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Sustainable Architecture or Regional Planning Case Study

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Abstract: Today's greatest global challenges include managing the environmental crisis and promoting sustainable development. Within architecture, the measures and approaches taken to address these challenges vary. The environmental crisis has led to sustainability being considered primarily a global and ecological issue. However, academic debates suggest that sustainable architecture and issues of technological change should reconnect with the social and cultural contexts where development occurs (Guy, 2005). Using a case study, this paper examines the extent to which one specific architectural approach to sustainability interacts with particular local conditions.

Keywords: case study, architecture, climate crisis.

Introduction

New technologies in architecture may affect the sustainability of our relation to place. While the relationship between technology and place has long been an issue, the increasing application of technologies in sustainable architecture requires further study.

The current debates address the modern and non-modern practices of sustainable development, the multiple cultures of sustainability, the need to reinterpret sustainable architecture, to question technology, its regularisation and ensuing dramas, to value or devalue place, and so on. Ultimately, the issues are about technology and society, but more specifically about sustainable architecture since it demonstrates how technology is used in specific places with particular natural, cultural, social and political conditions. The global focus on technology as a means of addressing challenges, including the climate crisis, results in our relation to place being lost or overlooked in favour of universal solutions, development models and ever- increasing progress.

Building on existing research, I study the challenges of creating a built environment that responds not only to sustainable development as we know it, but that also promotes a sustainable relation to place. I investigate how universalised systems of measurement relate to the contingent complexities of locality and identify tensions between technology and place as experienced through sustainable architecture.

Sustainable architecture navigates the complex relationship between the construction of technologies and place. For this reason, I chose the in-depth case study method to gain specific knowledge on a technological approach to sustainable architecture; I observed the development of an architectural project that aimed to be sustainable both for the environment and the community it was placed in. I observed and participated in the life of the community on a daily basis, learning about the use of spaces, core values and dwelling traditions. I analysed documents

and conducted interviews and site visits. The interviews revealed how the purpose and performance of the project were influenced by the prevailing, political agenda. In addition to the original data, I studied other selected publications available online. The tradition of social constructivist theory and a socio-technical perspective were used to study the meaning and implications of the selected case. It can be argued that generalisations cannot be based on one individual case study and that its contribution to scientific development is therefore limited.

Material and Methods. Trends in the application of certain principles and methods of design and construction, technologies and engineering systems are manifested in different names for the architecture itself: “sustainable”, “low-cost”, “emerald”, “environmentally friendly”, “green”.

The search for something new in architecture is carried out against the backdrop of global structural processes in culture caused by the advent of the information age, the formation of a post-industrial society, and planetary natural and climatic changes.

Climatic anomalies on the planet have become a universal challenge to humanity. The 2011 UN Global Report, Cities and Climate Change: Policy Directions, includes the thesis that “with further urbanization, understanding the impacts of climate change on the urban environment will become increasingly important.”

What is the role of technology and what technologies are used to create a sustainable architecture? These technologies are called "green" and are defined as economically safe innovative technologies that reduce resource consumption and negative impact on the environment while maintaining their economic efficiency" [2].

And one more definition linking the characteristics of technologies with sustainable development: “Green technologies are innovations based on the principles of sustainable development and reuse of resources” [3].

As a derivative of the use of "green technologies", "green construction" itself is also defined. “Green building” is an industry that includes the construction and operation of buildings with minimal environmental impact. The main task of "green building" is to reduce the level of consumption of resources (energy and material) throughout the entire life cycle of a building: selection of a construction site, design, construction work, operation and demolition" [4]. There are other definitions of "green construction" and "green buildings", but they are close in essence [5].

An analysis of the practice of "green building" and sustainable architecture gives grounds to single out two main features of sustainable architecture: environmental friendliness and the use of high technologies. Therefore, a new, more concise definition of sustainable architecture can be proposed:

“Sustainable (Green) Architecture – Environmentally-Oriented High-Tech Architecture”. At the same time, the ecological component takes into account the general ecology and the ecology of culture.

In a practical sense, rating systems have become criteria for the compliance of objects with the requirements of sustainability. The most widespread are three international rating systems: American LEED, British BREEAM and German DGNB.

What determines the architectural form as an integrator of the manifestation and implementation of the principles of sustainable development? We denote the spheres of the birth of sustainable architecture:

- scientific research;
- experimental design;
- regulatory support − regulation;
- educational activities;

- design and construction;
- life cycle monitoring.

It is in the diversity of these areas of activity of various specialists that the process of the birth and existence of sustainable architecture is carried out. Each of the areas has its own methodology for implementing the goals of activities and the tasks of creating a sustainable architecture. Note that the sequence of spheres is conditional.

Based on the experience and trends in creating sustainable architectural solutions, the following principles for the formation of sustainable architecture were proposed, the application of which can be considered in each of the above areas:

- harmonization of social, economic, ecological, territorial and spatial factors of development of settlements;
- identification of the optimal combination of "stable" and "changeable"
- in the object design program;
- natural conformity and biomimetics;
- adaptability to challenges and risks of natural-climatic and technogenic character;
- modeling of the spatial and mathematical forms of the building depending on the factors that determine the life cycle. Let us consider successively the influence of the proposed principles on the architectural form.

As part of the development of the trinity of economic, social and environmental components of sustainable development, requirements are being developed for the strategy for the formation and reconstruction of the living environment and, in turn, for architecture and urban planning systems. Full-scale design at the level of a new city, taking into account the harmonization of all factors, is currently being undertaken on smart-city models: Masdar (UAE) (Fig. 1, 2, 3) and Songdo (South Korea): from a common strategy linking life processes of the city, to a separate object, which provides the possibility of its optimal programming and taking into account all the factors that determine the functional-typological, architectural-artistic and typological characteristics.

Figure 1. Masdar City. General form

Figure 2. Masdar. Building fragment

Figure 3. Masdar. public space street

From the desire to adapt to natural conditions, mankind has gone the way to the possibility of overcoming the impact of nature in architecture, and then to the symbiosis of natural and artificial systems (Figure 3).

Figure 3. "Cactus House". Ref. architects. Rotterdam

The modern understanding of the influence of nature on architecture consists in the study of natural forms as having undergone a long evolution in terms of survival in various natural conditions through adaptation and symbiosis [9] (Figure 4).

Figure 4. Gwanggyo Urban Center Project. MVRDV Company, South Korea

Climate change, increasingly sharp fluctuations in temperature cycles, temperature rise, heat and drought, rainstorms and floods, other extreme natural impacts and man-made disasters - all this dictates new requirements for the "survivability", preservation and sustainability in the literal sense of urban formations and architectural objects. Hence the emergence of two directions for overcoming catastrophic impacts: tightening the requirements for the artificial environment, ensuring its safety and human protection. The second direction is the possibility of implementing new ways of existence of the artificial environment (floating, flying buildings and cities), etc. to solve the problem of the ocean in the face of global warming.

New forms of human habitation in contact with the water element were revealed by the projects of the Swiss V. Kolebo (Figure 5).

Figure 5. "Floating city". V. Kolebo

Stationary forms on the water surface are also presented in the projects of the Moscow architect A. Asadov (Figure 6, 7).

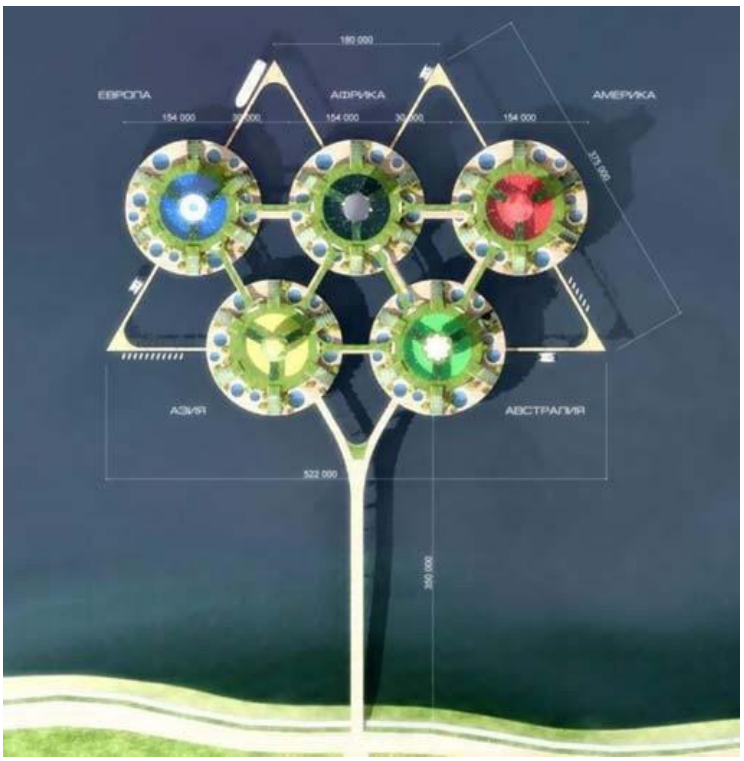

Figure 6. Conceptual design for the city of Sochi. Plan. Arch. A. Asadov

Figure 7. Conceptual design for the city of Sochi. General form. Arch. A. Asadov

IT modeling of forms with a demonstration of functional processes, natural and climatic cycles, natural risks and the state of the building, its systems during periods of various life cycles provides a new level of solving design problems.

Mathematical modeling is widely used in design and construction. Research and programming of architectural forms and spaces needs further development of software and its implementation in research and design. Although today the search for the optimal forms of an object, for example, the minimum surface area with the maximum volume (London City Hall building, architect N. Foster) is practically being implemented. Optimization of the shape and orientation of the building, taking into account the directional action of the outdoor climate, is carried out by mathematical modeling [12, 13].

The development of digital models that take into account the influence of both individual factors and their groups for a single building or a fragment of the spatial environment can have a significant impact on the birth of new architectural forms.

Thus, sustainable architecture as a design paradigm dictates the requirement of intellectualization, the inclusion of research procedures and expert assessments in traditional architectural and urban design, in which forecasting with modeling becomes an integral part of the activity in the context of the use of multi-criteria rating estimates of options for solving design problems and implemented projects.

In this approach, various combinations are real, and perhaps the allocation of certain invariants in the architecture of different directions, trends and unique objects of various types or certain universals: a frame, mobile shells, stationary forms and mobile equipment, self-adjusting systems that take into account innovations in various types of energy , and the creation of new materials and structures.

At the same time, all developments are based on the search for philosophical concepts and development scenarios, taking into account socio-economic, natural-environmental, engineering-technological, artistic-aesthetic and other factors and requirements.

Modern versions of minimalism are most programmatically aimed at embodying the principles of sustainable development. However, the search for architects and other creative areas demonstrates the possible ways of the birth of architectural forms built on a combination of original spatial and plastic ideas and innovations of "green" technologies. It is likely that the diversity of the latter, along with the factors traditional for architecture of the spirit of the place, the originality of the context, the traditional forms of folk architecture, the uniqueness of nature,

and others, will contribute to the emergence of original regional architectural schools and the individualization of the appearance of buildings and structures.

Conclusion. The definitions of sustainable architecture proposed by the author and the five principles of its formation can be used in developing a strategy for the development of sustainable architecture throughout the country.

The detailed content of the principles of formation of sustainable architecture determines the possibility of their application in research, design and experimental and scientific and educational activities at different stages of work according to the scheme “from general to particular”.

The selection of "natural conformity" and "biomimetics" as the principle will ensure their inclusion in the design program as a component of the analysis of the interaction and mutual influence of natural and artificial systems at all stages of the life cycle of the artificial environment.

Particular importance is attached to spatial and mathematical modeling in architectural design, which will contribute to the completeness and efficiency of solving design problems on the principles of sustainable development.

REFERENCES

1. Esaulov G.V. Ustoichivaya arkhitektura kak proektnaya paradigma (k voprosu opredeleniya) [Sustainable architecture as project paradigm]. Ustoichivaya arkhitektura: nastoyashchee i bu- dushchee. Proc. Int. Sci. Conf., Proc. Moscow Institute of Architecture (State Academy) and KNAUF CIS group. Moscow, 2012. Pp. 76−79. (rus)
2. Zelenaya entsiklopediya[Green encyclopedia].Information on: greenevolu-tion.ru/enc/wiki/zelenye-texnologii
3. Рашидов, Ю. К., & Файзиев, З. Х. (2019). Повышение эффективности систем солнечного теплоснабжения с плоскими солнечными коллекторами: основные резервы и возможные пути их реализации.
4. Esaulov G.V. Arkhitektura v prirode. Priroda v arkhitekture. Paradigmy razvitiya [Architecture in nature. Nature in architecture. Paradigms of development]. Arkhitektura v prirode. Priroda v arkhitekture. Moscow − Kislovodsk, 2009. Pp. 30−58. (rus)
5. Gridyushko A.D. Biomimeticheskie printsipy v arkhitekturnom proektirovanii [Biomimetic principles of design architecture. PhD thesis abstract]. Moscow : MARKHI Publ., 2013. (rus)
6. Khaydarovich, F. Z., & Zakirjanovna, Y. S. (2022). PASSIVE AND ACTIVE SYSTEMS IN THE USE OF SOLAR ENERGY. *Open Access Repository*, *8*(04), 114-118.
7. Tabunshchikov Yu.A., Brodach M.M. Matematicheskoe modelirvoanie i optimizatsiya teplovoi effektivnosti zdanii [Mathematical simulation and optimization of thermal effectiveness of buildings]. Moscow : AVOK-PRESS, 2002. Pp. 124−161. (rus)
8. Tabunshchikov Yu.A. Dorozhnaya karta zelenogo stroitel'stva v Rossii: problemy i perspektivy [Road map of green construction in Russia]. AVOK Publ., 2014, No. 3. Pp. 4−10. (rus)
9. Etzkowitz H. Triple helix. Universitety−predpriyatiya−gosudarstvo. Innovatsii v deistvii Tomsk: Tomsk State University of Control Systems and Radioelectronics Publ., 2010. 238 p. (transl. from Engl.)