

Research Article

Identification of Sustainable Architecture Dimensions

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Abstract: The main purpose in this research is identification of sustainable architecture dimensions. Nowadays, one of the most necessary complicated and main specifications of architecture with which architects are face is the issue of sustainability in various types of its interpretations. The issue of sustainability is interpretable and general according to many aspects. Therefore, it is necessary to identify this concept (architecture and its related categories). At the beginning of this discussion, we were faced with titles such as Green architecture², Sustainable development³, etc. However, the purpose of this study is to study of nature and identify the circumstances and essence of sustainability in all fields in which the architecture is involved. The innovation of this study is to identify and feel the fact of sustainability dimensions that is studied in procedure of library research, a case sample and proposal of common but insufficient ideas related to this discussion. This study studies 3 approaches including main environmental, cultural (value) and technical views and it tries to take the proposed topics under the subjection of this 3 factors respectively (presenting a modern model); furthermore, the minor factors are studied under the subjection of these 3 main factors.

Keywords: Cultural approach, environmental approach, sustainable architecture, technical approach

INTRODUCTION

Sustainability is the most necessary, complicated and major procedure with which the architectures are faced today. The verb "sustain" has been used since 1290 in English and is rooted in Latin words "sub" and "tener" meaning "maintain" or "keep" (Soflaee, 2004). In Oxford dictionary, the background of this word belongs to 1400 years ago. In Persian, the sustainability is also the synonym of "to be resistant, resistance, stability, etc.," (Dehkhoda, 1998). Sustainability has been proposed in architecture for less than half a century and it is generally used as one of the modern specifications of architectural works. In our country, this qualification and specification is used for conventional buildings which are usable yet and the permanence of life is observed in them. Therefore, this research seeks to study the nature of sustainability and essence of its conditions. The innovation of this study is to identify and feel the fact of sustainability dimensions that studies a case sample which is tried consciously or unconsciously to be according to sustainability circumstances. Since 1966, sustainability has been presented in field of protection of environment and preservation of non-renewable resources. Now, with the development of science, the interest in protecting and preserving the subterranean resources by pure and renewable resources has been subsided and the

sustainability, value and culture are the modern topics which are proposed and considered more in this study.

Whereas, it is possible to search the most obvious and simple components of sustainability in housing; the case and residential samples are also used for better presentation.

The subject of sustainability according to the environmental approach dates back to 1966 when the Apollo spacecraft sent the first pictures of the earth from the space. These pictures proposed two different points of view proportional to universal life system. First, the life universe is a little and vulnerable phenomenon. Second, the living universe is manageable and programmable. Since then, thinkers and environmentalists found out the vulnerability of environment and habitat of earth; and the issues of life protection, non-renewable resources, etc were proposed formally. Technical approach possesses almost the same background because of its topic related to the environmental issue. However, the value-cultural approach indicates a specific innovation proportional to 2 previous points of view which have has been studied in details and under the subjection of concepts such as sustainable values, praiseworthy traditions of architecture, contextual architecture⁵, etc. This study seeks to consider the above issues from the viewpoint of sustainability.

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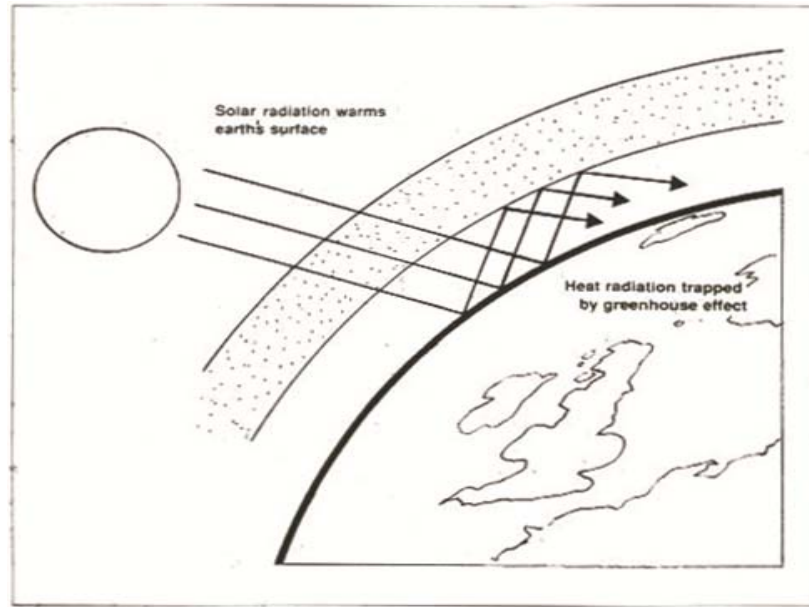


Fig. 1: The process of global warming (Edwards, 1999)

MATERIALS AND METHODS

Research procedure: In this research, the viewpoints, related to the domain of architecture, are studied through the library research procedure; and among the viewpoints, the author is inclined to 3 major viewpoints and other minor factors are studied under subsection of these 3 major factors. Finally, a suitable sample for research (New Shoushtar) was studied in order to respond to the nature of available sustainability circumstances more objectively in architecture and it was sought in this study to indicate that how the existence or lack of any of 3 presented viewpoints guarantees the sustainability and survival (or its non-existence) in architectural work. Furthermore, it has been consciously avoided discussing about instances such as Statement 21⁶ of *Rio de Janeiro* and *Tokyo* Conference in field of global warming to devote the study more explicitly to the final model of sustainability and to avoid the subsidiary issues.

Environmental approach: It is possible to consider the environmental sustainability concept as the result of logical awareness of universal environmental issues (Bahreini and Maknoun, 2001). The most important topic presented in this viewpoint is ecological design or "eco" as the short term. In this kind of treatment, designer should consider the nature as a dynamic system and the dependent manufactured environment. Perception of relationship between alive and dead parts of nature is the basis of ecological design. In this field, we should evaluate some indices; for instance if we want to build where we build, whatever we build and how we build from the beginning to the end of process interfere in nature and ground of construction. We cut the trees, extract stone from mine and even in case of

inappropriate design, we make the greenhouse gases while using the construction. Therefore, it seems that the verb "construct" is an action contrary to the nature. At the present time, some efforts have been done to construct the buildings that are self-sufficient in energy, so that they will not damage the environment while being used after the construction process. In fact, the ecological design is considered as the human optimum interference in nature. A European research indicates that "50% of energy is used for construction and 25% is used for transportation for civic design". Hosseinmardi (2004) in this classification, the function of architecture is significantly important as a responsible profession. According to the natural approach, the architecture sustainability is based on the combination of building with nature not overcoming with nature. It means the exploitation of nature and protecting it simultaneously from damaging. Design accompanied by nature cause attention to major natural factors which we should use and be conscious of its application method. The factors, related to the affair of construction and ground, usually include the glow of sun, the prevailing winds of region, trees and their shade, the substance of ground and the weakness of soil during rainfall. Here, we explain a sample of working with nature and its relation with sustainability: when we plan a plan to enjoy shadow in summer and light in winter for a house, using a grapevine (or any autumnal tree) is more profitable than mechanical plans. When house is a suitable place for the growth of grapevine and the grapevine creates shadow in summer and the light rays pass through the house, both factors will act for their profit and simultaneously help each other in a peaceful coexistence; thus we can argue that they have achieved the sustainability (Williamson *et al.*, 2003). Fig. 1 shows the process of global warming and Fig. 2



Fig. 2: Achievement of sustainability in construction and the ivies on the façade in a peaceful coexistence (Edwards, 1999)

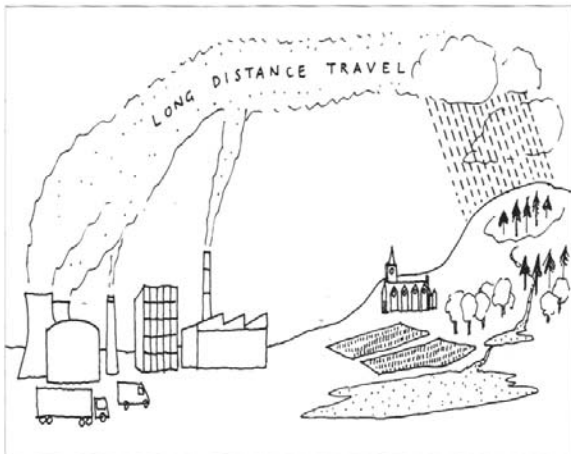


Fig. 3: Primary environmental pollution and the highest effects on the environment by generator (Edwards, 1999)

shows the achievement of sustainability in construction and the ivies on the façade in a peaceful coexistence.

We achieved a self-reliance of public service system (In which water, electricity, etc are provided for all buildings by municipality) with the use of plans such as rain water supply, use of prevailing wind and sunlight to provide energy for building. This issue will minimize the waste of energy. The importance of this

issue becomes obvious when we found out that in our country fossil energy and subterranean resources are used to produce electricity. This process is as follow:

First, gas and coal are converted to thermal energy and then to mechanical energy and finally to electrical energy.

A lot of energy will be wasted at every stage of energy conversion and during the process of producing electrical energy from fossil energy we unfortunately found out that 60 %of primary energy is wasted as the heat during the conversions. Figure 3 shows the primary environmental pollution and the highest effects on environment by generator.

Eventually, the nature has kept its special rules and order for millions years and the construction will guarantee its sustainability as much as it is combined with ground. Figure 4 shows the expected inputs and outputs of contemporary modern architecture combined with ideal sustainable architecture.

Eventually in the environmental category, designer should consider the plan which makes the region the best place for life in addition to considering the items such as features of ground and the more important items, so that the architecture will less make the use of non-renewable resources. Figure 5 shows the summation of factors affecting the environmental sustainability.

Cultural approach:

Identity: Identity means the individuality, existence and whatever identifies a person like personality or quality and expresses the characteristics of any person or event. Personality or quality of anything can be evaluated with some good or bad criteria. Calling people or phenomena unidentifiable, lacking personal integrity, or lacking quality are a current mistake which are used instead of calling them poor identified, personalized and qualified. Identity is a necessary dependant characteristic of anything.

However, the identity is differently evaluated in various intellectual systems. The certain tests evaluate the identity in a society with sustainable value standards such as traditional-educational society and uncertain test evaluates it in a society with unsustainable value

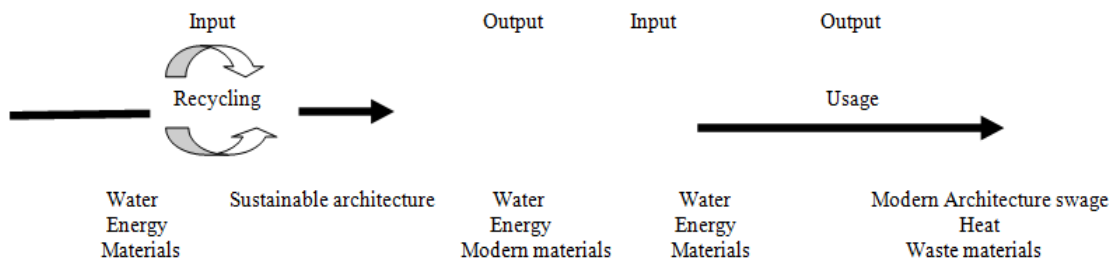


Fig. 4: The expected inputs and outputs of contemporary modern architecture combined with ideal sustainable architecture, (author)

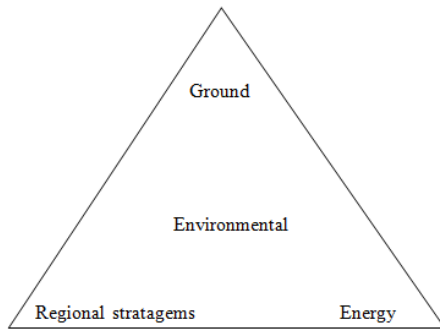


Fig. 5: Summation of factors affecting the environmental sustainability, (author)

standards such a modern-social society. Sadrolmotalihin believes that the identity of anything is expressed by its special way of existence. He says: "the identity of anything is expressed by its special way of existence; human possesses a united identity which is conducted by some codes. Human beings have some characteristics which are distinct from each other and their solidarity of personality is with them during their life; this is the identity" (Sajadi, 1984). Therefore, any person, work, or construction has the identity.

Belonging or not belonging to a total and sustainable identity is a factor which reveals a work as identifiable on unidentifiable. According to this viewpoint, an identifiable work is a work which its identity is in direction of total identity, like a historical construction in a historical context. This identity along with its implied vales, which are the major factors of its sustainability, is in fact a great academy for architects. It is an academy which originates from the ancient history (Talaie, 1997). An unidentifiable work is against the total identity like a modern construction in a historical context.

An architectural work can crystallize a total identity (religious, Country, racial) or only its designer's personality and identity, independent of social norms.

Genius loci: If we take into consideration the concept of sustainability as being stable, we should know the land and its public culture. According to this perspective, the sustainability means the reservation and maintenance of neighborhood culture and the context in which a building is constructed for its people considering the limitations and opportunities that the culture demands. Sustainability of a building is achieved by sustainability of soul and genius loci. One of of this perspective is the individuals' life and relationship with their buildings and their expectations from buildings in that land and culture. Sense of locality means the individuals' subjective interpretation of environment and their more or less conscious feelings of their environment that places the individual

in an inner relationship with the environment in a way that the individual's interpretation and feeling connects and integrates with semantic field of environment. This feeling is a factor that converts an area into a place with special sensory and behavioral characteristics for special individuals. Sense of locality supports the people's desired cultural concepts, social and cultural relationships of the society in a place, reminds the last experiences and achieves the possible individuality as well as producing the comfortably in an environment. Norberg Schulz and Hideger's adapting ideas about existed essence of residence considers the inhabitation as the purpose of architecture and believes that human being inhabits when he can conform to the environment and become adapted to it. Therefore, the inhabitation is nothing more than sanctuary and indicates the areas that life appears in a real concept (Hale, 2000). Norberg expanded the residence in this way:

- Visiting other people with the intention of exchanging goods, thoughts and feelings with the meaning to change the life into an arena of various possibilities
- Agreement with other people with the meaning to accept the set of common values
- Attainment of existence by means of minor universal selection process

"In general, the lack of things and places will result in losing the universe. Human being in modern life is losing the universe and his identity and his social understanding and association. Existence will become senseless and human being will become homeless because he does not belong to integrity with sense. Moreover, he becomes indifferent because he has no motivation to support and improve the universe" (Christian, 2000).

Therefore, we can infer that human's mind has the specification which creates sense of locality in his mind after remembering some memories and then if he feels other skeletal signs and symbols of memories somewhere (e.g.: a country), the sense of locality will be inculcated to him. Figure 6 shows the human reciprocal socialized relationship with Sense of Locality.

Circumstances and levels from Shamai's perspective are classified as follow:

- Indifference to location
- Awareness of being placed in a location
- Belonging to location
- location Affection to
- Integration with aims
- Presence in location
- Self-Sacrifice to location (Shamai, 1991)

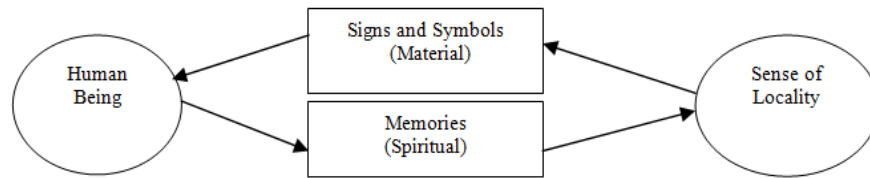


Fig. 6: Human reciprocal socialized relationship with sense of locality, (author)

Therefore, the knowledge of user's sense of locality, signs and indigenous patterns can guarantee the sustainability of value in architecture. Through watching the white walls of Boushehr, we understood that the construction belongs to south of Iran, or through watching 4-row houses we recognize that the building belongs to Zavvareh not Kashan. signs and patterns such as introversion, maintenance of superintendence and allocation of the largest and most splendid area of house (5-door) to the guest, etc show the sense of belonging to location and culture. As nature is vulnerable to little interference (e.g.: despite the fact that CO₂ gasses have not been used for some years, the hole in the ozone layer is expanding), culture also seems to be declined by rough factors. When a building is placed in a valuable construction, it sends a message to target person and if the building is placed in an untouched jungle, it will send another message. Now the issue of limit and measure is proposed. This common word, which is used in conversation, is suggested in architecture by mentioning an instance: Consider one block of residential buildings of Ekbatan Township and a cottage placed at the top of a mountain. The block located in the township is bigger than the small cottage, but its affection on a person is less than the cottage. The indifference and senselessness is now felt. However, this problem is proposed for valuable constructions because it is not possible for building to send a message and to be considered as an icon in metropolises. This is the crisis which we are faced with today. In any alleys of Tehran, each building is expanded in height and separated and displays its organ compared to the adjacent construction, but it is possible to build a house based on its resident's demand so that it will have a message for him. During the past, the house did not have items outside the wall for separating them from each other and thus they did not open to outdoors, but the house is considered as an individual's inner world and provides a shelter and habitation for him after daily struggle and its precincts provide the inner and outer limit. Ancient Greeks considered Delphi as the center of the world, the Romans called their metropolis "Rome" as the center the top of world and the construction of Kaaba in Mecca is yet considered as the center of Islam World like the past times.

"Each ethnic group, who has created the architecture, has transformed its special characteristics such as language, clothes and public culture. Before the disintegration of cultural boundaries in last century, there were separated local figures and details in architecture and the buildings in any site were

considered as the Children of beautiful engagement between people's imagination and the needs for land" (Christian, 1980).

Outer and inner skelton-precincts: Like other arts, techniques and human productions, architecture and its apparent skeleton also indicate the thoroughbred spiritual aspect which is designed to respond to the human's needs such as spiritual and material (consistent with his spiritual aspect). It means that a building displays a skeleton whose soul is the manifestation of culture and worldview of society. In Iranian thought, the word "architecture" which has always been based on the relationship between human and what lies beyond nature, refers to a higher meaning and a concept more spiritual than idiomatic and common meaning. Late Dehkoda described the meaning of "architect" as the construction supervisor of construction science and the one who instructs master bricklayer, master of bricklayers, elder of bricklayers, extremely constructive and who constructs, elevates and improves. (Dehkoda, 1998) Schulz quoted Kevin Linch¹¹ as he said: "Each pleasant environmental image is provided for who understands it as a greatly important sense for lack of stress so that he will be placed in the opposite point of fear which comes to his heart because of his unawareness of situation" (Christian, 1980).

From Hideo's perspective, consideration of sustainability is important in facade and morphology and then the bricklayer's honest and inner performance are important. He states that "Frontier (facade) is not only a thing in which something stops the progress, but also as the Greeks believed it is a thing by which the progress appears. (Christian, 1980) However, the traditional architecture considers the frontier beyond Hideo's idea and calls it territory of precincts. Human, as the most social living creature, needs to have precincts and territory and these precincts can be seen during the past from the major levels (gate of country, city and neighborhood) to the minor places of life. Lack of the characteristic, honestly, has caused absolute chaos and abnormality of the past. Existence of territory, even if it shows the private, semi-private, or public ownership and the wealthy culture and responsibility to human inner needs and wishes, indicates the limits such as completely private or familial precincts. Guests', neighbors' precincts and strangers' precincts are also separable. Figure 7 shows the levels and territories of relationship.

Finally, the sustainability from cultural perspective also considers the design which should take into

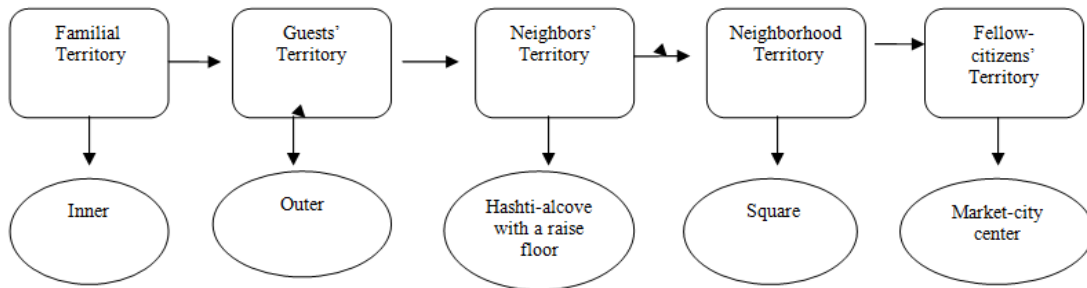


Fig. 7: Levels and territories of relationship (Haghighat and Ashrafi, 1997)

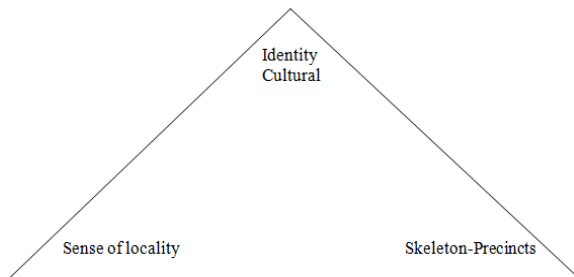


Fig. 8: Summation of determinants in cultural and value sustainability, (author)

consideration the establishment of identity and sense of locality; and the skeletal territories which build frontiers of an architectural work should be able to reveal the human environment. Figure 8 shows the summation of determinants in cultural and value sustainability.

Technical approach: Since Stone Henge's time or related to the time when we found traditional observatories, architects were familiar with technical and vocational aspects. It is not possible to consider technology separated from the culture and soul of an architectural work. Technical approach in field of sustainability is related to vocational innovations of finding solutions for modern problems. The study of architects' role in finding numerous solutions for different types of designs guarantees that the architectures are expected to provide various solutions for problems. The purpose of providing solutions for applying social and economic tools and physical sciences is to analyze the situation and to discover perfect solutions. However, providing and using solutions and tools will not be possible simply. Technical approach considers measurable issues and environmental facts including air, degree of sound and light, usable recourses, etc which are mainly measurable. Furthermore, the architect's knowledge and self-reliance is also based on programming, functionality of materials and optimal constructional system. The aesthetic aspect of this model refers to the use of contemporary materials in architecture such as intelligent windows, modifying light, rustproof metals, aluminum panels (which are light and long longevity),

etc. Passive and active solar energy¹⁵ such as double-shelled walls and roofs (that the air between two shells is used as insulating material), photo voltaic cells¹⁶ and intelligent shadow creators are now the common concepts of sustainable architecture all over the world.

Natural and artificial ecological factors: It is possible to define ecology as a relation and order between living creatures and their environment in a connected system. Each established element of ecological system (which can be considered as an ordered system alone) should be studied with its background and environment. In the case of information and knowledge about order of natural environment and its created elements on the one hand and also artificial elements of environment on the other hand and creation of logical relation between them in programming, design and construction of area of living, we definitely will achieve more desirable qualities, regular environment and more durable life in the environment. Figure 9 shows the effective ecological factors in creation of traditional architecture.

In fact, the architect's art is to identify the optimal procedure for bricklayer's design (including house and factory) and apply them. The technology can make any bricklayer proficient for any region and results in sustainability of architecture. For expansion and development of architecture, architectures of various nationalities have been already applied in various countries whose unfamiliarity with the project causes problems for globalization of designing. However, rules of constructed works are at least suitable references for optimum designing. In this, the project management, done by indigenous architects, can help to solve the problem. One of the problems facing the universal society is pollution caused by waste and presentation of suggestive solutions can be technically useful in this regard. Each year in Europe more than 1.6 billion tones of wastage is produced of which 22 billion are dangerous. About 25% of this rate belongs to industries which produce the constructional materials and make civic development. European Union recommends designers in wastage management to reduce the waste materials by 3 points:

- Production of less wastage which is resulted in strong designing

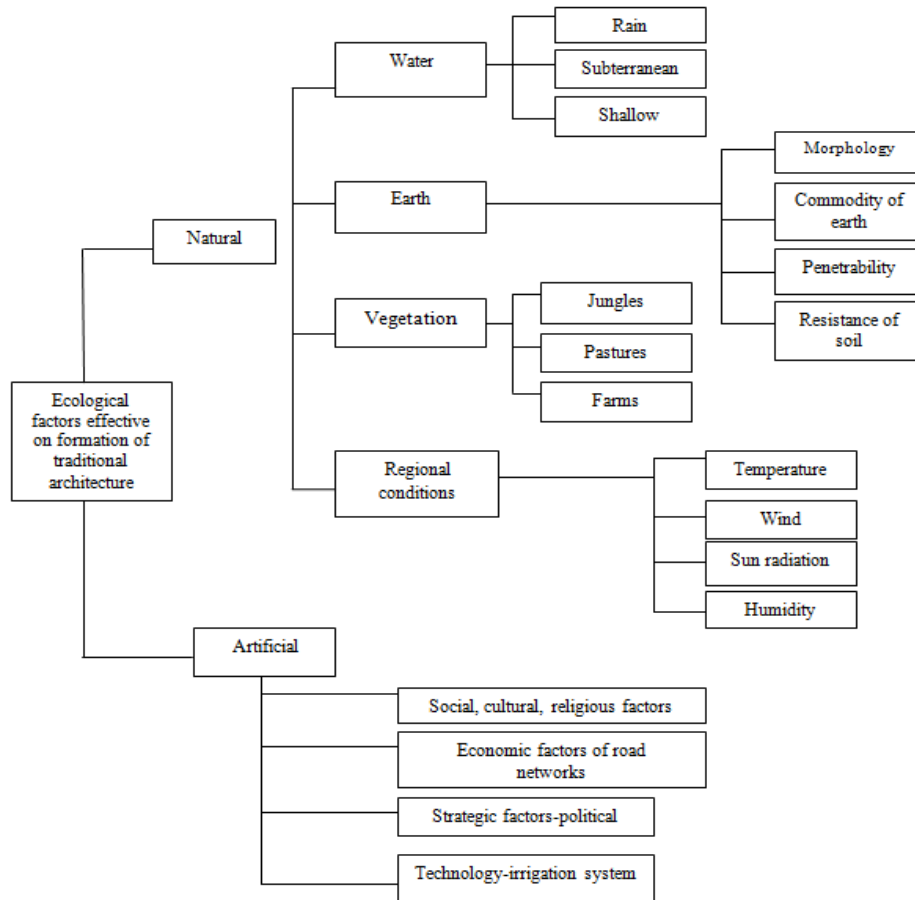


Fig. 9: Effective ecological factors in creation of traditional architecture (Qaffari, 1996)

Table 1: The recovery process of primary material until the recycling period, (Edwards, 1999)

Effects	Reuse	Production site	Transportation	Brick making	Extraction
<ul style="list-style-type: none"> • Determination of local land sources • Increase of Knowledge about Recycle 	<ul style="list-style-type: none"> • Application of land for recycling • Study of brick recycling • Mill of brick waste and conversion into crude material of brick 	<ul style="list-style-type: none"> • Consumption of energy for furnace • Sound pollution • Air pollution 	<ul style="list-style-type: none"> • Use of nonrenewable energy • Production of CO₂ in location 	<ul style="list-style-type: none"> • Air pollution • seepage in subterranean water • Possibility of production of improper bricks • Use of nonrenewable energy 	<ul style="list-style-type: none"> • Harvest of agricultural soil • Effect on ecology • Use of nonrenewable energy • Land application for waste

- Use of wastage materials as a source for producing new materials
- Designing for application of wastage materials in usable parts of construction

Recycling has some advantages in the field of energy as follows:

- Reservation of natural sources
- Reservation of energy for production
- Reduction of pollution caused by production process
- Possibility for producing materials by energy of wastages

However, the certain recycle will be done when the word "Recycle" is more advantageous than reproduction. For instance, we have a certain method in industries such as paper all over the world, but the technology of recycling is not available for the majority of industries. Recycling is not always limited to materials, but also the bricklayer's structure and even a civic construction can be the bases for second design. During the history, we have seen several cities, which their foundation and structure were redesigned after years of natural disasters. The foundation of Sassanian fire temple was also the basis for Islamic period mosques; moreover, destruction should always be considered as the final solution. Table 1 shows the recovery process of primary material until the recycling period.

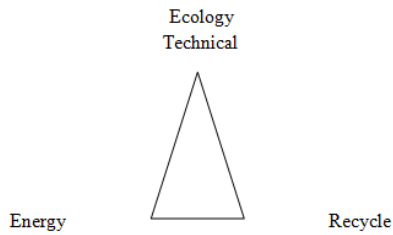


Fig. 10: Summation of factors effective on technical sustainability, (author)

Planting freshness and consistency with environment should be considered when recycling is possible. For instance: thickness of walls in hot and dry territory encourages us to use passive system, also the skylights and traditional ventilation present ideas of beauty for designing. Therefore, the methods of energy and materials application have a direct relation with each other. In general, the purposes of sustainable designing in framework of sustainable development emphasize on simultaneous preservation of natural and man-made environment. In accordance with ideologists' opinions, we can wholly introduce the following 3 principles as the principles of sustainable designing from technical viewpoint:

First principle: Giving priority to recycle of buildings, places, infrastructures and available network of thoroughfares by their adaptation with new conditions and needs. In fact, the sustainable civic designing specially emphasizes on preservation and improvement of civic buildings and structures.

Second principle: Sustainable designing considers the preservation of natural resources, earth and wildlife. Therefore, any kind of new constructional material should be made of sustainable resources such as wood which is the result of proper forestry.

Third principle: Sustainable civic designing in expansion of civic regions (such as construction of cities and new neighborhoods) focuses on reduction of energy consumption rate (Golkar, 2000). This purpose is followed through proper civic framework, proper constructional samples, suitable spatial distribution of functions and use of optimal compaction. In other words, energy saving is possible through creation of closer relationship among various kinds of usages as well as controlling the design of constructions about efficiency of energy consumption (Owens, 1991).

Figure 10 shows the summation of factors effective on technical sustainability.

Common ideas: From Rodrik J. Larense's perspective, the sustainability means the preservation of a situation in which the life conditions are moderate and desirable.

He also defines sustainability as ability of suffering unexpected and unpleasant problems. He considers local buildings as the identity of civilization in any society and considers it necessary to study these buildings in order to identify the primary principles through which the modern buildings are built sustainable.

Then, he takes human ecology into consideration in order to integrate the sustainability principles. The word "ecology" is derived from two Greek words Oikos and Locos meaning "science of residence". "Ecology" refers today to a knowledge concerning the conditions of human life and his relationship with his surrounding environment. However, since last century, this word has got other interpretations. One of them is the word "human ecology" that studies the dynamic relationship among human societies and physical, life and environmental indices of these societies. According to the human ecology perspective, it is necessary to study the local buildings and ancient human living environments for finding the principles of sustainability which are useful in that territory. Therefore, this perspective studies the successful sample of society as the sustainability mystery in the same land (Lawrence, 2005). In the following diagram, the summation of factors for establishing a sustainable environment. Figure 11 shows a diagram for human ecology.

Cristopher Alexander also sought to introduce a quality of lacking time and place. This quality seems to be related to our discussion about sustainability. The quality which Alexander speaks about, has 6 specifications:

- To be alive
- To be consistent
- To be comfortable
- To be free
- To be complete
- Not to be sensual

According to his view, these 6 specifications make the sustainability and immortality of a work (Alexander, 2007).

Alexander's view about immortal quality is extremely relevant to the discussion about sustainability in this study, but it is not complete alone. It is like the discussion about human ecology that is Lawrence's intention about sustainability in human societies and has been considered less and should be more concerned from environmental and living view.

Finally, for filling the gap of theory, we can consider the Author's model which refers to the comprehensive factors relevant to sustainability from 3 viewpoints: Environmental, Cultural and Value viewpoints. Figure 12 shows the final model of sustainability.

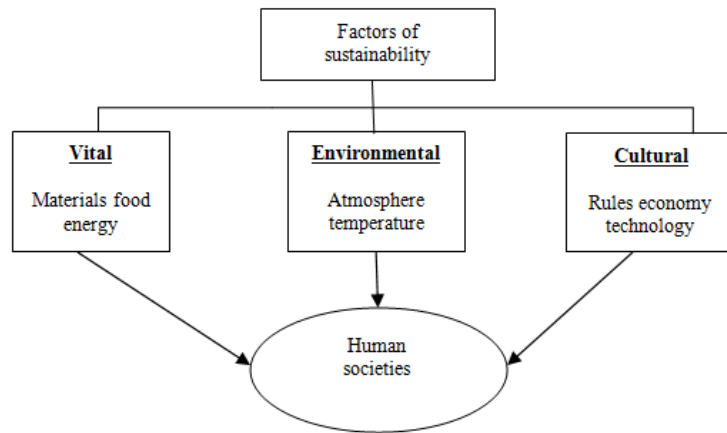


Fig. 11: Human ecology (Lawrence, 2005)

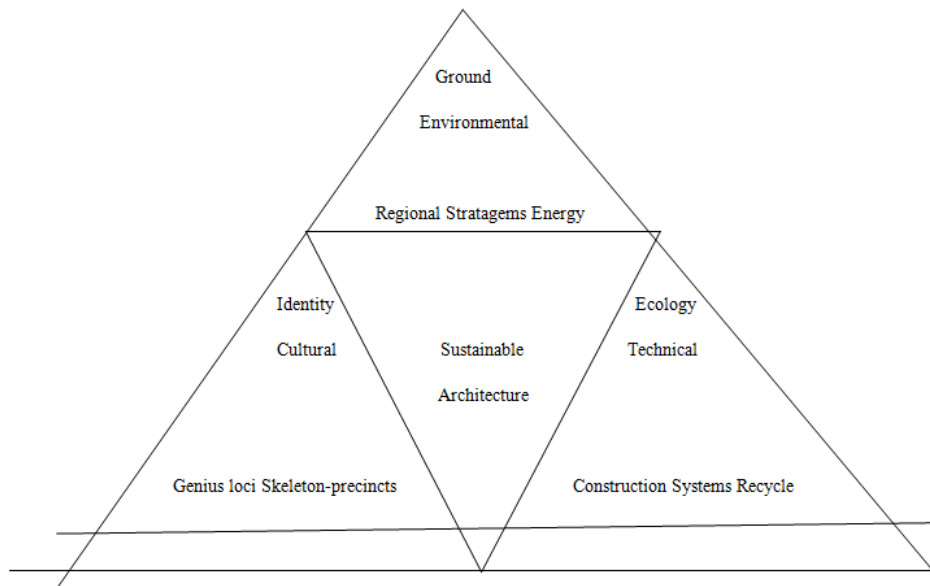


Fig. 12: Final model of sustainability, (author)

Table 2: Summation of introduced sustainability model specifications, (author)

Specification/View point	Level of factor emergence	Essence of manifestation	Domain of specification and performance	Esthetic aspect
Environmental	land of work	Outer	View and psychology of environment	Environment safety
Cultural	Regional	Inner-Outer	Theoretical bases of Architecture	Preservation and application of symbols
Technical	The work itself	Inner	Technology of architecture	Application of modern science

For better interpretation of author's model, its main items, identity, levels of factor emergence, domain of their specification and performance in the world of architecture are briefly considered in Table 2 and it finally refers to their esthetic aspects.

RESULTS AND DISCUSSION

Case study; new shoushtar residential system: Here, we introduce the architectural design and urbanization

of case study which is relevant to the introduced model. In this study, we consider that existence or lack of each of minor factors mentioned in the sustainability model and the way of guaranteeing the sustainability of design (or its non-existence).

New Shoushtar Township, next to the ancient town of Shoushtar, was designed about 3 decades ago before the Islamic Revolution of Iran; and its construction lasted till several years after revolution. The major feature of this township was to resettle the workers of

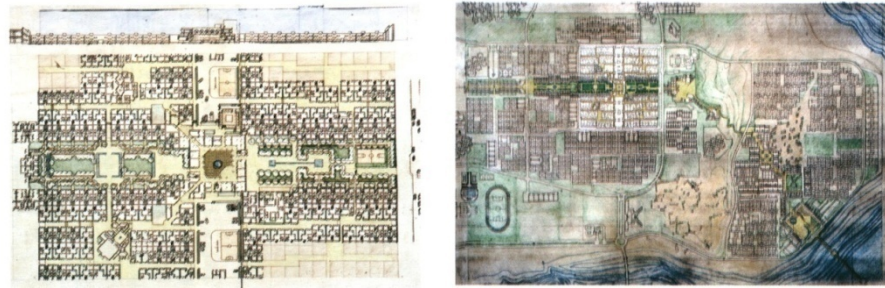


Fig. 13: Detailed design of new Shoushtar (right) and the first phase of system (left) (Diba and Javaherian, 2006)



Fig. 14: Centers of neighborhoods (right) and the roof line of system in 1986 (Diba and Javaherian, 2006)

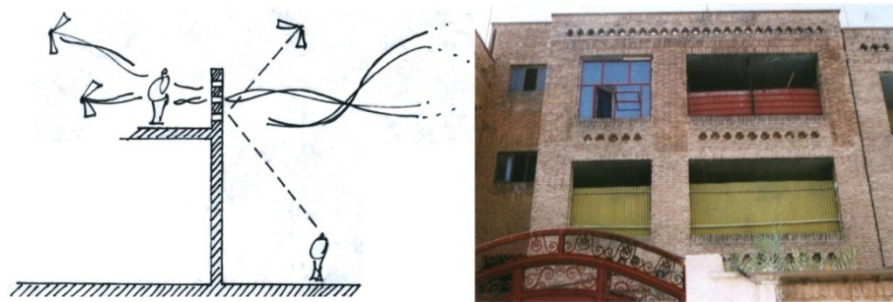


Fig. 15: Study of improper indigenous models by designer that caused the weakest organization by residents (author)

Table 3: Nine major decorative brick designs in ancient Shoushtar and some of its complexes, (Mashhoudi, 1997)

Band romi	Zolfe aroos serzi bala	Darcacal
Hasht charculeh	Taffah	Khaar mahi
Parakandeh	Panjdaneh	Kelidi

Karoon Cultivating and Industry Company and to design their required site and service. To design this township, it was sought to observe the models of Shoushtar and Dezfoul. Figure 13 show detailed design of New Shoushtar and first phase of system and there is Table 3 underneath which shows the major decorative brick designs in ancient Shoushtar and some of its complexes.

The thoroughfare of each neighborhood is called by special Iranian names or the names of performance, for example thoroughfare of bathroom are named by the name of Iranian literature characters such as "Shirin or Farhad". All the names are written on glazed tiles in turquoise blue and they are considered as the enduring parts of Shoushtar. In traditional cities, it is emphasized on the areas between the buildings and they create an

organic and attractive area with proper thoroughfares. Moreover, the locations, passageways and roadways in new Shoushtar are separated and it is tried not to bring automobile into the passageway as much as possible (Haeri, 2007). Figure 14 show the centers of neighborhood and roof line of system in 1986.

The model of buildings in ancient Shoushtar and Dezfoul is an introverted architecture. The places are formed around the central yard and they are used for regional conditions during the seasons of year. In residential architecture, a yard and small parterre provides a proper view and landscape for residents and wind cools the air. In new Shoushtar slender thoroughfares and without tree are built in the eastern-western direction, so that the residential units will be located in northern-southern direction and receive the desirable wind from north. Creation of brick apertures in walls, edges of balconies, arches and brick partitions in thoroughfares makes it possible for the wind to pass through the places. Residential houses are designed in 1 and 2- floor units, so that they will create shadow on the

Table 4: Study of new shoushtar residential block characteristics by sustainability models, (author)

Environmental	Land	Local Motifs-floor topping
	Energy	Roofed passage ways-Brick holes for ventilation
	Regional strategies	Building a yard and a small garden for each building
Cultural	Identity	Brick partitions and internal openings and various civic sites, brick decorations, glazed tiles
	Genius loci	Formation of residential units around market (linear form)-naming the thoroughfares by literary or performance characteristics
	Precincts	-
Technical	Ecology	Use of wind for ventilation- use of introverted model
	Construction systems	Brick porter walls- roof of steel beam net- wall plaster
	Recycle	-

thoroughfares. Since the cooling system is predicted for the city in accordance with design, the preservation of apertures and openings of air passages is extremely important.

The following table studies and criticizes the bases of loyalty to various circumstances of sustainability (from Author's perspective) introduced in the suggested model. Table 4 shows the study of New Shoushtar residential block characteristics by sustainability models.

In this table, lack of strategies is obvious for precincts of area and recycling. In ancient Shoushtar brick partitions were used for creating ventilation as well as they were set in a way that obstructed the passengers' view on the inner site of houses and the terrace, but this performance (which is considered as one of the mentioned factors of building sustainability) has been used only as a decorative and has no essence that is in contradiction to Iranian people' bigotry and the people had to cover the holes themselves. Now, because the holes were covered and the air became stagnant, the people had to use unit-air conditioners and because of lack of proper strategies for installation of air conditioners, some of them destructed the façade of building which had been awarded the present by Aghakhan. Figure 15 show the study of improper local models by designer which caused the weakest organization by residents.

On the other hand, it is necessary to mention that the designer was so successful to motivate sense of traditional location, so that the resident thinks that this building is a historical work that has been enduring yet after many years.

CONCLUSION

In studying the factors of sustainability, we achieved the following suggested model which is the totality of all proposed points in this study. According to this model, it is sought to take into consideration the issue of sustainability in general and without any premise about a special domain of issues relevant to the architectural work. Therefore, the major perspectives (environmental, cultural and technical) were chosen for this model and the relevant minor factors are described briefly:

- In environmental category, the items related to the ground characteristics and more significant strategies which a region provides for optimal

conditions of human life should be taken into consideration by designer, so that his architecture will make less use of non-renewable energies.

- Sustainability from cultural viewpoint also considers a designing through which the identity and sense of location are established and skeletal territories which make the precincts of an architectural work are able to be created in the field of human environment.
- Technical index, which has also a close relationship with environmental perspective, attracts our attention to ecology (natural and artificial) and are occurred in the ground of site; moreover, the modern construction systems should have the least use of materials and the most productivity and the modern perspective should demand the recycling.

REFERENCES

- Alexander, J., 2007. Environmental sustainability versus profit maximization: Overcoming systemic constraints on implementing normatively preferable alternatives, *J. Business Ethic.*, 76(2): 155-162.
- Bahreini, S.H. and R. Maknoun, 2011. Sustainable Civic Development: Since thought to Action. Scientific Research Quarterly of Ecology, University of Tehran Publications, No. 27.
- Christian, N.S., 1980. *Genius Loci: Towards a phenomenology of Architecture*. Rizzoli, New York.
- Christian, N.S., 2000. *Architecture: Presence, Language, Place*. Skira, Milan.
- Dehkoda, A., 1998. *Dehkoda Dictionary*. Tehran University Press, Tehran, 14: 84-211.
- Diba, K. and F. Javaherian, 2006. *New City of Shoushtar Experiences of Creating New cities in Iran and the world*. Published by New Cities Development Co., Tehran, 1: 97-109.
- Edwards, B., 1999. *Sustainable Architecture*. 2nd Edn., Architectural Press, Britain.
- Golkar, K., 2000. *Designing a Sustainable City in the Border Cities of Salt Desert*. Fine Arts Scientific-research Publication, Tehran University, 8: 43-52.
- Haeri, S., 2007. *New Shoushtar since past to Now*. 2-Month Architect, 44: 26-28.

- Haghighat, N.G. and M. Ashrafi, 1997. The Study of Concepts and Values of Architecture and Urbanization in Old Context of Naein. Congress of History of Architecture and Urbanization in Iran, State Cultural Heritage Organization Publications (Research Institute), Tehran, 4: 297-313.
- Hale, J.A., 2000. Building Ideas: An Introduction to Architectural Theory. John Wiley and Sons, Chichester, England, pp: 48-51.
- Hosseinmardi, H., 2004. Great architects and sustainable designing. *Abadi Quart.*, 42: 110-113.
- Lawrence, R., 2005. Learning from the Vernacular: Basic Principles for Sustaining Human Habitats. In: Asquith, L. and M. Vellinga (Eds.), *Vernacular architecture in the Twenty-first Century*. Taylor and Francis, London, pp: 110-127.
- Mashhoudi, 1997. Investigation of Iranian Architectural History, *Scientific Research quarterly of Ecology*, University of Tehran Publications, No. 11
- Owens, S., 1991. *Energy Conscious Planning*. CPRE, London.
- Qaffari, A., 1996. Ecology in Ancient Central Cities of Iran. Congress of History of Architecture and Urbanization in Iran. State Cultural Heritage Organization Publications (Research Institute), Tehran, 4: 169-191.
- Sajadi, S.J., 1984. *Islamic Knowledge Dictionary*. Iran Authors and Translators Co., Tehran, 4: 131.
- Shamai, S., 1991. Sense of place: An empirical measurement. *Geoforum*, 22: 347-358.
- Soflaee, F., 2004. A research about concepts and experiences of sustainable architecture. *Abadi Quart.*, 42: 62.
- Talaei, E., 1997. Effect of Architectural-historical Identities and Values on Contemporary Architecture and Urbanization of Iran. State Cultural Heritage Organization Publications (Research Institute), Tehran, 5: 413-417.
- Williamson, T., A. Radford and H. Bennetts, 2003. *Understanding Sustainable Architecture*. Spon Press, London, pp: 13-27.