Formation of the actual typology of urban multi-apartment dwelling based on the principles of minimalism and autonomy of residential complexes

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Abstract. This article examines the ways of forming the current typology of an urban multi-apartment dwelling based on the principles of minimalism and autonomy. The purpose of this study is to identify in the design of residential buildings that meet the principles of minimalism and autonomy. The main result of the study is the analysis of domestic and foreign experience in the design of multi-apartment urban housing and residential environment, taking into account the principles of minimalism and autonomy. The significance of the results obtained for design practice lies in expanding the range and possibilities of forming new solutions for multi-apartment urban economy, taking into account all factors.
Keywords. Urban multi-apartment building, minimalism, urban dwelling, development prospects, autonomy, residential environment, urban lifestyle.

1 Introduction

The modern city is a unique dynamically developing phenomenon. Urban residential environment is the main type of architectural environment that is in constant development and continuous change. The city is changing and the idea of urban dwelling and the requirements for it are changing. It is advisable to consider the formation of an actual typology of urban dwelling from the position that such a dwelling is a part of the general system of dwelling in the city. The appearance of any house or complex is a contribution to the creation of the planning structure of the urban fabric and urban environment.

The image of a modern citizen inhabiting the largest cities today is a mobile person who adheres to the ideas of conscious and rational consumption of resources and carefully treats the environmental situation in the world [1]. He is able to settle for less, if it does not deprive him of comfort and a high-quality lifestyle. A modern urban dwelling must meet exactly these requirements.

Studies are dedicated to the analysis of modern urban dwelling consider the current situation in the housing market and existing problems, but do not fully consider the formation of a new typology as a way to solve them [2-8]. Within the framework of this study, works related to housing intended for young urban residents are interested in [9-13].

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Analysis of the current situation in the domestic housing market allows to conclude that today the design and construction of urban housing is limited by the uniformity of architectural and planning proposals that do not take into account the needs of the dwelling dweller. The projects of residential complexes do not include modern technologies in the field of systems for providing urban housing that are in demand today, which can lead to a decrease in utility costs and construction costs, which, as a result, can help solve the problem of housing affordability for the population with an average income [14-16]. As a result, we see examples of mass and one-time development throughout our country with apartment buildings of the same type, with monotonous facades using cheap materials. This problem is relevant today.

As a proposal for a solution to this problem, the article describes the formation of a new typology of urban multi-apartment housing based on the principles of minimalism and autonomy of residential complexes. The principles of minimalism and autonomy are a timely response to the changing needs of the modern consumer of urban housing [17-20]. The design of residential buildings using the maximum environmental potential allows creating not only a comfortable external urban environment but also increases the energy efficiency of dwellings [21-26]. Both principles are directed at reducing consumer spending on the purchase and maintenance of a home, while taking into account the principles of sustainability of the architectural environment.

2 Methods

The methods of this research are the study and analysis of literary sources, Internet resources and design materials of modern apartment buildings. The authors carried out a comparative analysis of domestic and foreign modern residential complexes through the Internet sources. In addition, architectural competitions were considered in the field of housing design. For example, «Tiny house 2020», «Micro housing 2019», «Tiny house design competition 2017» are just a few of the competitions held over the past few years. Such competitions are directed at designing independent micro-modules for housing, but the study of their main architectural and planning solutions allows you to identify the main techniques in the design of minimized housing and use them in multi-apartment design.

2.1 The principles of minimalism and autonomy

The principle of minimalism of residential buildings implies minimization of costs and time for construction, minimization of residents' expenses for subsequent living and minimization of residential units that are part of a residential complex [14].

One of the most popular methods for minimizing living space is the vertical. Differentiation of the room in height allows to introduce spatial contrasts into the interior and to reduce the area of the residential unit. In addition, the development of apartments at different levels makes it possible to arrange a gallery or corridor pass way structures, which reduces the number of auxiliary and communication areas in the building.

The next way of minimizing residential units is to increase the width of the apartment building. It means that the deeper the building, the more square meters it consist within the same length and with the same area of apartments) and the more economical the construction and operation of the house.

Ways of reduction are also applied for the size of the equipment used inside the apartment in order to minimize the area of residential units. For example, placing a sitting-bath or shower cabin instead of a full-fledged bath allows reducing the area of the combined bathroom. There is variant for a maximum reduction in the area of the combined bathroom is the device of a bathroom with a shower and a ladder in the floor. In addition to plumbing fixtures, kitchen

equipment is often reducing in size. The device of a kitchen niche today is relevant not only when equipping minimized apartments, but also when designing full-fledged apartments.

Analysis of foreign experience in apartments designing revealed that often the hallway is completely excluded in minimized apartments. The expulsion of the hallway allows to reduce the area of the apartment by several square meters and to make some zones multifunctional. Therefore, the hallway can become a single space with other rooms, for example, a living room or a kitchen. The use of this way in Russia is inappropriate, since a «dirty zone» is required at the apartment entrance because of the multi-season climatic conditions.

The above ways allow reducing the area of a residential unit to the required minimum. To one degree or another, they are founding in modern practice in a variety of projects, but it is their combination, that makes it possible to minimize the entire apartment as a whole.

The minimalism of a residential complex is understood as a set of ways that reduce the number of apartments or families in a residential complex and the cost of an apartment or square meter. Cost reduction can be achieved by a rational size of plots, a decrease in the number of storeys in residential complexes and an increase in the density of the existing urban development. Dense urban middle- and low-rise houses in combination with the existing ones have certain advantages and allow to regulate the population density, to make better use of the terrain and better take into account the requirements of insolation of buildings. Low-rise houses promote opportunities to the volumetric-spatial solutions, the silhouette of the district, and contribute to the formation of more comfortable architectural spaces.

In addition, a distinctive feature of a minimalist residential complex is the presence of shared premises. The presence of such premises in the building allows redistributing the areas used by residents between apartments and shared premises. For example, a shared laundry room or shared storage rooms will allow residents not to overload their apartments with unnecessary equipment and furniture. Moreover, such premises contribute to favorable social relations between residents – collective free-use premises can be used as meeting place for communication of people with interest, or as a nursery for children living in the residential complex.

It should also be noted the possibility of using prefabricated buildings and environmentally friendly materials in minimalist residential complex. The use of prefabricated construction allows to minimize construction time, reduce the noise level during construction (which is important for construction in the central part of cities) and makes it possible to carry out the gradual construction of a residential complex. The use of environmentally friendly materials – such as wood or compressed straw – significantly increases the building's energy efficiency index, which can enable residents to reduce their utility bills [15]. Therefore, wooden houses consume only 65 kWh per m^2 per year, while in the central zone of Russia in brick houses, heating consumes 130-150 kWh per m^2. In addition to energy saving, construction from such materials also meets the requirements of quick erection and efficiency – according to Swedish experts, the construction of wooden multi-storey buildings is 5-20% cheaper.

The minimization ways described above can reduce the costs of residents, while not depriving them of their comfort and quality of living.

The principle of autonomy of a residential building implies design and construction for operation regardless of infrastructure, utilities and engineering networks. The principle of regulated autonomy of a dwelling assumes the relative technological, planning, constructive independence of the dwelling and its elements from neighboring dwelling cells at various levels. Accordingly, the autonomy of the dwelling can be realized not only in the engineering plan, but also in the architectural and planning. It is necessary to consider the urban dwelling not as a separate building, but as a territorial unit or residential complex. It should be self-sufficient in terms of engineering provision of living conditions for a certain number of apartments or families, as well as create the possibility of ensuring the life of the residents of the residential complex, as a community functionally and socially [16]. The principle of

autonomy of urban dwelling implies the position of residential complex in the structure of the city, as well as the specifics of the needs of various categories of families.

The principle of autonomy in the typology of urban dwellings can be manifested in various solutions. First of all, it is independence from engineering networks – we are considering the possibility of designing a residential complex not related to infrastructure – with electricity and gas networks, municipal water supply systems, wastewater treatment, storm sewers. Energy efficiency is one of the components of autonomous modern urban housing. Moreover, the use of energy-efficient technologies in the design of residential buildings can significantly reduce the cost of utility bills for residents [17-20]. Thus, the use and accumulation of renewable energy, passive energy saving due to natural lighting of the building, heat preservation using thermal insulation materials and special glazing, and the reuse of rainwater can allow residents to save up to 25% on utility bills [21-22].

The possibility of ensuring autonomy is directly related to the design features of a residential building, including the number of storeys in buildings [23]. A block-section layout is used, in which block-sections are apartments, structurally and according to engineering networks, representing an independent module; apartments are not connected horizontally with adjacent apartments, but are connected with vertical and higher risers. It makes it possible to assemble sections from different modules-apartments, as from puzzles, change the ratio, the composition of apartments of different types. Each residential cell should be relatively autonomous and, in the event of refurbishment or the need for repairs, not affect the neighboring ones. A low-rise building, in contrast to an apartment in a multi-story building, has more flexibility, has the potential for transformation and an increase in area.

The urban planning position of a residential complex also affects the degree of possible autonomy. Dwelling in this case should be considered as a living environment, as an integral formation, consisting of a residential building and the territory on which this building is located. For the urban lifestyle, service facilities are needed to provide residents with food, goods and create conditions for full-fledged life in the immediate vicinity of the dwelling – shops, restaurants, cafes. It seems that the degree of autonomy for residential complexes located in different zones of the city will depend on the location of public places, places of trade and work. For a comfortable lifestyle of residents in residential complexes, it is necessary to strive to ensure a different degree of autonomy for their functioning. So for the peripheral dormitory district to increase the autonomy of the living environment, it is necessary to place premises in the residential complex for collective residents use – sports hall, exercise equipment, a swimming pool, a kindergarten. As well as business centers, enterprises, small business offices, recreational facilities – these are public areas, service facilities, recreation and business activity. They can be located in premises in the structure of a residential complex, but intended for sale or lease for business and located with entrances from city streets. This will make it possible to change the lifestyle of the inhabitants of dormitory districts with their poor service infrastructure and underdeveloped urban open spaces. This is the path to the formation of a pedestrian city. The environment of the streets will change and pedestrian character will appear. The orientation of the urban environment will focus on the design of public spaces, squares, parks and courtyards. This will lead to a decrease in the level of motorization; emphasis will be placed on the development of cycle paths and public transport.

3 Results

Thus, the main directions of ensuring the autonomy and self-sufficiency of residential complexes are independence from engineering networks, energy efficiency, design features of the building and specificity, which takes into account the territorial location in the city structure. The main directions of achieving the minimalism of residential complexes are: architectural and planning solutions of apartments, which allows to reduce the area; the presence in the

residential complex of shared premises, allowing to redistribute the areas used by residents in their apartments and shared premises; the use of prefabricated construction; the use of materials and equipment, that meet environmental requirements and energy efficiency.

4 Discussion

The principles of minimalism and autonomy that we have considered are the timely response to the changing needs of the modern city dweller. Still, they have significant differences, since they are aimed at different social scenarios of lifestyle. When we speak of a minimalist housing, we mean a young city dweller in need of his first or temporary house. Of course, this format of housing construction does not imply the residence of family people who need constancy and stability. Minimalist housing can be a great launching pad for a young urban dweller living alone or as a couple. An autonomous residential complex with smart automated systems can suit both a young couple and a full-fledged family who prefer high quality and comfortable housing.

There are already successful projects of a multi-apartment residential building with the maximum use of energy-efficient technologies and with a certain degree of autonomy from the networks abroad. For example, Hanover Olympic apartment building of the TCA Architects in Los Angeles was implemented, which has zero energy consumption. The building does not need to be connected to external networks - it consumes the electricity that it generates itself, in some cases the generation volumes even exceed the norm. Electricity is generated by solar panels on the roof, the energy consumption of the heating and ventilation system is reduced.

In Russia, the Skandi Klubb residential complex of the Swedish company Bonava in St. Petersburg has also been implemented using energy-efficient solutions such as an automated water and electricity metering system, a heat recovery system, thermostatic elements on heating devices, water-saving sanitary equipment and energy-efficient lamps. Reducing power consumption. During the construction of the facility, environmentally friendly construction and finishing materials were used, and special places are equipped in the parking lot of the residential complex with the ability to charge electric vehicles. As a result of the solutions applied, the energy efficiency of the facility in comparison with the basic building model according to the 2007 standards was 40.2%, and the decrease in the cost of operating costs was 32.4%. All this allows residents in our climatic conditions to reduce costs and have affordable housing.

Architects should use materials for facades that ensure the energy efficiency of the residential complex, taking into account the aesthetic features. For example, in practice, fiber cement panels are often used for facades now. They combine a modern, practical and environmentally friendly cladding material consisting of lightweight concrete. The outer ceramic layer of the slab has different textures and colors, which gives room for architectural solutions. The large glazing area allows you to receive additional heat due to solar radiation and a maximum of natural light penetrating into the apartments.

5 Conclusions

Highlighted by the priority areas of the housing system in our country based on the concept of forming a typology of the urban population. The time has come when it is necessary to take the next step in solving a new urban architecture, to give new qualities for architectural and engineering solutions, to ensure effective functioning, taking into account the principle of autonomy. The territorial location in the structure of the city is also the financial affordability of housing and living in it for various families. Affordability implies easing the economic problems of purchasing an apartment, the ability for families to solve their housing problem quite quickly. The goal of affordable, self-contained housing is to give every family an enriching lifestyle a better quality of life. These are various forms of leisure, obtaining

spaces for the communities of different generations, which also implies a revision of standard typologies of residential buildings in general and the use of energy-efficient and resource-saving technologies and materials.

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