considered today in the framework of the theory of “compact city” [1].

Iranian compact city and economic use of energy

Urban and rural systems in warm and dry climates are compact and condensed (Figure 5) and this avoids the penetration of sunshine inside the system. Tall shelters of the houses not only protects these house from the view of the people (privacy) but also is a good shield and obstacle against the unfavourable wind, it casts a shadow on the roofs and allies and makes the yards and allies deeper, this closeness, this deepness and shadow, reduces the contact with the heat of outside the system (complex). Light colour of mud and straw also reflexes the radiant heat. The dome-shaped of roofs not only has a construction logic but also is an economic cover because wood is hard to find in these areas and it simply covers a wide opening with the skills of the constructors. In warm and dry areas these things are effectively helpful for the problem of radiant heat and reflex of night heat. Walls and thick roofs prevents from the penetration of radiant heat to inside. Adjacency and contiguity of house, makes the protection state in the inside [16].



Figure 5: Fabric compression in Yazd

In the pattern of “Iranian compact city” the principle of economic use of energy consumption was taken into consideration in different styles. The mentioned style can be classified to economic use of energy from “urban form”, “city structure”, “equipments and inactive systems”. In desert cities, the form of the city regarding both in morphology and skeleton and different functions provides the ground for less energy consumption for example in tradition neighborhoods like Fahadan of Yazd with regard to the combination of the elements in the center of neighborhood that is the mix of different functions, houses, commercial, hygienically, institutional... . Normally in contrast to new cities it's not necessary for the residents to consume energy by their cars to have access to the urban services [1].

CONCLUSION

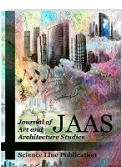
In this study we discussed the role of introversion in reduction of energy consumption in terms of Micro and Macro, one in architecture and the other in the urban designing of warm and dry climate with the emphasis on sustainable development and finally we concluded that as a monument depending on culture and climate houses with central yard in warm and dry areas are introversion. Body of a city is also introversion in a broader sense. And it can be considered the pattern of compact city in these areas in contrast with area in which it is located, is kind of introversion. These two patterns has one thing in common and that is economic use of energy which is one of the principles of a sustainable development.

About the relationship between introversion and architecture it has to be mentioned that architecture that is formed in a bed of culture and cannot be departed from the culture and these two are effective on one another. Also introversion is affected from the culture of this society can be seen clearly in the ethics and moods of Iranian in the past Iranian architecture introversion was more focused and was manipulated in as a principle in architecture.

In addition to the cultural dimension, Iranian architectures created a favourable climate in houses with building introversion houses. Therefore introversion in Iranian architecture not only include safety and privacy but also has harmony with the climate and weather, introversion houses in warm and dry area are a solution for dry weather, irritating heart, burning sunshine and finally reduction in energy consumption. On the other side, the study of Iranian desert cities like Yazd shows that anatomical features of historical and traditional mentioned cities are in accordance with the new scientific results and it seems that the mentioned environmental harmony is the result of a long process from continuous trial and error that was performed in designing and constructing the monuments and urban fabrics. Generally, with regard to the anatomical common things of traditional cities of Iranian desert area a patter at the title of “Iranian compact city” can be reconsidered and proposed. In this pattern the principle of economic use of energy in different ways were taken into consideration.

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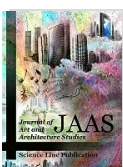
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