Effect of Ecological Factors in Sustainability of Iranian Vernacular Town (Meymand)

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Abstract

At present, the concept of sustainable development is singly that which most experts and practitioners agree on it. It appears in a way that the sustainable development and its different concepts are suited well to the purpose and aims of modern architecture; urban planning and can be introduced as an effectively operating factor to achieve our sustainability aims. Of course, an urban sustainability is not only limited to the concepts of environment but what matters most are to reach an economic dynamism in a viable environment and social quality. As a whole, an urban sustainable development can be defined as a typical development that brings about long-term social and ecological health in cities.

Varied environments in Iran have resulted in different parts of the country to make the most of the natural and available recourses when faced changing and mostly unfavorable environmental conditions, in architectural terms, the inhabitants of the Iranian plateau have had to come up with solutions to their unique environmental conditions much has been said of the use of earth in Iranian architecture.

This paper tries to analyze Meymand as one traditionally organic city in Iran while reviewing the origin where sustainability concept has appeared, defining and application of sustainability concept in urban planning. Finally by comparatively studying the determining indicators of a sustainable city on one hand and Meymand as a traditional organic city in Iran on the other hand, it is concluded that Iranian traditional cities are considered suitable models of sustainable cities because they are all qualified to have all sustainability indexes and were able to respond to their environmental problems after the elapse of long years. This research uses library documents and Internet sites as well as analyzing of urban planning.

Key words: Sustainable development, Sustainable city, Eco-city, urban planning, Meymand

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1-Introduction

The ever-increasing growth of world population, as some believe, has adversely and often disastrously affected the natural habitats of each globe. Uncontrolled and irregular consumption of fossil energies, destruction of forests and the extinction of faunas and plant species have been considered as consequences of them. Concern over the future environment on earth and its natural reserves is an undeniable truth, the thing that has attracted most attentions in the world. Man's activities on earth has, on one hand, ending eared the opportunists and possibilities of coming generation and on the other hand threatened the cities where people have selected as their chief places of performances and where the natural reserves and resources are consumed in great volumes.

Sustainability has been defined as ″ meeting the needs of today without compromising the ability of future generation to meet their needs. ″ It means thinking about our behavior in a big context – recognizing that our choices have a profound effect on our global environment and our future, and attempting to mitigate the negative impacts. A commitment to sustainability is a commitment to creative and responsible action.
This paper tries to analyze Meymand as sustainable city while reviewing the origin of sustainability, defining and application of sustainability concept in urban planning. by determining indicators of a sustainable city on one hand and Meymand as a traditional organic city in Iran on the other hand, it is concluded that meymand was built with the principle of sustainable city, and these principle could use this days in modern cites.

1. The Concept of Sustainability

2.1 Definition of Sustainability

Sustainability is a concept developed in the global political arena that attempts to achieve, simultaneously, the goals of an improved environment, a better economy, and a more just and participative society, rather than trading off any one of these against the others. While its primary context is global, sustainability is seen to be meaningful and achievable only when it is practiced through local initiatives with global significance.

2.2 Sustainability Goals and Indicators for a City

Sustainability goals and indicators are ways to incorporate the many overlapping areas of sustainability into a city's consciousness about what it values. They should cover the natural environment, resources, wastes, and human livability, the latter of which embraces the critical economic dimensions of a city. Each city needs a process to define a comprehensive list of important sustainability indicators and, in particular, ones that set it apart from others (Edwards, 1980).

2.3 How Dose Sustainability Apply to Cities

Sustainability can be applied to cities through extending the metabolism approach to human settlements so that a city can be defined as becoming more sustainable if it is reducing its resource inputs (land, energy, water, and materials) and waste outputs (air, liquid, and solid waste) while simultaneously improving its livability (health, employment, income, housing, leisure activities, accessibility, public spaces, and community) (Fathy, 1986).

2.4 Sustainable City Principles

The below Principles will provide the basis for pursuit of "Cities as Sustainable Ecosystems". The 10 Principles are:

- Provide a long term vision for cities based on sustainability;
- Empower people and foster participation and inter-generational equity;
- Recognize and build on the characteristics of cities including their human, cultural, historic and natural systems;
- Build on the characteristics of ecosystems;
- Achieve long-term economic and social security;
- Expand and enable cooperative networks to work towards a common sustainable future;
- Enable communities to minimize their ecological footprint;
- Enable continual improvement, accountability and transparency;
- Require effective demand management and appropriate use of environmentally sound technologies for cities.
- Recognize the intrinsic value of biodiversity and natural ecosystems and their protection and restoration (www.sustainable.dog.gov).

2. The sustainable Factors of Meymand Village

Meymand is a village of troglodytes - cave dwellers - located in the south-eastern Iranian province of Kerman. Meymand Village is one of the oldest continually inhabited places in Iran and has been continuously inhabited for 2,000 to 3,000 years making it one of Iran's four oldest surviving villages. The village consists of a number of amazing natural and man-made caves that are still used today for housing and shelter. By contrast the troglodytic village of Kandovan in northwest Iran is said to have been inhabited for 700 years. Some claim that Meymand village has been inhabited for 12,000 years, that is, since the middle stone ages, making it a mesolithic village. Reportedly, 10,000 year old stone engravings and 6,000 year-old potteries have been discovered at the site (Azizi, 1382).

The aim of this analysis is, to have a view on vernacular urban planning and architecture to increase the understanding of Iranian people and the construction of their living environment, and also this paper is an effort to provide an information base for further discussion in the respect of sustainability.

3.1 Geographical Location

Meymand village is located some 35 kilometers northeast of the town of Babak- *Shahr-e Babak*, a Kermani town on the road that runs between Tehran in the north and the port of Bandar Abbas in the south. Meymand is believed to be a primary human residence in the Iranian Plateau, dating back to 12,000 years ago; it is still home to nearly 150 people (most of whom are elderly), many of whom live in the 350 hand-dug houses amidst the rocks, some of which have been inhabited for as long as 3,000 years. It is exclusively unique in Iran (Census of the Islamic Republic of Iran, 2011). During the past centuries, all underground buildings in this town seem to have been engraved inside of mountain and also seem to be panoply of large caves. The interconnection between inside and outside of these buildings is exactly by entrance gate.

Fig. 1: Panoramic view of Meymand

3.2 Climate

Sandwiched between a desert and mountain, Meymand enjoys a mountainous climate with cold winters and exceedingly hot summers and abundant with mulberry and blackberry trees.

This village has a warm and dry climate and lies below the surface of the ground, so energy is absorbed and kept extremely well because it takes the heat and light of the sun from the south. This heat is well kept within the building because of earth's thick covering. Thus, it does not need so much mechanical installations such as central heating system and heater to supply heat in winter (Bonine, 1980). Only a fireplace or a small manual heater is enough for these kinds of buildings. Because of the location of this town (warm and dry area), the temperature raises considerably in day and night. The village has a compressed texture that has taken from under the ground.

3.3 Texture of Cities

Because this town has located in a warm and dry area and temperature degrees vary much considerably in day and night (Fig 2), the village texture is of a compressed type with an underground form.(It has an underground formation)

In this rocky town, as the buildings have thick bodies made of building materials and because the earth are spread around the perimeter of building, it acts like a source of thermal energy and radiates back gradual the heat that it has absorbed during the day (Azizi,1382). It also causes to provide more moderate temperature within the building.

Fig. 2: Home located under the earth because of environmental condition

3.4 Orientation

The building established in the south and south east, this direction is the best for controlling and minimizing the influence of heat from sun light in the afternoon into the building. This

ordination protects building against annoying wind from west to east. The southern side of this rocky house is the best because this side minimizingthe influence of heat from the sun in the afternoon into the building and in the cold days of winter is the best direction for keeping the heat in house (Ebrahimi, 1376).

3.5 Accesses

Numerous walking paths on the western and eastern hills sloped body could be observed, but these routes cannot be so permanent because of the rocks moved by people movement (fig 3). This town has not compressed texture. Access to one unit and moving away from it to reach the other are performed separately (Ezad panah, 1381). A very tiny entrance has been designed to avoid the penetration of cold weather and winter undesirable winds into the domestic spaces.

Fig. 3: Access in Meymand

3.6 Architecture

According to local tradition, Meymand was a Zoroastrian settlement before the advent of Islam and that prior to become Zoroastrian, the residents worshipped the sun, and there are claims that the ancient inhabitants also worshipped pre-Zoroastrian Mithraism. It is said that the original inhabitants did not bury their dead, but placed them in crypts carved into the mountainside. In addition, the village contains a 400 square meter complex of fifteen circular rooms where bones and personal belongings have been found, suggesting that it too was used as a crypt or even an ossuary (www.heritageinstitute.com).

The old houses of Meymand Village are carved like caverns inside the mountain andthe important thing in knowing Meymand architecture is, houses not appear only by laying on the stone and brick, houses cut like holes inside the mountain rocks, with no chimney or windows. The buildings of this village are made very sustainable, because integrated rocks have been used on their bodies and are buried in the ground and for that reason they have been used as houses of Meymand community for long centuries (Memarian, 1371).

The individuals cave dwelling units are about 2 meters high and have an area of around 16-20 square meters. The construction of a cave dwelling called a *kicheh* starts with the chiseling of 6 to 9 meter horizontal cuts into the cliff-side. There are presently some 400 *kichehs* /dwellings in Meymand. The dwellings usually consist of a single square or round room

(fig4). Windows where possible are hewed openings approximately 75 cm across (Ebrahimi, 1376). Otherwise, the dwellings are windowless and dark not just because of the lack of natural light but also because of the soot from fires and candles that coat the walls. Some dwellings have more than one room and even an attached stable or animal shelter.

Fig. 4: Square and round room in meymand houses

Doors to the dwellings are commonly made of wood and fitted with a secured latch known as *koleydun* which locks onto a hole drilled into the stone frame. Not all the doors are rectangular. Some have the shape of s standing human body, narrower at the base and widening a top to shoulder width. To prevent water egress, the threshold of the doors are raised some 15 to 20 cm above the level of the *kicheh*. Since the lower slopes have a shallow gradient, the entrance to the units is often preceded by a trench whose walls rise until the hillside is tall enough to accommodate a dwelling unit. At times the lower cave dwellings are grouped like town houses so that the entrance trenches of up to five dwellings open onto a terrace known as a *dalan*. The *dalans* are used for family and social gatherings.

The houses of this town are widely spaced in an alternate form with having four stories. They are not interconnected to each other. Daily light is supplied in any of these houses is absorbed by small overhead light catcher (Memarian, 1371). They also use deep underground natural energy to provide heat and cool for the domestic spaces. Of course, it is worthwhile saying that there is not good ventilation in the houses and they have not sufficient natural light because the only way for connection between outside and inside of this rocky underground house is entrance door. However, this problem can be overcome by digging the ground in order to set up a window or a lunette.

4. Conclusions

What can be concluded from this paper by considering the definitions, sustainable architectural principles and sustainable urban shape is that Meymand have for following reasons an architectural design and an ecological and environmental urban texture.

This town has been built according natural and ecological systems. Orientation of this city depends on the natural gradient of ground in order to make more use of sun heat in cold and snowy winters. The building are impenetrable to rain and wind and also resistance well against the fire. High density and expanded houses of Meymand in the altitude with the least cover area in tune with the natural gradient of ground. Layout of connecting ways from among the urban spaces depends on natural topography of earth. Use of vernacular materials such as wood, sun dried brick, natural stones, adobe and etc in architecture and structure.

Have Knowledge of air pollution, audio emissions and other ecological contaminations, use of natural resources such as spas and natural water sources to supply fresh water to be consumed by the citizens. Inserting of fitting thermal insulators to fight and counter the intense cold weather in cold winters and set in moisture insulator to seal of the rain water.

Use of natural grooves of mountain as canals to dispose of urban waste water and ….So, they provide a long term vision based on sustainability, built on the characteristics of cities including their human, cultural, historic and natural systems, Built on the characteristics of ecosystems and so on. As a final word, Architecture urban texture Meymand represented an environmental sustainable design. Today it can also be a suitable pattern for any other designing in contemporary cities.

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