

# The influence of architectural decisions on improving the economic efficiency of development projects

*Maria Bovsunovskaya*<sup>1,\*</sup>

<sup>1</sup>Moscow State University of Civil Engineering, Yaroslavskoye shosse, 26, Moscow, 129337, Russia

**Abstract.** With the changing approaches to the development of territories and the emergence of new legislative initiatives in the Russian Federation, approaches to the implementation of housing development projects become fundamentally different. The previous development model, which is focused solely on the interests of the developer and supported by unsatisfied demand for housing in the post-Soviet period, ceases to work, which necessitates the search for new approaches to the construction business and ways to increase the economic efficiency of investment housing projects. The paper is devoted to the study and systematization of architectural decisions of various levels, which can be taken into account by developers in housing projects in order to increase economic efficiency.

## 1 Introduction

In the context of changes in the social and economic structure of citizens: their high concentration and desire to live and work in large cities of the country (about 70% of the country's population is concentrated in Russian cities), approaches to the development of territories are radically changing. In this regard, new legislative initiatives, scientific and empirical studies appear. As a result, there are new targeted programs of different levels of the entities of the Russian Federation, which are aimed at identifying their place, goals and objectives of the development of productive forces, the establishment of a new technological structure of cities, as well as the restructuring of economic relations of entities of the urban economy [1.9].

A development project within the city is part of the program for its development as a whole. Like a puzzle, development projects fill the necessary cells in the structure of the city: residential, public, industrial. The capitalization of such a project is determined by giving liquid market properties to the construction project and, in the future, to the real estate project. The development project for the creation of residential real estate conceals the potential of future opportunities for residents and visitors of the city to implement vital, social, economic, industrial, and other initiatives and relations.

It is possible to take into account the potential for capitalization of residential real estate by improving the properties of the object at the stage of pre-design studies and design. The

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\* Corresponding author: [saltmasha@mail.ru](mailto:saltmasha@mail.ru)

city environment designed by the architect is the path to its sustainable innovative development, the accompanying effect of which is to meet the prospective needs of potential real estate consumers, i.e. residents of the city.

Objective complexity lies in the traditional understanding of the multidirectional interests of the architect and developer (investor) of the project. It is generally accepted that the interests of the developer (investor) and the architect are oppositely directed: in an effort to create an aesthetically expressive appearance of buildings, the architect cannot positively influence the solution of the investor's main task (to maximize profits). However, in modern conditions, in the development construction project, the developer and the architect simultaneously have a set of tasks, synchronizing the solution of which, the architect and the developer can achieve capitalization of the construction projects.

## 2 Materials and methods

*Conventionally, architectural decisions can be divided into two levels:* during the design of territories (by making urban planning decisions) and during the conceptual study and design of an object as part of a specific development project.

*Architectural decisions of the first level* should be aimed at developing the urban and social environment, as well as improving the quality of life: the current and potential needs of residents and visitors of the city should be taken into account (infrastructure, housing, industry and production) [2,4]. Unconditional complexity is that this is not about empty space, but, as a rule, about a densely populated city with its own way of life. The following priorities are identified at the state level: creating mechanisms for the development of a comfortable urban environment, integrated development of cities and other settlements, taking into account the urban environment quality index. At the same time, in practice, morally obsolete neighborhoods that meet Soviet standards, as well as post-Soviet trends in urban planning, are continue to be designed in the cities: fragmentary adjustments are made to the development of general plans, and urban development with multi-story residential districts without adequate infrastructure and without taking into account the socio-economic behavior of the townspeople is noticed. Nevertheless, new trends are being consolidated: the reorientation of mass construction to integrated approaches to the design and development of residential areas, the formation of an effective strategy for spatial and territorial development of the urban environment and urban real estate [2,3,4]. When forming such a strategy from the point of view of architecture, the following decisions can be distinguished, which in the long term affect the capitalization of housing:

**1. Search for a consensus of interests of all interested parties in the design, construction and operation of residential neighborhoods and the new urban environment** (residents, city authorities, developers, representatives of industry, culture, etc.). A compromise between the desire of developers and the plans of the authorities regarding the development of the city with residents is possible by participating in the *formation of a concept for the development of the city and a comfortable urban environment*. So, for example, the projected residential microdistrict near industrial areas may be comfortable for the employees involved in the production of the technopark [7].

**2. Search for relevant areas for new housing, if necessary, restructuring of existing urban real estate.** The classic issues of urban planners are how to strategically manage the urban environment, how to synchronize the interests of residents, providing them with the opportunity to live, work, and study comfortably, how to take into account the migration component, etc. On the one hand, it is necessary to take into account the preservation of cultural traditions and the identity of the territories. On the other hand, it is necessary to maximize its potential (for example, redevelopment of industrial zones with the subsequent development of territories). Consideration of the transport component is important: in the

last decade, with the transition to block development instead of infill in large cities, residents are faced with the phenomenon of “infill by block”, when a well-designed block is not included in the general city network, city highways can’t cope with the increased flow of cars and residents.

**3. Consideration of standards for the development of territories, including foreign experience in urban planning.** Along with safety standards and standards of density characteristics (density of residential buildings and population density), the projects should take into account the connection of residential buildings with public spaces, potential life scenarios of citizens: jobs, coworking, educational environment, etc. It is possible to alternate building density. For example, high-rise detached multi-apartment residential buildings can be alternated with blocks of blocked houses. In this case, there will be achieved the same density indicators as with standard homogeneous development, but the aesthetic expressiveness of the microdistrict, privacy of courtyards, and variability of residential objects will be achieved.

Nowadays, at the legislative level of the Russian Federation (the Ministry of Construction of the Russian Federation), a standardized base for the integrated development of territories is being actively developed (and is planned to be completed by 2021), the main areas of which are: the development of free territories for housing construction, the development of territories of residential and multifunctional buildings, landscaping open public spaces. The principles of the new Standard include: functional diversity, compact and dense development, safety and health, comfort of movement, comfortable housing. The standard includes a set of principles for the integrated development of urban areas, a standard for the development of built-up territories, a standard for the development of free territories, a standard for the city’s appearance, a guide for developing projects, a guide for implementing projects. The standards are designed to make the use of land for construction more efficient, taking into account the distribution of transport and engineering infrastructure [8].

Thus, specific development projects in the field of residential real estate with a high capitalization potential are related to the interests of the city (in terms of implementing programs for restructuring the urban space and sustainable development of the city, achieving a decent standard of living for citizens and social development, for example, a renovation program in Moscow), interests of the architect (in terms of realizing creative potential), interests of residents (in terms of comfortable living), interests of small businesses (in terms of function development and maintenance of new neighborhoods, for example, commercial institutions on the first or second floors of residential buildings), and finally, the interests of the developer.

*At the second level of architectural decision-making* (during the conceptual development and design of the object as part of the implementation of a specific development project), ready-made, carefully-designed solutions in the field of housing construction may be of interest to developers. Such solutions significantly save the cost of design and construction of objects. So, in Moscow, there are about 40% of panel-type new buildings. In this regard, the technologies of modern standard series of panel residential buildings (for example, the DOMRIK and DOMNAD series on the basis of DSK 1, PIK panels, etc.) and the criteria (requirements) for them developed by the Moscow Architectural Council under the leadership of the chief architect Sergey Kuznetsov deserve special attention:

- variation in the number of floors of the building, which allows creating a comfortable environment within the framework of a residential area (the possibility of variable number of floors in sections should be provided, technological possibility of building sections from 6 to 17 floors should be provided);

- planning solutions (providing the possibility of organizing free planning inside the apartment; ensuring the possibility of organizing several types of typical floors within one section; developing planning options for corner sections);
- a variety of facade solutions, forming a comfortable living environment with a variety of facade solutions within one section (providing facades with architectural expressiveness and a variety of facade plasticity (including corner sections); availability of space for air conditioners in the plane of facades in order to preserve the architectural expressiveness of facades; developing options for finishing facades);
- urban planning competence of the block (providing the possibility of placing sections with a shift relative to each other);
- open comfortable public spaces along the construction front, including trade and service enterprises with direct entrance from the street to the first floor, providing a comfortable and safe environment.

### 3 Research results

Based on the study of existing urban planning solutions, as well as existing approaches to projects of mass series of residential buildings, the developer develops his own project concept. The developer's interest is to conduct effective activities in the implementation of investment projects, to achieve the planned performance indicators of the project and, as a result, its capitalization. One of the approaches to assessing the appropriateness of the participation of an investor (developer) in a project on the construction of a residential property is traditionally considered the calculation of the economic valuation of investments [5,8]:

$$NPV = -IC + \sum_{t=0}^N \frac{CF_t}{(1+R)^t}, NPV \tag{1}$$

where  $NPV$  – Net Present Value;

$IC$  – Invested Capital;

$N$  – the number of periods (months, quarters, years) for which the estimated project must be calculated;

$t$  – the length of time for which it is necessary to calculate the net present value;

$i$  – the estimated discount rate for the estimated investment option;

$CF_t$  – expected cash flow (net) for a specified time period.

$$CF_t = Rt - Ct \tag{2}$$

$Rt$  – results (receipts) in the period of time  $t$ ;

$Ct$  – costs (expenses) in the period of time  $t$ .

From the point of view of formulas (1,2), the potential income of the investor can be increased as a result of measures in three main areas:

- minimization of costs (actually the net cost of the object) of the investor without loss of quality of the constructed object;
- increase in investor's income (result) at each step of the project;
- reduction in operating costs.

**Table 1.** Ways to increase the economic efficiency of a development project by choosing a rational architectural decision.

Way to increase income	1. Minimization of costs (net cost) of the investor without loss of quality	2. Increase in investor income (result)	3. Reduction in operating costs
Indicator	↓ IC	↑ Rt	↓ Ct
<b>Description of the area of architectural decisions</b>	Rational design decisions in the choice of building parameters (length, sectioning, number of floors, building depth, room size, layout of the staircase and elevator unit); the choice of economical structural schemes, structures, materials.	Response to demand, accounting for rational urban decisions, choosing the functional purpose of an object, choosing an object class: taking into account the location and infrastructure factors, designing common areas, rational planning decisions of premises.	Consideration of energy efficiency technologies in design as a factor in saving operational costs.

From this point of view, the developer, together with the architect, already at the pre-project preparation stage can set such conditions for the implementation of the project under which current trends in the field of architecture of the urban environment and housing construction will be taken into account, as well as the investor's interest will be preserved.

*Minimizing the cost of construction* (formula 1) can be achieved by the following areas of architectural decisions:

**1. Choosing the optimal space-planning solutions for residential buildings for a particular project.**

Despite the minimum amount of actual and calculated data on the parameters of the future object at the pre-design stage and the need to use insufficiently accurate aggregated cost indicators, in order to increase the economic efficiency of the project, it is possible to operate with ratios of the quantitative parameters of the building at architect's disposal. This possibility is caused by the objectively existing relationship between quantitative ratios and economic value indicators of the completed project. In multivariate design, one of the ways to assess the rationality of floor planning is to compile area balances, based on which space-planning coefficients are calculated (planning, volumetric, compact, constructive, non-apartment coefficients), which allows choosing or constructing the most economical option without violating the architectural integrity of the structures.

**2. The use of modern structural layouts, structures and materials.**

At the legislative level, it was noted that in the implementation of modern projects in the field of housing construction, it is necessary to modernize the construction industry and improve the quality of industrial housing construction, including by setting restrictions on the use of outdated technologies and stimulating the introduction of advanced technologies in design and construction. Nowadays, there is a variety in the choice of available materials, structural layouts (frameless, frame; monolithic, panel, etc.). The desired relief and geometry of the facades can be achieved, for example, by using prefabricated elements made of fiber cement, concrete and ceramics.

**3. Choosing economical parameters of residential facilities.**

Despite the abundance of the proposed modern solutions in the field of design and construction, many developments for achieving the economical parameters of residential buildings have been relevant since Soviet times: empirically, ways to reduce the cost of

construction due to the choice of certain parameters of objects were proved. For example, with an increase in the length of the building, the unit cost of the total area decreases, so the cost of the end walls extends to a larger area. The walls located between the sections have a lower cost than the external, as they are not designed for thermal protection. In these houses, the cost of 1 m<sup>2</sup> is 4-8% lower than in single-section buildings if they have the same floor space. With an increase in the number of sections over 6, the decrease in the cost of 1 m<sup>2</sup> slows down, since it is necessary to use port-cochere and passages, as well as temperature and sedimentary joints [6,7].

**Maximization of investor income** is achieved mainly by architectural decisions that are subjective in nature. That is, it is an assessment of a construction project (real estate) by a potential buyer due to its competitive advantages and the marketing strategy of the developer. Competitive advantages through architectural decisions can be achieved by following modern global trends in the design of not just housing, but a comfortable living environment:

### **1. Variability of design solutions and creating a comfortable environment.**

The buyer should have a choice of architectural solutions for facades, floors, the layout of sections, and the layout of the apartment. From this point of view, the designed residential districts and houses should be diverse. In this case, it will naturally focus on the location of the object: the current presence (or in the future) of the city district, transport, educational institutions, enterprises, etc.

It is necessary to take into account the current trend of living not only in high-rise buildings, but also in the so-called Human-sized buildings (houses with a height of 7-9 floors). Such number of floors is considered commensurate with the scenario of the urban environment.

Special attention is paid to the design of public spaces: both common areas at the entrances and landscaping of courtyards.

### **2. Functional planning decisions.**

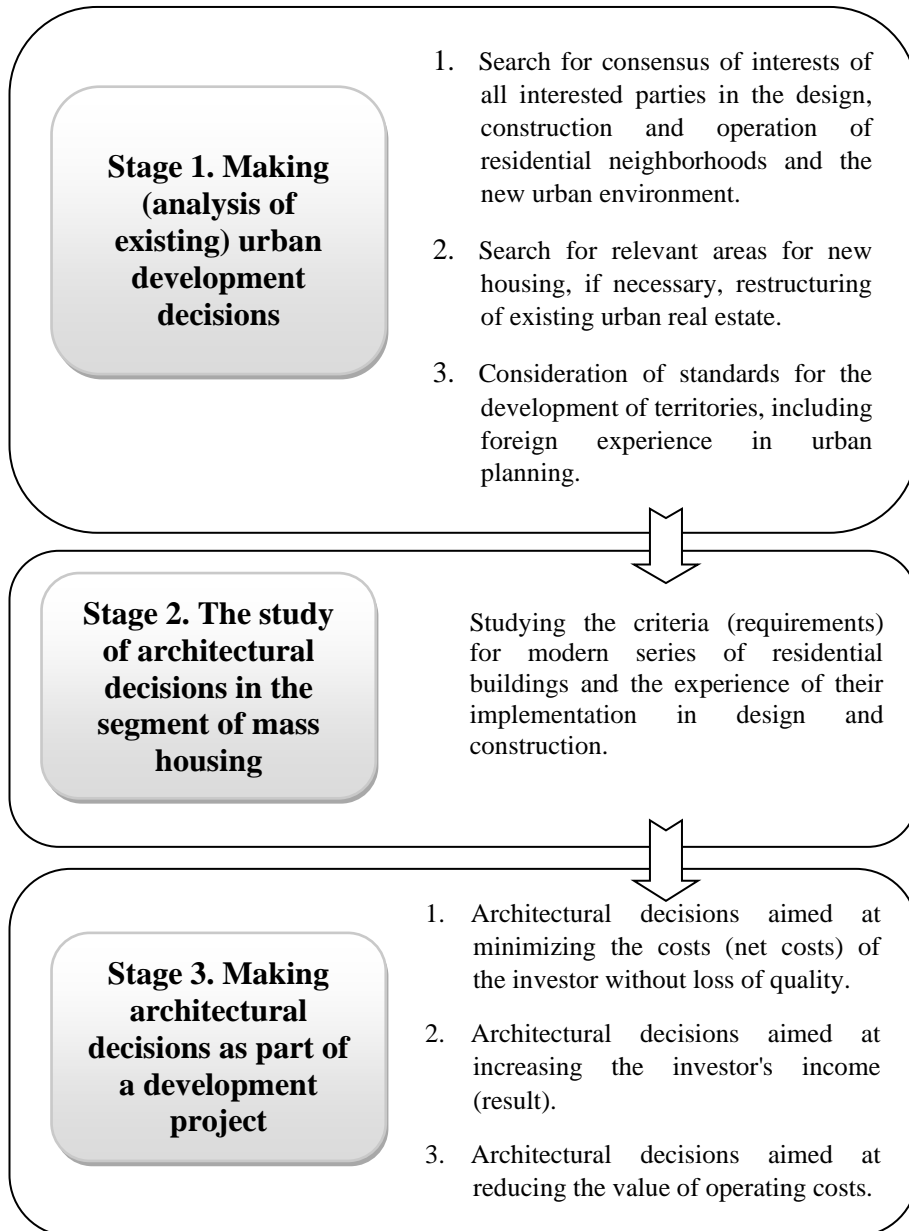
Housing should be modern and meet the needs of citizens. When designing, it is important to consider possible scenarios of the life of residents and visitors of the city: to provide solutions for living spaces both for large families (with a large number of bedrooms and bathrooms), and for students and specialists (studios and small one-room apartments). There is a tendency towards an increase in spaces for communication and cooperation, hence the design of large kitchen-dinner. The ability to quickly change the functions of space should also be taken into account in the project: for example, the possibility of re-planning a large kitchen-dinner (with two or more windows) into a kitchen and a nursery.

### **3. Accounting for classes of objects.**

Designing objects not lower than comfort class. It is necessary to take into account the characteristics of the class of real estate and its correlation with the selected location of the object, infrastructure and potential demand.

**Lower operating costs** can be achieved due to the design and use of modern equipment, external and internal networks of the building, preventing potential losses of heat, electricity, water and minimizing the amount and cost of their use. So, for the feasibility study of the efficiency of heat and energy costs, the following are needed: innovative technologies for the use of heat energy metering devices, measures to sort tariffs and energy consumption rates, optimize network performance, and the use of high-quality heat-insulating materials [7].

Areas of architectural decisions to improve the efficiency of a development project in housing construction are presented in Figure 1.



**Fig. 1.** Areas of architectural decisions for improving the efficiency of a development project in housing construction.

## 4 Conclusion

The identified areas of architectural decisions in the field of housing destroy the stereotype of the oppositely directed interests of the developer and the architect. The role of the architect in the modern development project becomes prevailing: its rational and reasonable decisions based on modern standards, experience in implementing similar projects in Russia and abroad, and also high professionalism make it possible to increase the effectiveness of development projects.

The study also allows suggesting the main areas of further studies. Among them: clarification and detailing of architectural decisions in the identified areas; the author's methodological approach will allow quantifying their impact on the economic efficiency of housing development projects in the future.

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