

Quality Concept in Persian Precedent Architecture: A Lesson in Eco-Building Design

Ali Vakili-Ardebili and Abdel Halim Boussabaine

School of Architecture, The University of Liverpool, Liverpool, UK

ABSTRACT: Architecture as a process of change, converts a set of in-puts into out-puts. This process creates building through dealing with four aspects of social, economical, environmental and design related issues. In this process technology and conceptual framework are two pivotal factors balancing the aspects needed for the design context equilibrium. Application of technology and specific strategies in design concept as well as prudent selection of materials and energy resources can decrease the rate of environmental impacts. Hence, the process management in general and the out-put management in particular are addressed in design stage. There are many lessons, thoughts and philosophies in precedent works in architecture long term education, which could be engaged in current projects experience.

Here, Persian precedents architecture, principles and characteristics are investigated in order to extract some lost values, found in this heritage. Then the paper points out how these values might be used in establishing a scope in sustainable architecture through eco-concepts in eco-building design approach. Quality concept originated in Iranian past architecture codes indicates that their architecture not only includes eco-concepts but also has a great respect for the environment. This paper is addressing some of the lost values in order to be revitalised.

Keywords: Iranian past architecture codes, Persian architecture, Precedent architecture, Sustainable architecture, Eco-concept, Eco-building design, Quality concept

1. INTRODUCTION

Despite occurrence of earthquakes, natural disasters and enemies' invasions in Iran history, there are many traditional buildings, surviving within centuries and resisting the worst conditions while carrying required functionality, efficiency, comfort, safety and health as well as aesthetic aspects.

This paper, to some extent, attempts to reveal the secrets applied in such durable, compatible, beautiful, reliable and eco-efficient buildings in Iran (Persia) with the hope that few lessons could be learned within this work for designing sustainable buildings through application and consideration of the points addressed in Persians' traditional buildings.

Architecture is a process of change, turning constructional materials and a set of needs as the inputs into building facilities as the outputs. This fact is illustrated in Figure 1. Thus, the value of the effort increases when the products (outputs) obtain more returns.

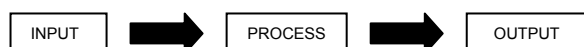


Figure 1: Input-Process-Output

In architecture the outputs are building assets and their probable Environmental impacts. Hence, the development of a process should seek production of more durable, efficient, compatible, economical and social focused buildings as well as addressing issues such as customers' satisfactions, level of comfort, safety and health. It is approved that whatever gained through an activity and its required operational process, determines the value and the level of the endeavour. Here, this paper attempts to introduce the concepts, attached to traditional Persian architecture which makes this heritage valuable. It addresses the solutions provided by *Mimar* (Traditional architect in Iran) to develop and improve the accordance between architecture and the environment through prudent consideration of socio-economical, cultural, and geographical restrictions of Iran. Co-ordinations, encountered in this architecture might have few concepts for architects in designing for sustainability in general and for those dealing with eco-concepts in particular.

Here this paper attempts to present theoretical philosophies found in Persian precedent architecture which might be used in contemporary architecture endeavours. The ideas and conceptual frameworks found in precedent architecture could still be used in modern projects covered by new forms applying new technologies. Authors of this work believe that the source for such an inspiration is that the essence of human basic needs does not change and what is changing is the context over the time.

2. TRADITIONAL PERSIAN ARCHITECTURE PRINCIPLES

The existence of principles in Persian architecture allows all stakeholders to take the advantage of a common language among them. This fact provides them with an assessment method to evaluate and to compare building designs and related activities, applied in facilities management. Persian traditional building principles are emerged based on standard measurement unit, modular design and proportions in design [1]. Persian architecture principles are presented based on consideration of different stages and levels in design and construction management. Persian traditional architecture mainly focuses on [2]:

- The natural elements in the environment
- The design stage procedure
- Geometry and modular design application
- Application of six pivotal codes in design and construction stages

These concepts are discussed and explained in the following section.

2.1 The Elements of the Nature

There is a respect for all elements of nature in Persian culture and community. In mysticism, it is believed that water, wind (air), soil and fire (light and temporal factors) are the basic elements forming our surroundings. Hence, in Persian architecture the presence of these elements are always apparent. Existence of wind catcher, water pond in the courtyard could be good examples of Persian architecture scopes. Inspiration of nature can be seen in many features of building. Benefiting natural vegetation, natural lighting, natural ventilation, earth geo-thermal and other potencies of nature are all included in this architecture. Also in the scale of urban planning and programming and application of nature potencies are observed. Building orientation (Rown in Persian) is a compass reading direction which is the most effective direction in benefiting natural potencies and resources within reach. Due to Persian principles any effect causing harm to the environment and its component is forbidden. This is what is considered as the first step or base in sustainability. As it is perceived, respect to the nature and its elements have an effective influence on conceptualism and initial innovation in early design stage.

2.2 The Design Stage Procedure

In Persian architecture design stage consists of many steps. There are five stages in traditional design as follows [3]:

1. Gaz-Kardan (To Measure): to find out site physical dimensions and possible capacities.
2. Goft-o-goo (Dialogue): To contact the client and have a mutual negotiation with them in order to realise what their required needs are and how they should be fulfilled regarding building asset whole life cycle (WLC).

3. Barzeh (Sketching): To draw a rough sketch to determine the concept of design in order to negotiate with the client.

4. Arayesh (Approved Plan): To complete the drawings based on accepted sketches and approved ideas and concepts by client.

5. Kast- Afzood (Finalising the drawings based on probable changes approval): to draw the final documents in a way that the building can be constructed due to drawings (As-built drawings)

This stage indicates how important customer needs and satisfaction are for Persian architecture. The codes addressed in this section shows that in the process of architecture client (user) is one of the key roles, playing in the system.

-Geometry and Modular Design

One of the Persian architecture specifications is use of geometry in their designs. Geometrical rules in design advocates stakeholders to have better perception of measures, proportions and aesthetics. Also it supports them in structure regarding forces dealt in a building construction. The precise understanding of geometry and its relevant terms enabled Persian architecture to present more durable, stable forms. The forms created in this architecture are based on circle, square or rectangular geometrical characteristics which are confirmed as the resistant forms regarding forces behaviours. Based on geometrical aspects, use of proportions and measurements helped *Mimar* to develop a modular design style. For example, barrier wall thickness is usually considered as the basic unit (It is called *Peymoon* in Persian) in modular design which is called one *Gaz* (Each *Gaz* is equal to 103 cm). Another example is the size of openings used in a building which are obeying the same unit of measurements. The module unit is divided to few *dub-modules* to design the details. The use of geometry and modules in Persian architecture enabled this style to solve structural problems in a decent method.

-The Six Pivotal Codes in Design and Construction Stages

Since these codes have influential roles in building WLC, the authors of this paper prefer them to be explained in the next section under an independent title.

3. PERSIAN ARCHITECTURE SIX PIVOTAL CODES IN DESIGN AND CONSTRUCTION STAGES

The six codes in Persian architecture deal with the concepts of quality and performance in the building [4]. They concern building quality from two aspects. One addresses quality of concept and idea, and the latter points out the issues related to

construction, technology, and socio-economical aspects management.

3.1 To Be in Accordance with people needs (Mardomvary)

This issue concerns user needs and functionality issues in a building. It means that all needs of a user in a building regardless their social class should be responded. Therefore the first mission in a design deals with fulfilments of human basic needs through reasonable functions.

3.2 Self-Efficiency (Khod-Basandegy)

Use of vernacular materials (Boom-Avard in Persian) is always one of the concerns in Persian architecture. As an example they used to use excavated foundation soil in order to make bricks. There are many examples like this which are placed in today architectural concepts in sustainable building design (SBD). Vernacular material selection, compatibility, Embodied energy, application of passive energy and design environmental strategies in waste and technology management concerning the impacts in the environment are concepts pointed out in SBD.

3.3 Module Unit (Peymoon)

The basic unit of measurement in building is called *Peymoon*. This unit (module) is a base for other measurements. This means that other parts of building are measured based on this module and the dimensions are a proportion of this unit. The measurement unit in Iran was called Gaz (103 cm). All elements used to be built based on this unit and its proportions in the building system. This system of measurement supported stakeholders to apply geometry and its advantages for better perception of forces behaviour in building structure.

3.4 Inward-Looking (Daroon-Garaei)

Each community has a great respect for their culture, habits, and traditions. Persians culture has a respect for family and its privacy. Based on this fact they had two types of spaces in their designs. The activities pertained to the family and their privacy should locate in separate spaces from public activities. Therefore the functional zoning was arranged in a way to fulfil this objective. This code in their design shows that how sensitive their architecture behaves towards society members cultural issues. In this approach customers satisfaction based on their real needs and desires are addressed.

3.5 Avoiding Un-necessities (Parhiz Az Bihoudegy)

This code in this section attempts to address all practical efforts made to achieve the highest performance for user regarding issues such as waste control, cost, and avoiding construction loads (making the structure as light as possible through removing some parts of dead loads). Today the equal terms for such concepts could be gaining more from the less, efficiency, performance, dematerialisation, different levels of economics and technology management.

3.6 Structural Rigidity (Niaresh)

This code embraces the necessities required in building statistics and dynamics and includes all endeavours carried out in construction in accordance with the existing level of knowledge and technology.

This paper attempts to show that there are many concepts in precedent architectures which are applicable in today architecture and design. As it is seen, some of them are concepts presented in SBD and sustainability related terms. Identification and perception of the concepts regarding their application in building might help building stakeholders to benefit what precedents had and could be a heritage for today use.

4. BENEFITS EMERGED BY APPLICATION OF PERSIAN ARCHITECTRE PRINCIPLES

Since Persian architecture is based on issues such as respect for environment and compatibility of building with its surrounding environment and community's social, cultural and economical values, therefore this coverage of aspects provides a sort of design and construction knowledge which has a large number of common values with sustainability scope in today architecture. The principles presented by Persian precedent architecture generally cover areas such as:

4.1 The Environment as a Main Part of the Design

The respect for natural elements and their potencies to affect the design is always as a main part of a design system. The better perception of natural capacities and their specifications is useful in two ways, those are:

- It is helpful regarding management of the waste rate in building process and WLC.

- It enables the stakeholders to use the potencies of nature in forms of both active and passive strategies applied particularly in design stages by applying eco-concepts to achieve eco-efficiency.

For example, the use of natural light and wind (renewable sources) not only provides better indoor qualities but also they are more economical over WLC. Application of renewable energies causes less impact in the environment because they are basically more compatible with the nature of human as the user and the environmental codes [5], [6]. This fact shows that use of renewable natural sources should be considered as a virtue in building assets design.

4.2 User Need, Expectation and Requirements

Design stage procedures discussed in section 2.2 shows how customer-oriented Persian architecture was on the subject of functionality and basic needs of society members. Therefore response to functionality issue in a building based on social, economical and environmental aspects is one of the basic missions to fulfil.

4.3 Compatibility

The strategies applied in Persian architecture; focus on increasing the compatibility of a building

facility through application of different design strategies. The out come is providing building with two types of compatibility, one is compatibility with building occupants and the other is compatibility with the surrounding environments in different scales. Thus compatibility dimensions embraces all social, cultural, economical, design, energy related aspects in architecture. Since Persian architecture embraces environmental, material use, social and economical aspects, therefore it attempts to enhance the level of compatibility of buildings with the aforementioned items. Compatibility based on the context is presented by different features. Durability, flexibility and usability over building WLC are examples of compatibility. One feature of compatibility could be durability which is addressed through geometry and modular design and construction applied in Persian architecture.

4.4 Performance

Performance is a long-term process dealing with buildings throughout their life spans in three aspects: customer expectations, operation, and maintenance [7]. The quality provided in Persian architecture is focusing on dimensions such as 1) *concept* in terms of elegance of form, spatial articulation, contribution to culture, 2) specification for the level of finishes required and achieving technical standards set for the building, 3) realization of project and 4) conformance in which the objectives set out are realised in practice [4].

4.5 Embodied Energy

Uses of vernacular, healthy, safe materials, available technology, feasibility and accountability of operations over WLC are issues addressed in today building activities. Embodied energy and issues such as Durability, maintainability, serviceability, Simplicity, dematerialisation concept are points, which probably could be emerged from Persian principles.

4.6 Retrospect (Change of Bad Habits)

One of the items in Persian architecture codes belongs to avoiding from un-necessities, implying on efficiency. Here, the question is that if all points mentioning in a project brief are necessary. To tackle this fact, stakeholders are invited to consider simplicity in building design. In other words our ability and willingness to change our mind may solve the problem rather than finding a certain solutions for a problem [8].

4.7 Architecture Is a Multi-disciplinary Profession

Architecture as a profession benefiting different skills and professions, deals with various aspects in building. A *Mimar* (traditional architect) in Persian architecture was a person with variety of skills. His knowledge in design and structure as well as high understanding of environmental potencies and characteristics enables him to act as a manager in his position. It can be concluded that despite large scales of today projects, there should be strong accordance and co-ordination among different professions advocating building process. This objective might be achieved through a precise effective management.

5. ECO-BUILDING DESIGN (EBD) AS AN APPROACH TO REVITALISE LOST VALUES OF PAST

Functional, environmental, technological, energy, social and economical aspects in building WLC according to a context are subjects addressed in EBD regarding sustainable development. The contents of EBD are illustrated in figure 2.

As it is observed in figure 2, the areas covered by EBD are; building design, environmental concerns, energy and resources consumption and socio-economics. The sub-categories are also presented in the figure [9].

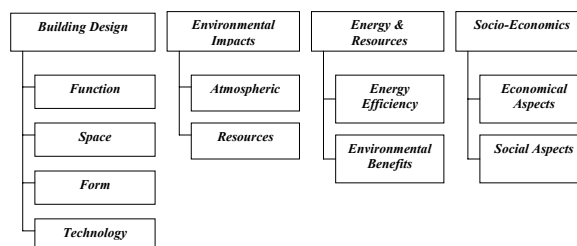


Figure 2: Categories and Sub-Categories in EBD

As aforementioned in this paper, in Persian architecture principles and codes, there are many issues which could be used in EBD. Achieving eco-efficiency as well as functionality is the main objective in EBD. This is why application of both passive and active design environmental strategies in EBD is of concern. EBD specifically focuses on lost values over time and attempts to enhance quality of building facilities through revitalising the past lost values found in precedent experiences [10]. The issues addressed in Persian architecture based on the same orientation followed by EBD, could be applied in today situation however it is anticipated that recent technology and knowledge could probably support eco-concepts through innovations to increase the quality of facilities in achieving higher rate of eco-efficiency and comfort based on concept of customer satisfaction [10].

Hence, EBD potencies are not just limited to eco-concepts and renewable energy sources application but it includes any design strategies which enables building to have a higher functionality, quality and performance as well as higher eco-efficiency based on the context and customer satisfaction.

6. DISCUSSIONS AND CONCLUSIONS

This paper attempted to show the strengths of concepts in the precedent Persian architecture. The exertion of concepts might be benefited in today architecture based on prudent understanding of environmental potencies. Recent concepts such as eco-efficiency, renewable energy, embodied energy, dematerialisation, design for Flexibility, durability, maintainability, reliability, performance, serviceability, usability, and the environment are all points

addressed in Persian architecture. Here, authors are interested to clarify a point, playing a main role in Persian architecture and achieving this point could be the key to solve today architecture deficiency.

Absence of a standard system and technology are the main problems in contemporary architecture. What Persians were benefiting of was a sort of compatible, capable technology in design and construction union system enabled building stakeholders to have a common sense towards the building management and activity. A compatible technology was developed in their time which is visible from beginning of activity until building obsolescence stage over WLC. The technology was totally compatible with its surroundings regarding both human (user) and the environment factors. The existence of such a technology is possible when a comprehensive perception of human needs and environmental characteristics are achieved by building stakeholders. Any ignorance about this fact might generate a range of problems and a level of impacts for building surroundings, introduced as human and the environmental scales. Based on the level of understanding of building system and its related terms the rate of impacts may differ. Thus, this paper is concluding that innovation is not the only way providing comfort for human but sometimes it is recommended that innovation should be limited to find how a better utilisation of facilities and potencies are feasible. EBD in the movement towards designing sustainable buildings basically follows the strategies which enhance the quality of life and building assets eco-efficiency. It is no matter if it is innovative or not but what is important is that innovation is sought in the way that a technology is selected, co-ordinated and developed in design, construction systems in the context. The compatibility of technology with its surroundings (human and the environment) and the nature of building components is what addressed in EBD. If such a technology emerges from current architecture, stakeholders are proud of their efforts and the result, otherwise there is still a need to rethink, redevelop and redesign. What ever is carried out regarding this goal is considered as a step towards sustainability.

ACKNOWLEDGEMENT

This paper is prepared based on university tutorial paper notes; module (Islamic Architecture) taught by the late professor Dr. Mohammad-Karim Pirnia at the University of Tehran, Iran.

REFERENCES

- [1] M. M. Falamaki, Memari-e Iran as Honar Ta Sanat, The Iranian Architecture: From Art to Industry Technology, Building Magazine in Persian, No.8, (1989) 40-49.
- [2] A. Vakili-Ardebili, University tutorial paper notes; Module (Islamic Architecture) Taught by the Late Professor Dr. Mohammad Karim Pirnia at the University of Tehran, Iran (1993).
- [3] M.K. Pirnia, Sabk Shenacy (Methodology), Journal of Art and Architecture (In Persian), NO. 10-11, (1971) 53-66.
- [4] G. Winch, A.Usmani, and A. Edkins, Towards total project quality: A gap analysis approach, Construction Management and Economics, Vol.16, No.2, (1998) 193-207.
- [5] S. Roaf, M. Fuentes, and S. Thomas, Eco House: A Design Guide, Oxford, Architectural Press, 2001, ISBN 0 7506 4904 6
- [6] P.F. Smith, Architecture in a Climate of Change: A Guide to Sustainable Design, Oxford, Architectural Press, 2001, ISBN: 0-7506-5346-9
- [7] M.Y.L. Chew, , S.S. Tan, and K.H. Kang, , Building Maintainability—Review of State of the Art , ASCE, Journal of Architectural Engineering, Vol. 10, No. 3, (2004) 80-87.
- [8] WBCSD (World Business Council for Sustainable Development), Exploring Sustainable Development Global Scenarios 2000-2050, Summary Brochure, 1997
- [9] A. Vakili-Ardebili, Development of an Assessment Framework for Eco-Building Design Indicators, PhD Thesis, 2005, The University of Liverpool, Liverpool-The UK.
- [10] A. Vakili-Ardebili, and A.H. Boussabaine, Proc CD; Eco-Design 2005; 4th International Symposium on Environmentally Conscious Design and Inverse Manufacturing, Tokyo-Japan (2005), The Intricacy of Eco-Building Design, 3B-1-2F, ISBN: 1-4244-0082-1