

Analysis and Investigation of Lasting Architectural Projects and Plans in Housing in Post Era of Ghajar, Tehran

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Abstract

The goal of present research is to investigate the ways employed in Qajar residence blocs of Tehran, in a manner that the architecture used have what extent of adaptation with architectural durable planning and designing for Qajar residential buildings. The structural and frame limit of this survey, has been selected and investigated from different buildings like (Mosques, coffee shops, ice houses, schools, markets, wind-breakers, residential architecture), residential architecture i.e. the old residential buildings of Ghajar time. Time duration of the investigation of case samples links to the buildings had been built at the last period of Ghajar {third period of Ghajar governance during 1934} and the beginning period of Pahlavi period and used then. The way of research, lies in the developmental researches area, and the research has applied two methods, 1- Historical research method which has engaged in the perception and the investigation of historical movement of the events 2- Expressive research method that has engaged in the description of components of a situation or condition relation. The tool to collect the data encompasses the library method (table, map, notes taking, plan and chart, document) observation, and field and face to face understanding. Following two methods have been employed to analyze the data: 1- comparative analysis and 2- descriptive analysis. As this investigation follows the answer to the question of Ghajar houses adaptation level to the lasting architectural standards and criterion, after conducting the study it indicated that the housing blocs of Ghajar's end period in city of Tehran had high adaptation with sustainable architectural designing and planning.

Keywords: Ghajar houses, sustainable architecture, Tehran climate, climatic/climate based house construction

Introduction

Today the environment, saving in fossil energy consumption and sustainable development has changed to very important and prevalent discussions at international level. In a manner that energy resources protection and co-existentialism with natural and climatic conditions have changed to one of the most important planning in architecture and urban development. One of the most important contemporary views that is considered as the logical reaction against issues and problems of industrial era is the sustainable architecture. In general, the sustainable architecture promotes the life quality and the residence of human beings as well as all beings that live in that environment and improves the comfort life level in the environment. Despite more than few decades have been passed after the discussion of sustainable architecture and several techniques have been presented to resolve the contemporary crisis by it, yet the problems still exist in the way of developing the sustainable architecture. It seems that it could be completed by removing the barriers via noticing the values and the attributes of traditional and indigenous architecture since in view of traditional architectural works and historical documentations, these buildings would conform to the goals of stability approach in its time and place.

Traditional houses of Tehran have also the patterns of Iranian traditional architecture until the last period of Ghajar rule that it seems by considering the researches carried out until now in this field that the architecture of these houses is in conformity to some of the architectural plans and designs. This research pursues the answer of this question that Ghajar houses have what extent of conformity with the standards of sustainable architecture? In this way, at first stage the sustainable architectural plans/designs were recognized and examined in the Ghajar houses of Tehran. After that the ruler and a standard was compiled to assess the ecological stability and the components of energy stability, stability at site, human stability as well as material stability was examined after that. At last, the research results were compared in the under study houses in quality form. The study and the analysis of sustainable architectural designs/plans were dealt with in Tehran houses of Ghajar's last period in this research.

Issue expression

Today the environment, saving in fossil energy consumption and sustainable/durable development has changed to very important and prevalent discussions at international level. In a manner that energy resources protection and co-existentialism with natural and climatic conditions have changed to one of the most important planning in architecture and urban development that requires the architectures and urban developers to respect the specific laws and regulation in the field of building construction. On the other hand, the continuous population increase has stood face to face the world countries with energy shortage problem and threatens the human life. One of the most important environmental polluting factors in the world and in particular in our country Iran is the use of fossil energy consumption in residential areas to prepare the consuming hot water as well as temperature fulfillment of house space etc (Mahdi Zadeh Seraj, 2008). By every day increased rushing of population from villages to the cities, the number of fossil fuel consumers is increased day by day (that in fact includes the pillars of modern industry of the world including our country Iran) that this issue can be combated by implementing the principle of environmental stability. The Iranian traditional architecture whether in housing sector or in non housing sector and as well as the combination of these two at larger scale that is called the city enjoys individual attributes that in addition to noticing the biological issues/problems and environment protection has also been the responsible to climatic needs of each district. Techniques and the methods used in this architecture have obviously many of the novel concepts in the area of sustainable architecture.

The house architecture has been under consideration since long ago due to its direct connection and relation to human being. House has closer and more accustomed connection and relation with human being, hence one of the typologies of the architecture that looks more consistent with human being is called house. Therefore, the study of house architecture in different regions and climates is possible from different viewpoints. In residential architecture of Iran, the Ghajar architecture can be counted as one of the change points, since during this period the ancient system of life was subjected to change and transformation under the impact of the factors that had more global origin (Safarian Toosi, 2000). Under the effect of these developments Tehran as the capital became the bed for the most basic and deepest developments and skeletal changes to the extent that modern style came into existence named Tehran style. (Khan Mohammadi, 1997) one of the important and significant buildings of this style were the houses such that Mir Miran (2004) has called the architecture of Ghajar period as the house building architecture and or the architecture of residential houses/buildings. Since the most constructions of this period due to the urban population increase focus on construction of the houses and shelters for migrating people and new comers to the cities. This construction trend has been continuing in Tehran until today and following that the following issues and complications have come into existence: extra ordinary population increase, uncontrolled use of non-renewable energy, environmental pollution, acidic rains, traffic and air pollution and finally the elimination of natural resources. These issues indicate the need to deal with the sustainable architecture and the life importance under nature and with nature. It is worth explaining that the sustainable architecture is considered as one of the important views of today that is a logical reaction against the issues and the problems of industrial era. Sustainable architecture is an architectural response that put the human life at first level of significance. The use of indigenous materials and the minimum consumption of fuel energy resources in the direction of destructing the minimum environment has been the objective of this type of architecture. As a whole, the sustainable architecture has promoted the life quality and the residence of human being and all living beings that live in those environments and

improves the level of life comfort physically and psychologically in the environment. (Edward, 1389). The Ghajar houses due to the closeness to the present period are still present and observable from the viewpoint of access to their documents, while the houses of previous periods might have been demolished or reconstructed completely. Among different cities in which the Ghajar rulers had more construction works, the city of Tehran is considered by this research because it was the center and the capital of the country. Therefore, the survey and study of the existing sustainable models in the architecture of transient period and Tehran as the capital levels the way more for further studies of stability.

Research record

Considering that the present article is in inter-subject researches shape and a specific species of architecture types is studied and investigated in it; its past must also be observed and seen from multi-views. This past has been accommodated into two groups of sustainable architecture and the architecture of Ghajar houses architecture of Tehran that in this study first the record of sustainable architecture's studies has been surveyed and studies at world's level and then dealt with the introduction of sustainable architecture's studies in Iran and finally the studies carried out on Ghajar houses of Tehran is investigated in the area of architecture.

Studies on sustainable architecture at world level

The verb of 'sustain' has been used since 1290 A.D in English language. Different forms of this verb have been present during centuries but in recent few decades the word of sustainability has found application along with its present meaning i.e. 'whatever that can sustain.' (Edward, 2010) this word is one of the most obvious concepts that expresses whatever exists in the thought and mind of many people and that is why it has found general application. The birth of sustainability concept during 1970s, can be known as the result of logical growth of awareness in relation to global issues of environment and development; in this way the first conference of united nations organization was held in Stockholm on 'environment and development' in the year of 1972. (Same reference) after taking place of first conference by United Nations organization, during the next years, other commissions and conferences were also held with the objective of expressing the principle and concepts of sustainable architecture that some of the most important agreements on environment are as follows with the goal of studying the principle and the concepts of sustainable architecture at world level:

1. 1987, Branchland commission with the subject of 'our joint future' (united nations organization)
2. 1990, green pages on the top of urban environments
3. 1992, earth consortium (Rio) (UNO)
4. 1996, environment conference (UNO)
5. 1997, Kyoto conference on global warming
6. 2000, Hague conference on water and climate change
7. 2002, Galesburg on sustainable development (UNO) (previous)

Studies on sustainable architecture in Iran

In Iran, the discussion of sustainable architecture has been pursued in the shape of "conventions on the optimization of fuel consumption in the building" and "conventions on sustainable architecture" during recent years. In addition, different studies have been carried out in the historical and climatic textures of Iran in connection with climate and architecture as one of the sub branches of sustainable architecture; few of them are referred as under:

One of the outstanding books, is the "climate and architecture" in this field written by Morteza Kasmaei. In this book the theoretical discussion and the description of the tests carried out and the experiences obtained in different countries have been dealt with in the field of climate and building. However, we have endeavored in this regard that up to the possible extent the common attributes of these countries should be under considered with our country from the viewpoint of geographical situation and climatic conditions. In addition, by using the results obtained, in the field of existing climate related statistics of the country, the climatic divisions of Iran have also been introduced from the viewpoint of architectural typology. (Kasmaei, 2007) The climate and the apportionment of climatic architecture of Iran have been explained in the book of "the study of climatic survey of Iranian traditional buildings." Then the discussions have been made in connection with climatic attributes, urban texture, building form, residential buildings and the type of material of every zone and finally,

the climatic grounds of buildings have been described in different climatic conditions. (2007). In addition, in discussion of the national building regulation as saving in energy consumption the detailed regulations, of course by maintaining the simplicity have been compiled for the buildings with the application important from energy consumption viewpoint that have multi infrastructures or situated in grave areas or in large cities. On the other hand, the using possibility of specific techniques has been provided without calculation and particular details for common and small buildings. (Office for compilation and promotion of national building's regulations, 2009) Diba and Yaghini (1995) have dealt with the study of local architecture of Gilan in the study framework of traditional architecture of Iran based on environmental conditions and finally refer to the complications related to today's buildings that "modern architecture must use the prevalent material at site and consider the climate constraints accurately." Saghafi and Saed Samiei (1992) in their research have studied the relation of environment with peripheral material consistency and saving in building and express that considering the energy crisis in the world, non-consistence of material and increasing depreciation or devaluation of the buildings the relation of environment must be assessed and estimated with material especially in some environmental conditions. Therefore, refers to the appropriate ways to select varied and appropriate material for the buildings.

Architectural studies and surveys of Ghajar houses/residential buildings of Tehran

The protection and revival deputy of cultural heritage of Tehran in registered reports on Ghajar houses/residential buildings of Tehran that are registered in the inventory of national works has explained the instances such as cognition of the buildings, the map of urban situation, images and the present state of the buildings with interferences made and necessary measures taken for repairing and betterment of the existing buildings. This should be said by considering the several researches conducted in the field of building designing in view of climatic conditions that sustainable architecture in residential buildings of areas with particular climate such as Yazd and Kashan and in particular in the context of climatic planning and designing, it seems that the survey and study of sustainable architecture has not been accomplished in Ghajar buildings of Tehran.

Objectives, questions and supposition of research

Objectives

The objectives which are followed by this research accommodated in three parts, general goal that replicates to the writer's approach of architecture. The goals to which the writer must reach to conclude are considered the sub objectives. And finally, the major goal that is the climax of each research in a particular field.

General objective

The general objective of research is to obtain a technique for measuring the coordination rate with measurable standards for architectures and researchers in relation to sustainability issue in the architecture. On the other hand, by striving in the direction of obtaining the signs of sustainable architecture in traditional architecture of Iran the present research endeavors to reinforce and support this belief that traditional architectures of Iran have been following this principle in accordance with traditions and existing conditions in specific time and location conditions and paving the ground for materializing the sustainable Iranian architecture.

Major objective

The main goal of this research is to study the methods used in the Ghajar residential houses of Tehran that was in conformity with planning identified for sustainable architecture or can potentially be discussed as the novel planning/designing: sub objectives

1. Recognizing the elements, components and plans of sustainable architecture used in Ghajar houses of Tehran
2. Analysis of different sustainability plans used in Ghajar houses in comparison with today's discussed and famous models in sustainable architecture and compilation of localized collection from sustainable techniques.

Research hypothesis

Few decades have been passed of starting the sustainable architecture and numerous techniques have been presented to solve the contemporary crisis by it but problems still exist in the way of developing

the sustainable architecture. It seems that it can be completed by removing the barriers and considering the values and the attributes of traditional and local architecture. Since by considering the works of traditional architecture and historical documentations these buildings would conform to the objectives of sustainability approach in its place and time. Traditional houses of Tehran have also the models of Iranian traditional architecture. In this situation, considering the researches carried out in the field of Iranian traditional architecture and sustainable architecture, this is the research hypothesis that the architecture of Ghajar houses is in conformity with some sustainable architectural designing/planning.

Research questions

Considering the research hypothesis the basic question discussed in this research is that the architecture of Ghajar houses has what extent of (means the qualitative limit which is determined in the tables of sustainability designing as compared to the case samples and specified with a cross in case of fulfilling the required planning. In this research the numerical and quantitative standard for each of the sustainability designing has not been specified due to the vastness of the subject from the thesis limit and the comparative and qualitative standard has been expressed in the form of comparison among samples and specification of existence or non-existence), conformity with the planning/designing of sustainable architecture? That access to the answer of this question is possible via respond to the following questions:

1. What are the plans/designs of sustainable architecture in the Ghajar houses of Tehran?
2. Up to what extent the Ghajar houses are in conformity with the standards of sustainable architecture? Time dingle: this research deals with the case samples study constructed and used during time dingle of last Ghajar period (third period of Ghajar rule in the solar year of 1934 until 1965) and the first part of Pahlavi rule. Location dingle: the houses discussed in Tehran city (Tehran's boundary until last Ghajar period) and historical zone of ancient Tehran.

Research method: this research is accommodated in the research fields of developmental researches. The basic objective of this research is the optimizing of previous researches, compilation and preparation of new designs/plans. This research can be reviewed by two methods: the first research is the historical research that includes the perception as well the study of past events and the second method is the descriptive research that its major objective is the detailed description of a situation with condition string. Research process (thoughtful access movement to research result): first, using the today's methods (library studies and theoretical studies and surveys) the latest information is obtained, cohered and classified as well as practical techniques are studied in sustainability. Then, these findings are conformed to required geographical climate and a specific list is compiled of sustainability plans and designs. Finally, case samples are analyzed considering this list and research results are concluded in view of the selected samples.

Selection way of case samples

First the list of all houses of last Ghajar period in Tehran was prepared that was registered by cultural heritage and possesses the reports and written documentations in this research to select the case samples. There were some limitations in one to one survey of these houses. A number of them suffered from vast destruction such as abandoned houses and assessment possibility of sustainability elements was limited for them. Some other numbers of them just like the residential building of Fazel Iraqi were facing huge transformation (changed to hospital) as the result of use changes and had many differences as compared to first building. The initial specifications of a number of other such houses such as the house of commander Asaad was incomplete in the documents of cultural heritage of Tehran and limited the possibility of accurate assessment of them. A number of these buildings had private ownership and there was no possibility to visit them. In the next phase, a number of these houses were selected that had possibility of accurate survey and investigation. In the final stage these houses were divided into two groups. A number of them such as the house of "State treasurer" and the building of "Paradise Building" were related to the important ruling authorities during Ghajar period and completely affected by European architecture in view of façade and decoration, some other buildings such as the house of Sadegh Hedayat as well as the residential building of Col. Iraj was related to prominent and cultural personalities, were the combination of traditional and European architecture. From other viewpoint, the mentioned buildings have changed their usage and were not under the use

of private owner and as a result four buildings (house of “State treasurer” and the “Paradise Building” the house of Sadegh Hedayat as well as the residential building of Col. Iraj) were selected for assessing the sustainable architecture plans and designs.

Table.1- table related to the last period of Ghajar present in cultural heritage organization

Utilization type of building	Construction date	Building location	Building name
Residential and private use	1310, solar year of	Khayyam Ave.	Residence of Jalal Ale Ahmad Parvin Eetesami
Residence, under possession of Eetesami family	Solar year of 1310 corresponding to 1931	Odlajan neighborhood	
Abandoned house, a part of it is used as store	Last period of Ghajar	Baradarane Ghaedi Ave.	Rahavi house
Utilization change of building from residence to hospital during solar year of 1334	Last period of Ghajar	Firdausi Square	Fazel Iraghi house
Utilization change of building from residence to museum	Last period of Ghajar And beginning period of Phalavi	Sheikh Hadi Ave.	house and meseum of Moghaddam
Abandoned house under the possession of Tehran municipality	solar years of 1911-1921	Odlajan neighborhood	House of Dabirolmolk
Under reconstruction abandoned house	Last period of Ghajar	Wahdate eslami Ave.	House of Dr.Hesabi
Country residential house under the possession of private person	Last period of Ghajar And beginning period of Phalavi	Shariaati Ave.,Roomi bridge	House of commander Asaad

Table 2- Table of selected houses related to the last period of Ghajar in this research

Utilization type of building	Building location	Construction period	Building name
Residence of Ashraf in past period, changed to cinema museum nowadays	Saadi Ave.	Founded during Mohammad Shah period and expansion during period of Naseruddin Shah	Baghe Ferdous building
Residence in past period, changed to post company museum nowadays	Mostofi passage	Last period of Ghajar	State treasurer house
Residence in past period, changed to the library of Amir Aalam hospital	Pamanar neighborhood	Last period of Ghajar	House of Sadegh Hedayat
Under restoration	Valiasr Ave	From solar year of 1300-1285	Col.Iraj house

The way of sustainability plans/designs

It was endeavored by referring to the themes titled in previous parts especially the third part and based on sustainable architecture principle that a framework and assessment standard is extracted in the form of final checklist. It is necessary to explain that specifying the sustainability assessment standard in other countries has been accomplished through assessment and ranking institutions such as BREEAM-sustainable architectural assessment institution in England and Leeds- sustainable architectural assessment institution in America. These systems are going to be localizing and regionalizing in the present time. In a sense, that different standard has been assessed and different scores are considered for each region considering the specific specifications of that region. Unfortunately, in our country Iran, no system has been designed to assess the sustainable building. However, such system can be formulated considering the discussions related to national regulations including point 19 of saving in energy consumption. It is worth mentioning, sustainability assessment institutions also exist in the countries such as England that act to compile and formulate the sustainability standards and criterion based on their climatic and regional conditions. Considering that

there is high resemblance between Iran and America from the climatic and climatic diversity viewpoints the assessment standard was selected from institute of Leed.

Major standards of Leed system

Leed is the abbreviation of management and the leadership in energy and environmental designing. Assessment process has been summarized in a list that indicates the sustainability degree in the buildings accessed them. This list has been classified into five major branches that include the sustainability site, energy and climate, material and resources in addition to the quality of internal space of the building. In addition, six extra scores have been considered for innovation in the building that encourages the specialists of sustainable designing to designing of sustainable innovative system whose standards have not been discussed in these five major branches. In addition to that, 4 other scores are considered for regional priorities to produce the incentive to consider and discuss the specific parameters of life related to geographical region that should be measured with local standards. (Vallero and Braiser, 2008) this list is explained in the continuation of assessment standards.

Standards of sustainable sites

In the study and survey of sustainable sites the response to the discussed in the following can specify the assessment manner of sustainable site and the components discussed in it.

- Whether the building causes the betterment of site or the reason of its fall?
- Whether the building users can traffic there on foot? Or the access should be taken place through general transportation means so that causes the energy optimization and decrease of air pollution?
- Whether the site would be destructed by the modern buildings in case of expansion? (Vallero and Braiser, 2008) .

Standards for optimal water use

In the study of optimal water use the response to the instances/items discussed below can specify the assessment manner of sustainable site and the components discussed in it.

- How the rain resulted water is collected? (Whether reserved in the site for use? Whether is used for feeding the underground water beds or discharged to sewage?)
- The use of stored flood water or extra colorless waters (water resulted from washing that does not contain the harmful human materials) for irrigating the green space
- Innovation in the improvement of sewages

The use of Equipment that reduce the water consumption (Vallero and Braiser, 2008).

Energy standards and atmosphere

In the energy and atmosphere study response to instances and items such as the efficiency of the systems as well as the cooling and heating equipment in the building, use of renewable resources and energies in the site in addition to potential abilities of building and building waste to safeguard the Ozone layer can specify the assessment manner of energy sustainability and the components discussed in it.

Materials and resources

In the study of materials and resources the standards such as recovery of building material and building wastage, volume of recovery in relation to the building materials used, use of local materials that use less fuel to be transported, materials with high speed of renewal, the wood from legal and allowed jungles can specify the assessment manner of sustainable materials and the components discussed in it. (Vallero and Braiser, 2008).

Quality of internal environment

In studying the quality of internal environment such as the quality of internal air, smoke removal way, efficiency and effectiveness of ventilation, air quality during construction, use of material that does not cause the discharge of toxic substances, thermal comfort and the use of natural day light (Vallero and Braiser, 2008) can specify the assessment manner of components discussed in it.

Respecting the local and regional priorities

This part of the inventory/list is still in the state of expanding, this inventory has been used until now to authenticate the initial and major occasions of a sustainable building. In addition, it is a powerful tool to supply information on environmental issues to architectures, engineers as well as contractors. (Vallero and Braiser, 2008) .

Assessment table of sustainable architecture

This table has been drawn with the ecological sustainability assessment goal and inspiration by general model of Leeds' institute of sustainability assessment based on 19th discussion related to national regulations of the building and the assessment standard has been accomplished in the qualitative form in it and it is in the form of novel pattern in sustainable architectural assessment that is in conformity to the standards and the regulations related to climatic and regional conditions in Iran. In table 1, the 2nd principle of sustainable architecture, the coordination with climate has been studied that is discussed in the Leed's table as the "index of regional priorities."

In table 2, 3rd principle of sustainable architecture, use decrease of novel resources of materials that are discussed in Leed's table as "materials and resources." General attributes of building material have been expressed considering the themes expressed in 55th journal and the 5th national regulations.

Table.3- assessment standards for climatic sustainable designing (author)

Parameter title	serial
Environmental sustainability (ecological)	A
Sustainable climatic designing	1
Appropriate orientation to locate the house	1-1
Optimized shape and mass of the building ¹	2-1
Optimal designing for Light transparent walls	3-1
Climatic shed designing	4-1
Internal spaces location of the building	1-5
Exploitation of natural cooling	6-1
General assessment	

Table.4-assessment standards for building material and sustainability (author)

Parameter title	serial
building material and sustainability	2
Use of natural and raw material	1-2
Re use likeliness of building material	2-2
Ability to return to natural cycle	3-2
General assessment	

In table 3 the fifth principle of sustainable architecture studied, coordination with site and 6th principle of sustainable architecture and holism are studied that have been discussed in the Leed table as "sustainable sites" and "water efficiency."

Table 5.standards to assess the sustainability in the site (author)

Parameters title	serial
Sustainability at site	3
Observing to the curves of topographic balance	3-1
Non disturbing of underground water beds	3-2
Maintaining of animal and green cover	3-3
Designing combination with public transportation	3-4
Support of multi-purpose expansion	3-5
General assessment	

In table 4, the first principle of sustainable architecture, energy saving would be studied that has been discussed as the “energy and atmosphere”. The considerable point is that the table has many common points with the table of climatic sustainable designing but the analogous components with it will be studied due to the significance of the energy theme. The major reference in this subject is the 19th discussion of national building regulations such as climatic sustainable designing.

Table 6- standards to assess the sustainability and energy (author)

Parameters title	Serial
Sustainability and energy	4
Exploiting the renewable energies	4-1
Non active solar designing	4-2
Designing using air	4-3
General assessment	

In table 5, the 4th principle of sustainable architecture, satisfying the residents needs and respect to the users are studied that have been discussed in Leed’s table as “the quality of internal environment.”

Table 7- standards to assess the sustainable human designing (author)

Parameter title	serial
Sustainable human designing	5
Providing human comfort	5-1
Visual relation provision with outer environment	5-2
Appropriate use of day light/sun light	5-3
Supply of clean and fresh air (internal space)	5-4
General assessment	

Conclusion

This was the major question in this research that the architecture of Ghajar houses has what extent conformity with sustainable architectural design/plans? The major components presented were grouped and formulated based on the assessment standard of American Leed’s institute, due to the particular climatic consideration in Iran, the discussion of 19th principle related to the national regulations of building was introduced as acceptable reference for sustainable climatic assessment and optimizing of energy

consumption. It is noticeable, that sustainability assessment institutes in other countries such as America, England and Australia are identified as acceptable reference to compile and publish the plans and designs for sustainability while there is no any such organization in Iran. The study results show that the residential buildings of Ghajar period have conformity with Tehran climate in addition to appropriate utilization by evaporating cooling as well as ground cooling with sustainability standards. In assessing the 2nd component, the sustainability of building's material, the following factors were studied and investigated: the use of natural and raw material, reuse possibility of building material and the ability to return to the natural cycle. The study results indicate that during the construction time dingle of these buildings there was no use of today's industrial and modern materials such as: concrete, plastic, polymers etc and rocks and wood in its natural and raw form in addition to bricks, glass, gypsum, tiles that had less need for energy during manufacturing stages and their reuse is possible have been used in the construction of residential buildings. The sites sustainability in the following factors were studied in assessing the 3rd component: observing the balancing topographic curves, non-disturbing of underground water beds, protecting the herbal and animal cover, designing combination with public transportation and supporting the multi-purpose development. The study results indicate that all these buildings were in residence use at first and gradually changed their utilization and support component of multipurpose development is observable in all of them. Excavation of subterranean canal in the Tehran of Ghajar period and access to underground water beds have been the important mater in supplying the drinking water to residential buildings that in the northern spots of the city the possibility of water filtering was existed due a general slope from north to south of Tehran and water was provided with better quality to water consumers. The building of Ferdos garden and the residence of state treasurer/Mastofi, both were designed in the shape of castle between the garden and welcoming and entertainment building for nobles and aristocrats; and appropriate green space coverage was considered as the major goals of designing of these buildings. The designing matter with slope and observing the topographic balanced curves is observable in most houses of this period and no possibility of accurate study was available only in the house of Col. Iraj. Designing factor with public transport was not under discussion due to presence of carriage passage route or buggy way in today's shape during Ghajar period and these buildings can be dealt with central points and in view of access. The house of colonel Iraj was situated in the historical locality of Odlajan and the state treasurer house (Mostofi) was located near the old area of Chal Hesar that are counted from the first five localities of old Tehran. The following factors in view of sustainability and factors such as energy were studied in reviewing the 4th component: exploiting the renewable energies, non-active solar designing and designing by using air. The wall heaters, hearths and heaters were used during Ghajar period for warming the houses as a result the use of fossil fuels was prevalent such as oil. Of course the clean energies such as biomass, ground heating and waves are very modern such that the exploiting equipments for completely using these renewable energies have not yet been exploited in different places of the world however, two sources of clean energy such as solar and air energies were two inseparable part of climatic designing of the buildings. The non active solar designing planning such as appropriate orientation of the building, appropriate angle of southern front, shedding by the building walls, and the color of building façade were respected throughout the under study residential buildings. On the other hand, air flow possibility has also been provided due to exploiting the intersecting walls or face to face walls. Sustainable human designing related following factors were investigated in evaluating the 5th component: fulfillment of human comfort, satisfying visual relation with outward surroundings and supply of clean and fresh air across internal space. In the building of Ferdows garden and the residence of state treasure (Mostofi al mamalek) which are constructed in the shape of castle, the producing of visual relation seems necessary matter with outer environment. Considering five tables presented and qualitative study of selected house of Mostofi and the building of Baghe Ferdows have relatively the higher conformity with required planning. Considering the presented and discussed themes the following suggestions can be made for researchers of the future research.

Above compiled tables have qualitatively weighed the existence and non existence of conformity with sustainability standards in each house and in comparison with other houses and provided the comparison likeliness among the selected samples. It is worth explaining that specification of boundary in conformity with standards in quantitative form and numerical standard needs separate valuating for each of sustainability components as well as compilation of quantitative model that requires more vast studies.

In designing the sustainable houses the architectures can exploit the traditional Iranian architecture by considering required climate for designing in place of western models. For example, the non active solar designing's planning used in Ghajar houses and/or the way of flow creation across the internal spaces is implementable with very low expenses from active designing and mounting the active cooling and heating systems in the building.

The low number of selected houses, in addition to their specific time dingle is the constraint of this research. Study and assessment of sustainability rate in different climates and different time dingles can present the technique for sustainable architecture that is more consistent with climatic conditions of Iran.

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