Analysis of Armenia's Green Building and Vision Proposal

Atanes Papoyan*, 1, Changhong Zhan*

School of Architecture, Harbin Institute of Technology; Key Laboratory of cold Region Urban and Rural Human Settlement Environment Science and Technology, Ministry of Industry and Information Technology, 66 Xidazhi Street, Harbin 150001, China
E-mail: atanes.papoyan@gmail.com

Abstract. This research is intended to do an overview of green building and market trends, to determine the recent state and future industry prospects, to analyze the current state of green architecture in Armenia. The major fraction of this research work is based on scientific research and literature review. The information has been derived from legislative documents, evaluation guidelines, governmental reports, company databases and through an extensive analysis of the scientific articles as well. There had been arranged several interviews with key representatives of the construction and architecture field. Besides of the interviews done with the professionals, there were done a questionnaire survey for citizens of Armenia. Have been collected more than 200 answers.

1. Introduction

This thesis is intended to be useful to solve problems related to green building occurred in Armenia. During the research work there have done an explanatory work, made inquiries, analyzed the basic factors and to motivate the development of this topic in Armenia. The primary objective of this research work is to be an impetus to improve the methods of green technologies. The main research objective of this study is to provide a stock of knowledge which in future can help architects, engineers in designing green buildings to consider the importance of internal environment of thermal comfort. “Green architecture” is used as an umbrella term to define the overall evolution of architecture, focusing on energy and design driven towards a reduction of the negative environmental effects and the unsustainable activities caused by the built environment. According to Tabb & Deviren [1] “the greening of residential architecture became an emerging process that attempted to transform modern architecture into more benign, environmentally oriented residential buildings”.

The birth of green architecture in the 20th century is a result of the return of environmental values within developed countries [2]. Different movements have arisen reflecting the concerns and awareness of the moment. American literature suggests that research into improving the energy efficiency of a residential building is now in its seventh decade of activity. According to Szokolay [3] and Tabb [4], green architecture became an issue after the 1950’s when European and North American architects started working in unusual tropical locations and became aware of the need to analyze their unknown climate [5], [6].

The study consists anticipated problems of green building and the ways of use of green building technology. In the 21st century, the domestic energy saving design ideas have been ripen, the theory of similar design also greatly enriched [7]. P. Penna, A. Prada, F. Cappelletti, A. Gasparella, Multi-objectives optimization of Energy Efficiency Measures in existing buildings, the paper shows life cycle...
cost of the building and energy consumption depending on the thermal discomfort for consumers [8].
Creating a design with the use of green technologies is becoming more in-depth attention, some domestic 
colleges and universities to create a building with low energy consumption and climate research institute
[9], by focusing on sustainable urban planning and green economy, as well as an architectural design
theory of sustainable development [10], environmental protection and construction of saving high-
energy physics, green, and other aspects of complex systems research.
In 2019 year in Armenia by authors had been arranged several interviews with key representatives of
the construction and architecture field, such as:
• Sarhat Petrosyan – founding director of Urbanlab. Head of the Real Estate Cadastre Committee,
  former professor of National University of Architecture and Construction of Armenia,
• Arsen Karapetyan – Head of Architectural Bureau d’Arvestanots,
• Alen Amirkhaniyan – Architect of Acopian Center for Environment ACE of American
  University of Armenia.
For interviews have been made a questionnaire and written down the answers and notes.
Besides of the interviews done with the professionals, there were done a questionnaire survey for citizens
of Armenia. Have been collected more than 200 answers.
The strategies developed in the city of Yerevan (Armenia) and the development of green building
technologies, are intended to promote energy-saving measures both in residential and industrial
buildings. The purpose of this process was to demonstrate, and more importantly, to implement energy-
saving measures based on the transfer of knowledge between the various parties involved in the project
the green building. For the case study, this process has been shown to be one of the great importance
when the planned measures green building solutions technology combined with the expected new
project.

2. Results of interviews
The interviews have been arranged with the purpose to identify the main problems, lacks and the current
stage of the green architecture in Armenia. According to the key representative of the field heating and
ventilation systems in existing residential buildings are not organize by the optimal way, in addition, in
most of residential buildings any kind of green technologies, such as green roofs, vertical green walls,
etc. are not used during the construction. As was indicated, the topic “green building” is actual in
Armenia, but the development process is so slow.
The discussions have shown, that there is need of using of green technologies both in existing and new
residential buildings, but it’s much easier to utilize during the new design projects. In their opinion, year
by year, step by step there should be done changes in construction law, in result of which will be a
demand of using green technologies during the new constructions or reconstruction works, and this will
be motivation and stimulus for further certification. All of the professionals argued that there is a
necessity to involve new subjects and research topics (which are absent now) related to green
architecture in universities. In summarization of the results of interviews there is a need to be mention,
that using of green technologies and the development of the field will be beneficial not only for citizens,
but also the negative impact on environment will be decreased.

3. Result of questionnaire
The questionnaire survey was intended to identify, how far the citizens are common with the topic, do they use any kind of green technologies in their houses, etc. In this section the monitoring of the results
of questionnaire survey with citizens is generalized. The results shown below:
• 61.50 % of responders have no idea about Green Architecture, from rest 38.50%;
• 8.50 % of responders are thinking that Green Architecture is related just with plants, like the
  buildings which facades, roofs or floors are covered with plants, grass yards and trees;
• 10.50 % are thinking, that its away of organizing a living space that does not harm the nature or
  minimizes that damage, from recyclable materials during planning to energy efficient and low-
carbon emission materials and renewable energy sources used in construction, as well as using the solar panels, wind turbines etc.;

- 4.50 % are thinking that Green Architecture is when buildings are in harmony with nature;
- 3.50 % are thinking that Green Architecture is just the using of eco-friendly materials;
- 9.50 % More green areas, parks and trees;
- 2.00 % Other, like Pure, Landscape architecture, Eco home etc.

Most of residents (about 88%) are not familiar with green building certification (Figure 1), and only 8 citizens (4%) could mention the exact green-certified buildings in Armenia.

![Figure 1. The results about the green building rating systems](image)

The first purpose of the question about the typical features of Green Buildings was to identify the opinion of citizens, secondly, it was as an educational information for them. The answers have been collected, summarized and are presented in Figure 2.

![Figure 2. The results about the typical features of Green Building](image)
93% of responders have claimed, that they are not using any green technologies in their houses, and the different methods by which there are providing the cooling and heating process in their apartments are presented in Fig. 3. And just 7% of responders are using solar panel systems in their houses.

![Cooling systems](image1) ![Heating systems](image2)

**Figure 3.** The cooling and heating systems which are provided in the apartments

### 4. Discussions

In Armenia only during the last several years there are approaches in using green technologies, such as “Energy Efficient Construction and Reconstruction of Multi-Apartment Buildings and Houses”, “Solar Water Heaters”, “Solar Photovoltaic (PV) Energy” [11]. But there are not widely exploited due to their lacks and not appropriate matching of several specific aspects of Armenia, and due to low level of awareness of citizens [12].

On average, every family in Armenia needs 120-240 litres of hot water daily for various household needs. The given requirement may be fulfilled without burning fossil fuels and greenhouse gas emissions. 50 000 - 100 000 AMD (in case of natural gas) and 110 000 – 220 000 AMD (in case of electric energy) may be saved per annum by installing a solar water heating system with the surface 2-4 m². The solar water heater used in few apartments in Armenia, works based on the following principle: water passes through solar collectors (or panels), which heat the water. The solar collector absorbs solar light energy and transforms it into thermal energy. There are various types of solar collectors used in Armenia: with vacuum or flat tubes, different sizes and constructions, technical parameters and terms of service, as well as prices. As to the current rates (November 2020), the payback period for such technologies is 2.5-5 years. When choosing a solar water heater, do consider that solar radiation differs during summer and winter months at approximately 2.5 times.

While conducting construction or reconstruction works at a residential area or an office, consider not only the aesthetic appearance of the building but also the application of energy efficient technologies and materials. With the help of available investments, competent professionals, habitants may ensure up to 60% energy efficiency along with increasing the ventilation and heating comfort level at an office or an apartment with only thermal insulation of the building envelopes. At the same time, such an energy efficient approach gives citizens opportunity to save household budget and cut the expenses (up to 200 000 AMD annually for the average residential area of 100 m²), as well as reduce the volume of hazardous emissions resulting from burning fossil fuels. It is advised to take full advantage of renewable energy benefits and install efficient LED lighting.

Several methods have been used in the research to make quantitative analysis, to identify the main existing problems in Armenia related to green architecture, and to make clear vision proposals for development of the field.

- **Step 1.** Historical review of domestic and foreign countries experiences in the corresponding field.
- **Step 2.** Explore modern ways of the using green building technologies.
- **Step 3.** To bring an obvious evidence of being worth this topic to be a part of development of architecture of Armenia.
- **Step 4.** Finding ways to develop the green building technologies in Armenia.
The results of the research allow to improve the composition of green architecture, taking into account technical, social and economic development, promote the concept of green building technologies, strengthening the ways of development of green architecture in Armenia. The following points have been identified:

- scientific justification of beneficial affection of green building technologies on economy;
- prerequisites of development ways of green architecture;
- ways to involve newest green building technologies into the existing architecture of Armenia, particular in restoration, reconstruction and renovation of existing residential and public buildings.

5. Conclusion

The results based on interviews and data collected from a questionnaires survey of 200 respondents show that the market development environment and ecological value have a significant direct and comprehensive impact on sustainable design of green buildings. Interviews clearly shown that green architecture in Armenia is just in its first stage of development and need to be developed in many spheres, like during designing and reconstruction of residential buildings, and need to pay more attention in involving related topics of researches in Universities. The results of questionnaire have shown that major part of Armenians haven’t any idea about the green architecture; energy efficiency technologies, and this is the first obvious reason, that this topic should be developed in Armenia.

More environmental issues of Armenia can be decreased with an adaptation of green technologies and involving them into daily construction. The significant barrier for green residential buildings is estimated high capital costs. Additional costs for the implementation of green technologies depend largely on local factors such as climate, local building codes and the level of skills. The observations have shown, that “green building”, As a new type of building for Armenians is not easily accepted by the public due to immature green building technologies, long investment return period and low public awareness which are key issues in the sustainable development of green buildings. The status compared of international research, the study of the construction in the housing sector, Armenia has started relatively early results of studies mainly focus on the function, space, structure, architectural ideas.

The outcome of this research work will be the self-improvement stimulation of the intellectual and artistic level of the population according to the laws of green architecture.

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