Modern Conditions and the Impacts of the Creation of Architectural Environment

Vadym Abyzov

1 Kielce University of Technology, Faculty of Civil Engineering and Architecture, Chair of Architecture and Urbanistics, al. Tysiąclecia Państwa Polskiego 7, 25-314, Kielce, Poland

vadimabyzov@yandex.ua

Abstract. The purpose of this research is an attempt to identify and analyse the modern conditions and impacts of the creation of architectural environment and on this basis to determine the main directions and tasks of the development of architecture at the appropriate hierarchical levels. A comprehensive review and structural analysis of all impact factors and different current conditions that lead to the sustainable architecture design are conducted in the proposal. The main groups of factors and conditions such as social-economical, natural-geographic, urban, ergonomics, ecological, typological, technical, cultural, and aesthetics are determined in accordance with their contemporary specifics. This analysis provides an opportunity to define the appropriative hierarchical levels of the modern trends and prospects of creation an effective, attractive and friendly architectural environment. Some examples of author's projects and implementations is presented in the article. Such methodological approach will help to create a holistic view of the creation architectural environment, will allow to systematize existing knowledges and concepts, practices and prospects of the means and methods of its formation and development.

1. Introduction

The environment in the broad sense is the concept of universal significance and it covers both the natural conditions of material world surroundings of a human, that never experienced human impact (natural environment); and the environment adapted by a human for a variety of processes and types of life (artificial environment). But whatever changes would have been done to artificial forms of material world during their adaptation to human needs, they are basically the product of nature. That is why the environment of human activity almost cannot be completely artificial. The only exceptions are certain processes that require special conditions or completely isolated from the environment. At the same time, the environment of human life hoods is not absolutely natural, because the fact of choice of a one or another environment already involves it into anthropogenic processes.

A variety of research studies have been dedicated to the issues of typology of environment [1-10]. These and other authors, relying on the concept of a systematic approach considering environment as an architectural integrity of conditions of the material world of human, that changes in transition from one system level to another.

The need of creating a harmonious environment and solving diverse and complex aspects related to its development and construction in line with the concept of sustainable development of human settlements is a major and urgent task in front of modern architecture and construction science. Galloping urbanization, the rapid development of various technologies and technical means that form an artificial environment on the one hand, and natural disasters occurring in the world because of its depletion caused by the same development, on the other hand, creates new requirements and conditions for modern architecture.
Modern architectural design, which is an integrated creative work of forming a harmonious object-spatial environment, can not be considered outside the context of social, economic, environmental, technical, aesthetic and other aspects and factors [3]. Each of them, in one way or another, affects both the conceptual solution and the ultimate realization of design objects.

In many international documents and scientific researches various aspects and factors of architectural environment and its sustainable development considered in a certain way [3-11]. At the same time, it seems necessary to conduct a comprehensive review and structural analysis of all factors and conditions that lead to the creation of urban environment. Such analysis will provide an opportunity to consider trends and prospects of sustainable development and allow us to imagine the nature of the formation of environmental systems and objects more deeply and will be beneficial for integrated design of effective architectural solutions.

2. The main factors

Study design and construction practices and literature, author’s own experience allowed to reveal the main groups of factors that determine sustainable development, such as: socio-economic; natural-geographical; urban; environmental; ergonomic; typological; technical; aesthetic.

**Socio-economic factors** include:
- socio-economic state of society;
- existing and future needs and opportunities of the population;
- socio-demographic structure of the population;
- provision of living conditions and socio-cultural infrastructure.

Creation of the environment of human life must meet first of all the social needs of society, which directly affects the selection of forms and means of its arrangement, beginning with the arrangement of interiors and parks and ending with the shaping of urban spaces arrangement. Actually, social and financial status of the owner of any residential or public buildings and facilities definitely determine their feasibility and related aesthetic performance.

Considering the needs of the population is one of the determining factors in the development of both society and of spiritual and material forms of its existence. At the same time, there is a problem of the feasibility of these needs. The architectural design of diverse types of housing and their comfort are determined lately not so much necessities of life as the income of different social groups. And expenditure needs often exceed revenues.

Depending on the level and degree of economic development of the country and society, the social and demographic structure of population are undergoing slow but significant changes. Thus, the dynamics of socio-demographic changes and, accordingly, the urbanization processes are largely connected with the general macroeconomic conditions of the country's development. In highly developed countries with regulated market economies, the gradual improvement of living standards of the population determines the needed growth of appropriate living conditions, services and leisure. Increasing the degree of availability of housing and institutions of cultural and community services, as well as improving comfort and engineering equipment of territories and buildings accordingly. These processes cause the construction of houses for immigrants and the creation of a wide network of specialized housing for older people. The demographic dynamics in Europe also shows a significant increase in the number of people of retirement age and therefore need for the arrangement of their life in urban environment.

Special consideration is necessary for the issues of creating an unobstructed environment and the availability of housing and public buildings for people with disabilities. For these categories of the population, that now account for about 10% of the population is necessary to ensure proper ergonomic decisions of the urban development.
Natural-geographical factors include:
- climatic and geological conditions of construction;
- natural landscape, including topography, hydrography (natural and artificial lakes, etc.), degree of soils and their fertility, vegetation and so on;
- other various characteristics of the environment.

These factors largely determine the functional, lay-out, constructive, and artistic-aesthetic design features of the urban environment. Their influence is essentially reflected in the account of the numerous regulatory operational requirements, and of the need for adequate architectural and spatial organization of buildings, structures, improvements, and the like. Historically, architectural products were arranged according to the climatic, vegetation, topographic and mounties, forests, steppes and seaside settlements, that primarily determined the suitable arrangement of both open and closed spaces of environment.

A significant amount of construction in Europe falls in areas with complex geological conditions, collapsible soils, areas of rock seismic areas. Specifics of development of these areas require engineering solutions that define the appropriate architectural-planning and constructive structure of the buildings in the region. The separate group constitutes the natural landscape factors (topography, natural and artificial reservoirs, soil, and the degree of fertility, vegetation, etc.) which directly affect the establishment and development of urban structure and its components. For instance, the rivers have always played a key role of the overall composition and formation of panorama settlements. So, it is important the identification and preservation the natural landscape factors that are the integral part of the urban landscape, that complement and organize architectural environment of settlements.

A specific feature of natural and geographical factors is that they are practically unchanged in time, although in the last century the climate in the world has become slightly different, it has had no fundamental effect on the specifics of the formation of environmental systems and objects.

Urban factors include:
- the size and national economic profile of the city;
- functional and planning structure of the city;
- the density of urban development;
- the development of transport and engineering infrastructures;
- system of cultural and community services and landscaping areas;
- building plots and environment characteristics.

These factors, which are in close interaction with the socio-economic factors, impact significantly on the formation and development of environmental systems and facilities. They are characterized by various levels of their changes, and the dynamics of these changes are determined by the continuous development of the architectural environment.

In modern conditions of scientific and technical progress a variety of changes occur in the economic characteristics of the cities and their spatial structure [7]. If in the cities - the centers of the agglomerations, the population is growing, in small and medium towns it drops. In recent years, the growing trend of construction in the central parts of large and major cities of large volumes of housing, modern business office, banking and commercial organizations, garages, warehouse facilities, and the like (figure 1). All this causes a substantial induration of inner-city development. In this regard, special attention should be paid to degraded areas of historical urban environment. Immediate measures for regeneration and reconstruction of its residential areas and streets are required to improving their construction and design, engineering, transport, social, and cultural infrastructures.

The basis for the sustainable development of human settlements is the effective planning of urban settlements based on the concept of compact development as opposed to the extensive territorial growth. The introduction of the concept of compact development determines a significant decrease in the needs of the city for extra territorial resources for their development; identification of new and revision of existing approaches to landscaping and urban development; the increasing density of residential areas; the development of the relevant principles of zoning of the urban environment and development with a view to
its multifunctional use and construction of integrated residential and public complexes. Along with the formation of large residential, industrial and other areas, specific multifunctional zones are arising and developing within them. Such zones are formed as the territorial associations of the industrial enterprises, municipal and warehouse facilities, and administrative and business institutions and organizations, educational institutions, medical institutions, objects of cultural and consumer services. However, in these areas there is a sizeable proportion of major multi-storey residential buildings. The development of urban and regional transport systems, the growth of motorization of the population leads, on the one hand, to the development of peripheral and suburban areas with the creation of low-rise individual residential building for the population with high incomes, on the other hand, the inclusion of a transport components in the structure of residential and public buildings in city centers with extensive use of underground space.

Figure 1. Intensive and chaotic urban development. Shanghai.

**Environmental factors** include:

- physical and chemical environmental conditions, including hygiene parameters and microclimate conditions of human life, considering the impact of environmental problems and nature conservation and rational use of natural resources;

- conscious and unconscious human intervention into natural processes (pollution and destruction of the environment, etc.).

These factors are closely related to the natural-geographical factors. Provision of hygienic standards and requirements to the parameters of the architectural environment, including residential buildings, businesses, and service agencies with the surrounding areas and diverse types of engineering, is one of the main problems that must be solved at creation of favorable sanitary-hygienic conditions of life of the population. It is important to use durable and “green” building materials and constructions. The creation of “friendly environment” microclimate of residential units and ensure the organic inclusion of new urban objects in the existing natural and architectural environment depends largely of their architectural design.

Along with these modern stringent requirements to reduce energy consumption, particularly of non-renewable forms of energy underscores the need for minimizing construction waste, recycling of construction materials and waste, its also need for formation of effective engineering, transport, architectural and environmental systems respectively [8]. Thus, the implementation of construction engineering systems using a variety of renewable energy sources (solar, wind, earth heat, etc.) require large investments in the construction, but the operating costs of civil buildings which have such systems, is much lower (figure 2).
The steady tendency is the increasing of requirements to quality of residential buildings and its sanitary standards in connection with the growing level of environmental pollution. It is constantly improving the environmental performance of construction materials, developing technical and engineering equipment that becomes an integral part of the urban environment. According to these phenomena require further improvement contemporary design ideas and solutions.

**Ergonomic factors** include: anthropometric, physiological and aesthetic conformity of distinctive features and functionalities of the person to the subject-spatial environment and conditions of work and rest.

These factors largely determine the design of the architectural environment. Ergonomics as a separate scientific discipline emerged at the intersection of anthropology, anatomy, psychology, physiology, hygiene, engineering sciences, biochemistry, biophysics, medicine and others. Mutual coordination of human capacity and technical products, to minimize negative impacts of working conditions and environment of people in their nervous system, health, and recreation is crucial for the formation of external and internal environment and appropriate design solutions.

Anthropometric compliance environment defined properly elected its functional-spatial and constructive parameters according to the anatomical features of the human body. Of course, that design for children, especially preschool establishments, theatres, parks, attractions, etc. requires specific design solutions. The establishment of proper conditions of life for people with physical limitations and disabilities requires special attention.

The physiological components of environmental systems and objects are characterized by differences in vision, hearing, touch and smell. And this should be considered especially when designing external and internal environment of concert, theater, entertainment and other buildings and structures subject to the requirements of visual perception and acoustics. The important role of the physiological issues of conformity is played in the creation of various objects of landscape design, including for relaxation and recreation.

The aesthetic line that defines the psychological and emotional satisfaction from the perception of a harmonious environment, in each case is determined by the composition means, in particular such as color, scale, rhythm, and proportion. It is known that the human eye can simultaneously perceive visual no more than seven individual objects, and color scheme can cause the different psychological state and the mood of a person.

**Typological factors** include:
- the features of typology of residential, public and industrial buildings, as well as various green areas;
- improvement and development of functional and lay out structure of civil buildings and elements of their accomplishment and resettlement.

The development of scientific and technological progress, changing social, cultural and spiritual needs of the population leads to permanent conversion of functional-technological processes of environmental...
objects [3,10,11]. The improvement of the public service causes the further development of the types of public buildings. Functional processes and typology of environmental systems and facilities determine their basic parametric characteristics. Organization of social service in each case affects the consolidation, disaggregation, or co-operation of different facilities, and at the same time - on their external and internal design.

Along with the need of development of various forms of social housing in conditions of limited budgetary financing, there is a tendency to increase the number of rooms in apartments, enhance their residential and public area for housing with a high living comfort. Modern foreign practice has a large palette of techniques of the design of the environment as a social municipal housing, and a variety of houses with high comfort of living. Improvement and development of diverse types of residential and public buildings with different functional structure, level of comfort, and forms of ownership specify a variety of design solutions of architectural environment.

Due to dynamic changing of typological requirements and operating conditions of residential and public buildings substantial distribution will acquire various methods of its flexible layout organization. This, in turn, defines innovative approaches to the formation of their modern structural and architectural solutions.

**Technical factors** include:
- introduction of new building materials;
- innovation technologies of production structures and construction techniques;
- improvement and implementation of innovative design and engineering systems;
- dynamic development of information technologies;
- existing state of the industrial base and the availability of relevant material and raw material resources.

These factors are in close interaction with the functional-typological factors. The emergence and development of new building materials have had an impact not only on structural and spatial characteristics of the environment, but even determined the stylistic features of architecture and design [4, 10]. The development and introduction of new building materials, such as plastics, polymers, foams, PVC film, various admixtures to the concrete, and many others, may subsequently affect not only at improving the principal design decisions, but also to the emergence of the fundamentally new. For example, the implementation of currently developed transparent metal may determine essential transformations both technical and aesthetic features of the urban objects in the future.

At the same time, technical solutions of various technological and engineering systems are improving constantly, which directly determines the parameters and shape of the main structural elements of the architecture environment (figure 3). Here the technical and economic indicators play a vital role that affects construction costs: reduction of labor and material consumption; the timing of construction of buildings and structures; the size and circulation of produced elements; efficiency of building materials and engineering systems and so on. The efficiency of construction depends not only from reducing the cost of production of building structures, but also from improving performance of the residential and public buildings.

The experience of design and construction practices demonstrates the ongoing improvement of the technical level of construction, modernization and implementation of advanced designs, technologies and products, construction materials, advanced systems engineering facilities and equipment. This, in turn, necessitates the further improvement not only technical, but also artistic and imaginative solutions. Passive and active solar systems, which use an accumulation of solar energy, are integral part not only of roofs but also of compositional and spatial solutions.

The development of innovative designs, technologies and construction materials also causes a substantial transformation of the construction’s base. An important role will belong to the diverse use of local raw material resources, including industrial waste.
Aesthetic factors include:
- cultural and spiritual needs of society;
- historical and cultural features and traditions;
- influence of fashion on changing tastes and needs of consumers;
- aesthetic characteristics of the architectural environment.

Figure 3. left: Introduction of innovative building materials, structures, technologies, an engineering support systems, right from France and the Netherlands.

These factors and conditions, which are closely interrelated to all the other groups of factors, significantly influence on the formation of environmental systems and facilities, which should provide for broad freedom of choice of architectural and spatial forms of habitat in accordance with cultural and spiritual needs of the community. They largely determine the creation of impressive urban ensembles, a variety of its artistic solutions. Along with multivariate architectural decisions, it is important to ensure the integrity of the compositions and the individuality of both the whole building area and its components, considering the local socio-cultural characteristics and urban traditions [5, 9].

The aesthetic quality and effectiveness of environmental development, considering national traditions and values, largely depends on the material and technical means of its implementation. The development of technical, economic and environmental factors determines the necessity of applying appropriate means of aesthetic expression, which must comply the new requirements and conditions and at the same time meet the historical and cultural traditions (figure 4).

However, the aesthetic conditions of the formation of architectural environment are influenced by fashion requirements and changes of consumer tastes, largely due to the development of both socio-economic living, and cultural and spiritual needs of the community. Development of various directions and styles of art and design, architectural schools and trends often determines the key characteristics of imaginative expressiveness and aesthetic qualities of the architectural environment.

Figure 4. High-rise buildings in Hague and their harmonic insertion into the silhouette of the historic center.
The identification and structuring of the main factors’ groups of sustainable design will provide an opportunity to form a holistic view of the creation of a modern architectural environment, determine trends and prospects of its development on the basis of a systematic approach.

**Modern conditions and trends**

In a system approach, the core of which is to implement the requirements of general theory of systems, the object of research is a set of interrelated elements and components that make up a system, linking the components of the overall objective.

The main statements of the theory of architectural environment systems organization are: the system of architectural environment is not the simple sum of the individual elements of building development and landscape fragments, but the single holistic unit; as a holistic unit, architecture system has certain boundaries that separate its territory from the external environment; every architecture system (from the interior to city) consists of number of subsystems, which are also divided into smaller-scale items; the stability of system (immutability of its components in its vital activity) is determined by internal regulation, which is implemented through forward and backward linkages; every element of the system can be considered as a complete system of the second level of organization of matter; systems are distributed into the open systems, if they exchange information and energy with the external environment, selectively open systems and closed systems when this exchange and interaction does not occur; architectural systems belong to the selectively open for exchange with the environment, due to the human factor [9].

First, it is worth noting the presence of the social demand of societies of various countries for the development of social, cultural, material and spatial environment. Such a request is becoming more common by both public institutions and private companies due to the orientation of citizens to meet their cultural and spiritual needs for the development of historical and cultural traditions. Creation of the environment of human life must meet first the social needs of society, which directly affects the selection of forms and means of its formation, arrangement, beginning with the arrangement of interiors and parks and ending with the shaping of urban spaces arrangement. Therefore, the first hierarchical level of the creation of architectural environment should be considered social conditions of its arrangement considering not only urban and other requirements, spiritual needs and tastes, but also the social status of customers and investors, and specific consumers.

The next hierarchical level is the urban spatial structure, the specific parameters of which are implemented in open and closed urban spaces of cities, their planing, areas, altitudes, configurations and so on. This embodiment is town planning structural unit that determines the role and place of environmental objects in space of settlement and its development under various climatic conditions and urban location of facility design characteristics, surrounded by natural and artificial environments. Urban development conditions of design units’ location, together with the natural and geographical factors play a significant role on the formation of both open and closed spaces of environment. And this hierarchical level has several structural sub levels or subsystems: the first level - general scheme (conception) of settlement of the country and planning of its territory (the concept of territorial development) considering placing the country in the European urban space (il.1); the second level - regional planning (planning regional territories); the third level - city master plan (il. 2); the fourth level - projects of development of districts, neighbourhoods, urban housing and public entities and ensembles with relevant improvement of streets and squares (il 3).Regarding the formation of streets and squares, it is worth to pay attention that this problem becomes especially important in the historic cities of Europe that have a significant historical and cultural heritage and at the same time are the centres of countries, regions and districts with their business and commercial activity.

The following hierarchical levels, according to the major groups identified above, will be environmental, typological (objective), technical. The influence of ergonomic and aesthetic factors will affect all hierarchical levels.

Thus, it is possible to formulate the main directions and objectives (far from recipes) for the development of the pursuant architecture with such hierarchical levels: social, urban, environmental, typological (objective), technical.
Social level.

1. To provide people with wide freedom to choose their full environment and architectural and spatial forms of adequate living and income levels of various social groups.

2. The provision of citizen with decent housing by the State, with the necessary minimum sanitary amenities for the socially disadvantaged.

3. Creation of living conditions, principles of development that exclude the social segregation of various groups of the population.

Urban level

1. The effective management of urban development systems based on sustainable development principles and in line with hierarchical sublevels mentioned above. Ensuring the integrated sustainable development of human settlements and the renunciation of their rigid boundaries, considering the creation of conditions for the phased environmental regeneration of industrially depleted territorial resources.

2. Creation of a harmonious architectural environment, with reasonable consistency and equilibrium in the location of industrial, residential and public buildings, considering historical and cultural heritage and the natural environment. The priority of a pedestrian before any, including high-tech, means of transport with a spatial separation of their traffic levels.

3. To ensure the rational development of residential settlements and entities, considering the needs of different social groups, with a rational approximation of service facilities to the consumer. Effective use of forms and practices that reflect not only the material but also the socio-cultural and spiritual needs of society (figure 5).

Figure 5. Architectural environment on the level of the projects of development of districts, neighborhoods, and public entities and ensembles. The historic area with recreation spaces adjacent to the National Historic and Cultural Preserve “Kievo-Pecherska Lavra”. (Architect Vadym Abyzov in the group of autors).

Environmental level

1. The total reduction of energy consumption, non-renewable energies in particular, through efficient transport, engineering and architectural-engineering systems.

2. The use of renewable natural resources, minimizing and disposing of construction, household and other wastes with recycling of spent materials.

3. Establishment of a "ecologically clean" micro-climate of residential settlements and entities in accordance with sustainable development of urban systems and ensuring that new construction facilities are fit into the existing natural and architectural environment (figure 6).
Typological (objective) level

1. The creation of a variety of forms of architectural, spatial and constructive organization of the buildings best suited to the social and economic needs of the various layers of population, considering historical, cultural-architectural and urban traditions.

2. Wide application of the principles and methods of flexible planning, which provides the development of buildings in time and space in according with constantly changing requirements and conditions for their operation. Consideration of subsequent structural changes of urban facilities, ensuring that necessary reserves and associated costs are well adapted.

3. The development of multifunctional structures of housing complexes and entities that integrate various functions with the greatest possible approximation of service objects and diverse activities to human needs. Inclusion of a new type of information system into the housing structure (figure 7).

Technical level

1. The development of a clean construction industry, highly mechanized and automated construction, excluding the primacy of financial and productive interests over individual and aesthetic human needs. The introduction of the most efficient and durable new and traditional building materials and technologies.

2. Improving existing and implementing new prefabricated and monolithic architectural and building systems, considering the complex integration of architectural, constructive and technological solutions, the choice of optimal constructive and planning parameters that provide broad range of functional and planning possibilities using progressive technologies and innovations in construction. The application of combined building systems suited to specific urban conditions and the capabilities of the industrial base, using local material resources, as well as industrial waste.

3. The introduction of new architectural, engineering and developing bionic forms for the development of hard-to-reach surfaces of the earth as well as extraterrestrial spaces using new techniques and tools unknown to modern physics.
For the full implementation of these tasks, effective organization and management of the complex arrangement of the territories of settlements is necessary. The main directions and tasks of the organizational and economic level, covering all the above levels, can be the following:

1. Scientifically-methodical substantiation and maintenance of complex formation of settlements with allowance for valuable and investment-attractive territories.
2. Coordination of design issues of the architectural environment with strategic planning and the solution of social and economic problems of urban development, effective management of the creation and implementation of projects for the arrangement of territories.
3. Creation and maintenance of effective cooperation of the public and private sectors in the process of development of settlements with full participation of all stakeholders and large-scale attraction of private capital on mutually beneficial terms for both local authorities and commercial structures [5].

Of course, in one article, you cannot illuminate these critical problems in building an architectural environment. Each of the positions outlined above may be the subject of discussion.

3. Conclusions
A comprehensive review and structural analysis of diverse current conditions and all impact factors that lead to the sustainable design provided in this article are important for proper understanding of the phenomenon of architectural environment as a system and can be used more effectively for further research and creation of various concepts, models and multi-level matrix’s, as well as for the design and development of urban recreational facilities and objects, that will be useful for both the theory and practice of architecture.

Such methodological approach will help to create a holistic view of the creation architectural environment, will allow to systematize existing knowledges and concepts, practices and prospects of the means and methods of its formation and development.

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