

Persian heritage: A Significant Role in Achieving Sustainable Development

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Abstract:

In every country, heritage plays a significant role in achieving sustainable development. Iran, a high plateau located at latitudes in the range of 25-40 in an arid zone in the northern hemisphere of the East, is a vast country with different climatic zones. In the past, traditional builders have presented several logical climatic solutions in order to enhance human comfort. In fact, this emphasis has been one of the most important and fundamental features of Iranian architecture. To a significant extent, Iranian architecture has been based on climate, geography, available materials, and cultural beliefs. Therefore, traditional Iranian builders had to devise various techniques to enhance architectural sustainability through the use of natural materials, and they had to do so in the absence of modern technologies. Paper describes the principals and methods of vernacular architectural designs in Iran with given examples which is predominately focused on some eclectic ancient cities in Iran as Kashan, Isfahan, and Yazd. Design and technological considerations of past, such as sustainable performance of natural materials, optimum usage of available materials, and the use of wind and solar power, were studied in order to provide effective eco architectural designs to provide the architectural criteria and insights. This study will be beneficial to today architects in the design of architectural structures to provide human comfort and a sustainable life in adverse climatic conditions. Later describes Persian ancestors thought in system frame work, lifestyle and their contribution to the present science and their cultural heritages left to the world for future generations. Finally examines different threats to the Iranian cultural heritage posed by development and globalization in the recent decades and then explains essence of putting an end to the crisis of the protection of cultural heritage in a country with thousands of ancient sites and historic buildings.

Key words: heritage, environment, management, sustainable development

1 Introduction

We live in an age filled with awesome technological advancements. It is hard to think how anyone could have lived before our time without electricity, air conditioning, automobiles or computers. With humanity's vast fund of knowledge and technology, we live in a world of escalating troubles. As one problem appears to be solved, more take its place. What has led up to today's conditions?

The way we've done business recently has not been sustainable. At the rate we are going, resources are going to run out and it is essential to tackle it and prevent it from diminishing.

Energy conservation is meant by practice of decreasing the quantity of energy used. It may be achieved through efficient energy use, in which case energy use is decreased while achieving a similar outcome, or by reduced consumption of energy services. Energy conservation mostly result in increase of financial capital, national security, personal security, and human comfort which leads to increase value of life and in broader context can change the world towards maintaining a frequent innovatively sustainable life style and comfort.

Innovation can best be regarded as the key to increase value of life bringing about sweeping or subtle changes to the world. The changes which today are

extremely inevitable. Change can be achieved through adapting and evolving to a changing environment propelling us forward using groundbreaking methods or reverting the life to normal and restoring the truly sustainable environmentally-friendly conditions created by our ancestors in past, utilizing them in today's way of life by applying new technologies in them to save the human life.

One of the biggest breakthroughs to understand and guide sustainability and eco-friendly change is abstained through perceiving concepts of systems theory and systems thinking.

2 Systems theory and Systems thinking; Changing System, changing environment

Sustainability is a system property rather than a property of system components in isolation [1]. In this regard, products, services, technologies or organizations individually cannot be defined as sustainable or unsustainable and they should be considered within the systems they are embedded. Only if the systems of concern are sustainable, then the products, services and technologies therein can be regarded as sustainable. The three major subsystems of the meta-system (i.e. ecology, economy, society) and most of the sub-systems of these components (e.g. evolutionary processes, market operations, individual animals, companies, etc.) are complex adaptive systems (CAS). Hjorth and Bagheri (2006) state that complex systems cannot be fragmented without losing their identities and purposefulness. CAS are hierarchic or have multiple-levels and each element is a subsystem and each system is part of a bigger system [2].

To achieve sustainability, there is a requirement for transformation of socio-technical systems which fulfil certain social functions such as energy, mobility and food. Today, Companies should align their innovation strategies with ongoing and expected sustainability transitions to respond the new environment created by depleting resources, ecological thresholds, changing economic and demographic conditions [3].

Systems thinking has been identified as essential to explore opportunities to leverage technology deployments [4] and can be used to address the sustainability of natural renewable energies like wind and solar energy.

3 Energy sustainability

The WCED defines, energy sustainability as an energy system that meets the needs of the present without compromising the ability of future generations to meet their own needs. A balance among economic, social and environmental pillars is required for a sustainable energy system. The energy system faces various challenges. Architectural designs have not been energy-friendly and permitted a great loss of valuable amount of energy. According to the Iranian Energy Productivity Organization, today the country consumes electricity 17 times more than Japan and 8 times more than all the European countries. Twenty percent of the total amount of the electricity is used for air conditioning [5]. Other concerns related to energy are environmental damage, potential adverse health effects in communities where energy facilities are located. In this paper, it is focused on depletion of some renewable energy resources like wind or water energy with a great focus on essence of utilizing natural energy resources and imitation of environmentally friendly architecture in historical monuments and heritages remained in Persia or Iran.

4 An Introduction to Persia

Persia? If you had not associated it with Zoroaster, Daniel, Esther, Cyrus the great, Darius, Xerxes, Hafiz, Saadi and Omar Khayyam, you have heard at least of its charm. Persia was the original home of some of most common fruits and flowers and it is indubitable that to Persia the English language owes such words as rose, jasmine, lilac, narcissus, peach, spinach, orange, cypress, musk, myrtle, azure, magic, candy, rice, chess, sugar, caravan, caravanserai, paradise, peacock, lemon and etc [6]. Persia has contributed to the world more diverse and numerous religions. Here Zoroastrianism, Mazdakism, Mithraism, Shi'ism, all had their beginning [7]. It was the dawn of history and of dispersion of the Indo-European people. They were breaking their tents in central Asia along the Hindu Kush and the Pamir, primitive Aryans with their dogs and herds of domesticated animals in the trek they proceeded to the farthest confines of Europe. A part penetrated into India and another portion into Persia. [8]. In 550 BC the king of the Persians, Cyrus the great established the kingdom of the Persians ruled by the Achaemenid dynasty, the first modern and all-embracing government.

The Achaemenids ruled over a large territory. The seat of this vast empire was Takhte Jamshid (Persepolis) in

today's Fars Province. UNESCO declared the ruins of Persepolis a World Heritage Site in 1979 [9]. Its ruins are still evidence of a splendid empire and a great civilization. During their era agriculture made enormous progress. Also, ironworks, stone carving, use of stone in building, architecture, construction, use of gold and copper developed remarkably. The Achaemenids had a very effective and intricate fiscal and accounting system and usually used coins in their transactions [10].



Figure 1: Royal palace Of the Achaemenid Empire Kings

Establishment of a united kingdom by Cyrus in his time put an end to quarrels among different groups who were rivals in Persia like Persians and Medes. In order to create integrity among different ethnicities living in Persia, he unified all diversified groups and tribes under a unique formal system under name of Persian Empire.



Figure 2: The tomb of Cyrus II dates to 559-29 B.C.E at Pasargad

Integrity of life and system thinking remained as a heritage and became a part of Persian culture among scholars, philosophers, Scientists, architects, poets and ... later. Among well-known Persian poets who

directed unity in their literature towards an overall desired goal of human comfort and sustainable life, Saadi, Hafiz, Ferdowsi, Molana , Khayyam names and their heritages, own a great deal of popularity .

Iranian poet Sa'adi, from the 13th century, is one of the major influential Persian poets of the medieval period. He is recognized in the literary world for the quality of his writing style and in the spiritual realm for the depth of his thoughts. Sa'adi wrote a poem that later became a motto on the entrance of the United Nations building [11]. Secretary-General Ban Ki-moon said: "At the entrance of the United Nations there is a magnificent carpet – I think the largest carpet the United Nations has – that adorns the wall of the United Nations, a gift from the people of Iran. Alongside it are the wonderful words of that great Persian poet, Sa'adi": "All human beings are members of one frame, Since all, at first, from the same essence came. When time afflicts a limb with pain The other limbs at rest cannot remain. If thou feel not for other's misery A human being is no name for thee." [12]. Saadi wrote many precious books that later became as one of those most valuable heritages for next generations in Iran and the world. During his time, he used to recommend the contemporary generation to learn and work. He believed that all communities and bodies set a whole system and they should work together towards achieving the overall desired goal for the society. Regarding the importance of professions Saadi writes darlings of your fathers, learn the trade because property and riches of the world are not to be relied upon; also silver and gold are an occasion of danger because either a thief may steal them at once or the owner spend them gradually; but a profession is a living fountain and permanent wealth; and although a professional man may lose riches, it does not matter because a profession is itself wealth and wherever you go you will enjoy respect and sit on high places, whereas those who have no trade will glean crumbs and see hardships. There have been many Persian scientists who contributed to science and technology branches such as medicine, mathematics, philosophy and....

5 Persians and Architecture

Iranian architecture or Persian architecture history dates back to at least 5,000 BCE with characteristic examples distributed over a vast area from Turkey and Iraq to Uzbekistan and Tajikistan, and from the Caucasus to Zanzibar.

Architecture is one of the areas where Persians have made outstanding contributions. The most prominent ancient examples some of which are still extant today, are the work of the Achaemenids hailing from Persis. The quintessential feature of Persian Achaemenid architecture was its eclectic nature with elements of Median, Assyrian, and Asiatic Greek all incorporated [13].

Geometry plays a fundamental role in design of Persian architectural monuments and arts. From the viewpoint of exterior functioning, the use of geometry as art for creation of shapes, patterns and proportions reminds the Great Architecture of the World and recalls the Archetypes. The art of geometry is thus the key element to make a correspondence between the building and the Ideas that the builder has in his mind. From the viewpoint of interior functioning, geometry as science for selection of structural dimensions such as height, length and width of the building and its structural elements governs the structural behavior of the building, the behavior that follows the geometry. The right geometry makes the building behave correctly and contribute to sustainability of environment.

In Persian and Arabic, the term muhandis (engineer) is derived from hindisah (the common word for geometry) with the meaning of measuring and it is used for both the sciences of geometry and architecture. Geometry is the practice of forms through the measure and relationships, by which means each form can be unfolded out of a preceding one, i.e. geometrical archetypes. Reality, as Plato stated, consisted of Archetypal Ideas, or pure essences, of which the visible world is only a reflection. The senses cannot perceive this metaphysical realm. Geometry makes use of the visible forms to describe these Ideas. Sacred Geometry opens out the oneness underlying all geometric forms and the inseparable relationship of the part to the whole, and continuously reminds the Unity and sacred origin of all things created.

Alberti, in his Ten Books of Architecture, defines the natural beauty of forms and proposes that beauty is an agreement of constituent parts with the Law of Nature. The ancients...did in their works propose to themselves chiefly the imitation of Nature, as the greatest Artist at all manner of compositions. For Alberti, Law of Nature is the rule of proportions and mutual correspond dense of parts with and within the whole Nature, the rule of these proportions is best gathered from those things in which we find Nature herself to

be most complete and admirable. Nature is sure to act consistently, and with a constant analogy in all her operations.

For traditional architect geometric patterns are as aspects of the multiplicity of the Unity. The repeated patterns symbolize the idea of infinity and timelessness. The beauty and harmony observed in geometric patterns reveal the geometrical order that reflects a higher and more profound order viewed as Cosmic Laws. Spiritual man seeks geometric patterns as means of understanding the Creator.

In Persian history, Science, art and architecture have been working together concurrently as main parts of a whole system, towards a common goal of creating sustainable environmentally-friendly conditions for the future successors.

6 Simultaneous Presence of Environmental Friendly Architecture and Art among Persian Ancestors; Rich Heritages for Future Generations

The unique aspect of Persian culture is its geo-political context and its intricate relationship with the ever changing Persian political arena once as dominant as the Achaemenids stretching from India in east to Libya in west, and now limited to Iran stretching from Afghanistan, and Pakistan in the east to Iraq and Turkey in the west. It is this ever-changing reach within the Iranian plateau that brought Persians face to face with Babylonians, Greeks, Egyptians, Scythians, Arabs, Turks, Mughals, Hindus, North Africans, and even the Chinese, allowing them to influence these populations with their cultural norms all the while being influenced by them in what can best be described as a "reciprocal cultural receptivity"[14].

Persian cultural contributions include artistic (Persian carpets, Persian artworks and crafts, miniature paintings, calligraphy), linguistic (Persian literature and poetry), Societal (Architectural influences, customs & clothing, Gardening, music, social norms and standards), culinary, political and ceremonial (Nowruz festivity, Chaharshanbe Suri festival) contributions.

6.1 Persians Gardens

Persian gardens utilized the Achaemenid knowledge of water technologies [15]. As they utilized aqueducts, earliest historically recorded gravity-fed water rills,

and basins arranged in a geometric system. The enclosure of this symmetrically arranged planting and irrigation, by an infrastructure such as a building or a palace created the impression of "paradise." [16].

When the Spartan general Lysander reported back to Xenophon, he described how Persians have created Paradaisos (paradises) where they collected all manners of plants specially fruit trees, and exotic animals they encountered on their military campaigns. Xenophon would translate the Old Persian term Pairidaeza (a combination of pairi meaning "around" and daeza meaning "wall") into the Greek term Paradaisos.

Cyrus the Great's quadripartite garden plan, incorporated architectural elements, as well as planting, water rills, and shade-giving pavilions, producing the background to all later garden developments in Persia. These Persian gardens had a reach far greater than their immediate civilization and were vital in the development of spiritual Muslim gardens, and the Indian gardens of the Mughal empire as they have been influential in the gardens of Renaissance Europe and the Western civilization [17].

Besides gardens there are other types of open spaces like variety of parks in Iran but based on recent studies, Iranians are not eager to use the parks frequently as before [18] despite all the benefits and importance of this activity for improving quality of life [19]. It seems that quantity and quality of public open spaces are not responsive to contemporary Iranian society needs. That is, the imitation of European gardens, chiefly French ones since 18th century, resulted in parks and public places that are not suitable for the Iranian culture and climate; consequently, the use of those areas by urban residents has been reduced. Nonetheless, historical gardens are still being actively used by urban residents.



Figure 3: Fram Garden

Fin Garden, or Bagh-e Fin, located in Kashan, Iran, is a historical Persian garden. It contains Kashan's Fin Bath, where Amir Kabir, the Qajarid chancellor, was murdered by an assassin sent by King Nasereddin Shah in 1852. Completed in 1590, the Fin Garden is the oldest extant garden in Iran. The garden covers 2.3 hectares with a main yard surrounded by ramparts with four circular towers. In keeping with many of the Persian gardens of this era, the Fin Garden employs a great many water features [20]. These were fed from a spring on a hillside behind the garden, and the water pressure was such that a large number of circulating pools and fountains could be constructed without the need for mechanical pumps. The garden contains numerous cypress trees and combines architectural features of the Safavid, Zandiyeh and Qajar periods.

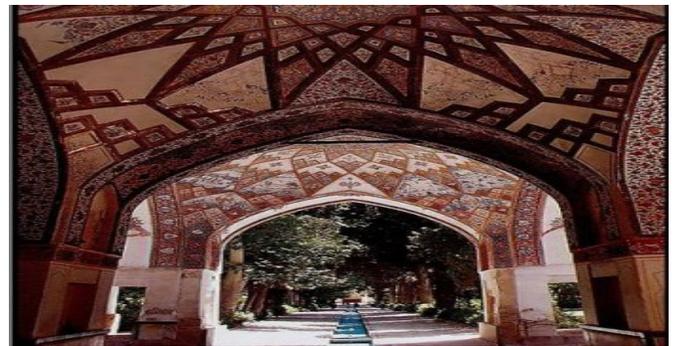


Figure 4: Fin Garden

6.2 Traditional Persian Architecture: Buildings, Cisterns, Wind- Catchers, Bath

Traditional Persian residential architecture, is the architecture employed by builders and craftsmen in the cultural Greater Iran and the surrounding regions to construct vernacular houses. The art draws from various cultures and elements from both Islamic and pre-Islamic times. Almost all traditional Persian houses were designed in order to satisfy the following essential features:

1. Hashti and Dalan-e-vorudi: Entering the doorway one steps into a small enclosed transitional space called Hashti. Here one is forced to redirect one's steps away from the street and into the hallway, called Dalan e Vorudi. In mosques, the Hashti enables the architect to turn the steps of the believer to the correct orientation for prayer hence giving the opportunity to purify oneself before entering the mosque.

2. Convenient access to all parts of the house.
3. A central pool with surrounding gardens containing trees of figs, pomegranates, and grape vines.
4. Important partitionings such as the biruni (exterior) and the andaruni (interior).
5. Specific orientation facing toward and away from Mecca.

Furthermore, Persian houses in central Iran were designed to make use of an ingenious systems of wind catchers that create unusually cool temperatures in the lower levels of the building. Thick massive walls were designed to keep the sun's heat out in the summertime while retaining the internal heat in the winters.

6.2.1 Borujerdi House

The Borujerdi House is a historic house in Kashan, Iran. The house was built in 1857 by architect Ustad Ali Maryam, for the bride of Haji Mehdi Borujerdi, a wealthy merchant. The bride came from the affluent Tabatabaei family, for whom Ali Maryam had built the Tabatabaei House some years earlier.

It consists of a rectangular beautiful courtyard, delightful wall paintings by the royal painter Kamal-ol-molk, and three 40 meter tall wind towers which help cool the house to unusually cool temperatures. It has 3 entrances, and all the classic signatures of traditional Persian residential architecture, such as biruni and daruni (andarun). The house took eighteen years to build using 150 craftsmen.



Figure 5: Borujerdi House

6.2.2 Cistern

Persian Imagination ingenuity is unrivalled in making the best use of water in the desert and in this the country's contribution to the world's technology is unique. It has been pointed out that other area's such as Central Australia or deserts of the United States with similar climatic conditions have no agriculture whatsoever. Both water collection and storage are based on long experience. Cisterns are one of the few traditional structures which are still in general use. A deep circular well, about 5meter in diameter is protected from evaporation and dust by a dome. It is reached by a long flight of steps of steps which tunnel underground to the base of the well; a vaulted porch shades the upper part of the flight. Cisterns are often cooled by wind-catchers in the hottest parts of the plateau [21].

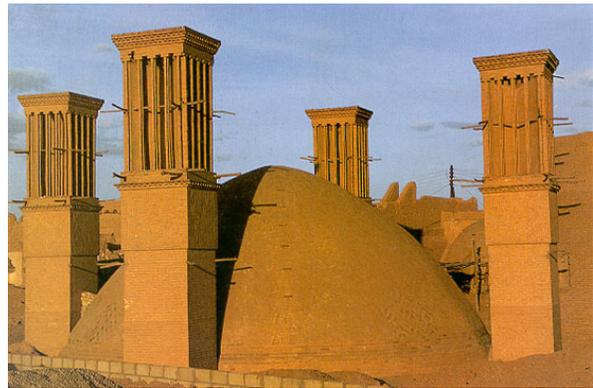


Figure 6: Borujerdi House

6.2.3 Wind Towers (Badgir), Aged air conditioners in ancient Irania Buildings

It is simply a ventilating shaft which projects above the roof of a building and provides it with air-conditioning of a most effective kind. Wind-catchers are among the most spectacular and best-known elements of Persian architecture, providing natural air-conditioning in hot, dry and humid climates for thousands of years. These towers rise not only on ordinary houses but also on top of water cisterns (Ab-anbar) and mosques. Unfortunately, about details of their interior design little information exists. The wealth of local knowledge is chiefly empirical. For instance the wind-catchers of a simple village cistern which appear to be similar to one another may have different internal design such as either a plain or extraordinary intricate interior at ventilator level [30].



Figure 7: Air traps

Function of the cistern found below most wind towers in warm dry regions was to help balance humidity inside the structure. In many desert buildings, wind towers were built on top of a lavabo (howzkhaneh, which functioned as a summer courtyard). The wind was directed over the pool where it evaporated the water and took the cool air into other rooms. The first historical evidence of wind towers in Iran dates back to the fourth millennium BC. To counter the harshly variable climates of the country, Iranians invented wind towers which still stand in various desert towns except in areas where the city was located in a valley or in places experiencing frequent violent storms. Wind towers are an inseparable part of the architecture of central and southern Iran, namely Yazd, Kashan, Bam and villages on the Persian Gulf coast. In desert areas houses are closely set together, high-walled and made of baked brick with small windows facing away from the sun to minimize heat and maximize shade. In order to provide occupants with constant comfort, wind towers were built with a four-directional orientation to catch wind from all directions and guide it into the house. Mr. Gholam Hossein Memarian divided air traps into two categories:

- Purely functional air traps
- Symbolic and functional air traps

The first category can be found in most typical houses in Yazd and areas around it, such as Ardakan and Meibod. In the two cities mentioned above, one-way

air traps that have their own unique form are used. The second category can be found in some Yazd houses and in the houses of other cities nearby. In addition to its function as an air trapper, it indicates the landlord's financial status. The size of some of air traps exceeds the size of a three-door room! Each constituent element of the air trap has an effect on the final shape of the air trap. From bottom to the top, an air trap includes these parts: Stokehole, stalk, chest, chain, and shelves. (Fig. 13a) Since the framework of the air trap is built higher than the height of the building itself and the sucking holes reduce its strength against lateral powers, the importance of resistance of the elements mentioned above is obviously significant. For building a Yazd air trap, a wooden ram is placed horizontally in bricks, and this obviously increases its resistance against lateral forces [31]. (Fig. 13b).

Conclusion

As modernization and nationalism were two important bases for King Reza Shah Pahlavi's reign, reigning from 1925 to 1941, a new architectural style was coined inspired by ancient Persian architecture and was applied in modern public buildings like Banks, Police headquarter and stations, National museum, administrative buildings and schools. Although in this period attention was paid to the preservation of ancient architectural heritage, historic centers became the victim of urban development programs which did not take account of the integrity of city centers and their local habitants.

Modern urban planners, who believed that geometrical grid system had to be adopted by the historic fabrics, made the Isfahan, the former capital of the Safavid dynasty with an exemplar urban design from the 17th century, ripped by their developments programs.

The oldest historic square of the city, Atiq Square, was split into two parts by the new and modern streets. Since then, the square became a marginal place in the city's life. This has also happened in other cities like Kashan, Hamedan, Qazvin and Yazd which were compatible with regional climate and environment.

In Kashan, a city situated on the edge of the central desert of Iran, the earthen architecture and organic urban design, created a harmony for defeating hot weather, dry air and lack of water. A modern 60m wide road was constructed exactly in the heart of the historic center by demolishing the historic buildings alongside the road. The new roads, in Kashan and

other cities, soon became the important focal point for constructing new buildings and attracting the investors [32].

There were the cities which had the best-preserved examples of the traditional architecture deserved being integrated into the new life? The exceptions which had the ability of demonstrating the “golden past era”.

After analyzing the most crucial elements of an unsustainable development, which threatens cultural and natural recourses in the country, now the question is how a developing country such as Iran, can create a balance between the necessity of development and the protection of cultural heritage? And how this heritage can become a driver for the development in the country? The first domestic law on cultural heritage was approved more than 80 years ago, and the next legislation was formed on the basis of the primary law. The vacuums in the legislation, have led to removing cultural properties from National Heritage List. The inefficient structure of the responsible organizations for the protection of cultural heritage has permitted development projects to ignore the economic, social and cultural values of the historic city centers.

The first and the next laws on cultural heritage in Iran were approved when still the idea of sustainable development was not globally introduced. Therefore, the approach to the cultural heritage doesn't provide a creative way for such heritage to participate in the development process of the country.

Although the law emphasizes the necessity of the protection of historic centers, but without providing a strategy for safeguarding them. Therefore, city managers always complain that for the protection of these historic centers they need an over budget fund, which is not ever available. Consequently, these urban fabrics are left defenseless against different natural and human-made factors of deterioration, and when they are deteriorated or useless, their demolition is justified by the city managers.

According to Article.171 of the Fifth Development Plan of Iran (2011), the Ministry of Housing and Urban Development and all the municipalities annually have to rehabilitate at least 10 percent of deteriorated urban fabrics. Here, the law is not explicit about the historic centers and cultural heritage. It could be more effective if the law had a particular emphasis on the revitalization and rehabilitation of historic urban centers. With participating of the governmental and non-governmental cultural heritage organizations and undertaking the conservation and restoration of these properties in this project, it would be a solution for

safeguarding the historic centers and integrating them into the contemporary life of the cities.

Annually, the state-owned organizations spend parts of their budget to obtain, buy or build new premises. If the law obliged them to dedicate a part of this budget, obviously not whole of it, to buy and reuse the historic buildings, a large number of these properties could be saved. Clearly, this solution cannot rescue all historic buildings and centers, but is able to provide a strategy to reuse the valuable buildings. The strategy has economic, social and cultural benefits. Comparing the cost of reusing a historic building with the cost of a new construction, economically will balance this legal approach. The cultural and social benefits of this decision are not deniable, as it helps in safeguarding the cities' historic features and the connection of people and citizens with their common heritage.

The modern full glass buildings, in the hot and always sunny cities, extremely poor thermal insulated constructions and majority of architectural designs have not been energy-friendly and permitted a great loss of valuable amount of energy. According to the Iranian Energy Productivity Organization, the country consumes electricity 17 times more than Japan and 8 times more than all the European countries. Twenty percent of the total amount of the electricity is used for air conditioning [25].

Now the situation must change, otherwise the country will face the lack of energy in the next years.

Apart from applying the new code for energy saving in building constructions, there are many essential lessons that can be learnt from traditional and regional architecture in Iran. The first simple but sadly forgotten lesson is compatibility with environment, climate and nature. The typology study on the traditional and vernacular architecture of the country reveals that the creative architectural forms in the Iranian plateau have always been linked to the climate variety. Therefore, a wise reflection on this heritage would result in emergence of a new understanding of local architecture. The poor copy-pasted architectural patterns, diffused carelessly all around the country, are not only inconsiderate of the environment and climate features, but also waste energy. By establishing again a link between architecture and its surrounding, environment and nature, the result would be variety in architectural patterns, which creatively respond to today's necessity. Obviously, this should be based on an understanding of the relationship between human and nature under support of national bodies and legislation.

Once these changes are applied, the lesson derived from this heritage would help carry forward the concept of sustainable development in the country.

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