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NEW APPROACH TO DESIGNING MULTIFUNCTIONAL RESIDENTIAL BUILDINGS

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Abstract. This article analyzes foreign and domestic experiences in designing modern multifunctional residential complexes and buildings, focusing on creating a self-sufficient environment and functionally convenient space capable of integrating apartments, commercial facilities, social infrastructure, and recreational areas.
The lack of a unified approach to designing such facilities and the need to develop a concept for their creation in Uzbekistan are highlighted. Positive aspects of multifunctional buildings are identified, including improved living conditions, reduced transportation burden, efficient use of urban land resources, and enhanced safety. Noted drawbacks include high construction costs, overloaded service infrastructure, and increased risk during emergencies. A new approach to designing multifunctional residential buildings, aligned with sustainable urban development principles, is presented.
Keywords: multifunctional residential building, social infrastructure, open functioning system, closed functioning system, self-sufficient environment, service system, comfort level

INTRODUCTION

The modern urban environment of Uzbekistan is currently undergoing significant changes. This is due to major challenges arising from rapid population growth in large cities, the increase in private car ownership and resulting traffic congestion on major roads, and the reduction of green spaces. These factors, in turn, lead to a decrease in the comfort and safety levels for residents. In light of this, developing a concept for designing modern living environments aimed at meeting the social needs of the population, ensuring safety of life, and maintaining building stability in conditions of a dry, hot climate and seismic hazards is crucial. The most promising approach to addressing these challenges appears to be the introduction of multifunctional residential buildings into urban planning practices. These buildings can combine apartments, commercial facilities, social infrastructure, and recreational areas.

LITERATURE REVIEW

Multifunctional residential buildings, combining apartments with public and business establishments, emerged in construction practice as early as the mid-20th century. Several factors contributed to this development, including the high cost of land for construction, the distance between residential areas and workplaces, and the need to increase the economic efficiency of urban land use. One of the most renowned examples of such a building is the residential complex in Marseille, designed by Le Corbusier and completed in 1952 (Fig. 1). In this house-complex, service facilities (shops, library, café, medical offices, etc.) are distributed throughout the entire height of the building, while recreational areas for residents, a gym, and a kindergarten are located on its roof [1].

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Fig.1. "Unité d'Habitation" (1947-1952), architect Le Corbusier, Marseille, France: exterior view of the building and rooftop structure

For over 30 years, global practice has focused less on constructing multifunctional buildings and more on multifunctional complexes comprising business centers, residential areas, and recreational zones situated on a single plot of land. Although these complexes offered a wide range of service, leisure, and office facilities, by the mid-1980s, their main drawback (large land area) led to a reduction in their physical size and infrastructure levels, as well as a return to specifically multifunctional buildings. New construction projects typically combined three infrastructure levels: parking lots, social and community facilities, and residential apartments [2, 3, 4].

From the late 20th century to the present day, the dominant influence of social factors is clearly evident in the global practice of designing multifunctional buildings. The housing market is sufficiently saturated, population well-being is increasing, and demand for comfortable living environments is growing [5, 6]. When incorporating social and community service facilities, they are preferably allocated to the first two or three levels and the roof of the building (Fig. 2). The buildings themselves are predominantly designed as high-rises, which minimizes the size of the land plot required.

Fig. 2. Multifunctional residential building project

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One of such multifunctional buildings is the Tour Odéon ("Odeon Tower") - a skyscraper in the Principality of Monaco (Fig. 3). The 49-story building has 10 underground levels, which house parking spaces. In addition to residential apartments, the building's structure also includes office spaces, a restaurant, a spa, a fitness center, and a swimming pool [7].

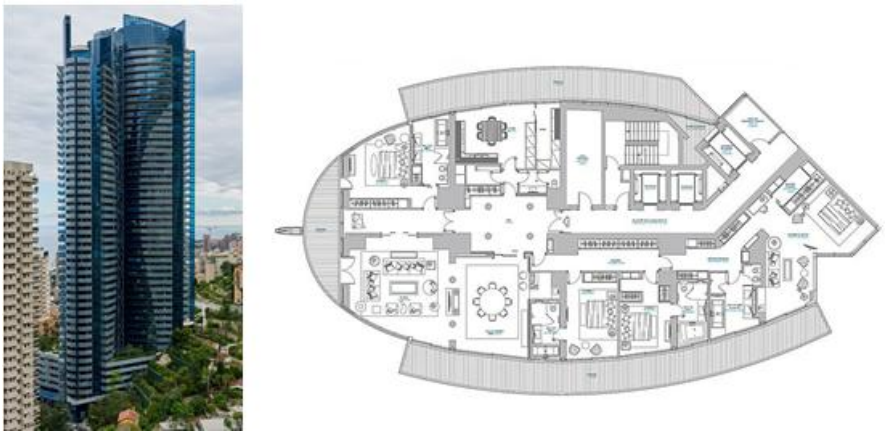

Fig. 3. Tour Odéon, Monaco, 2015:
exterior view of the building and floor plan of the residential area

In Tashkent, the capital of Uzbekistan, the first multifunctional skyscraper, Nest One, has been constructed. It features apartments, guest rooms, conference halls, a spa, a fitness center, a swimming pool, a library, restaurants, a cinema, playgrounds, office spaces, and underground parking (Fig. 4). Public areas are scattered throughout the building's height. For instance, restaurants are located on the 50th and 51st floors, a sports zone on the 28th floor, a fitness center with a swimming pool and spa facilities on the 2nd and 3rd floors, and apartments on the 41st to 50th floors [8]. The building has virtually no courtyard space, which reduces the level of residential comfort [9].

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Fig. 4. Nest One skyscraper, Tashkent, 2023.

At the same time, it seems more rational when designing to use a certain order in the arrangement of rooms with different functions within the building's volume, allowing to achieve a sufficient level of isolation from each other to ensure fire safety requirements, noise protection, and general safety (Fig. 5) [4]. This method is called vertical zoning of multifunctional buildings.

Fig. 5. Rational scheme for placing functional groups of rooms in multifunctional buildings

For example, in the project of the multifunctional residential complex "Leninsky Hills" in the Moscow region (Fig. 6), underground parking lots are located on the 1st and 2nd floors, stores of various types (grocery, clothing, household appliances, and others) on the 1st floor, and a modern children's playground, fitness center, wellness center, and similar facilities on the 2nd floor. A library, educational centers, internet cafes (IT-center), and similar services aimed at educational development and requiring relative quiet have been designed for the 3rd floor. The 4th floor is allocated for company offices and trade agencies. From the 5th floor to the very top floor of the building are residential premises, divided into economy, middle, and premium classes [10].

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Fig.6. Multifunctional residential complex "Hills of Lenin"

In the global experience of designing multifunctional buildings, horizontal and mixed zoning are utilized. One example of the use of mixed zoning is the multifunctional residential complex "Five Stars" in Moscow (Fig. 7).

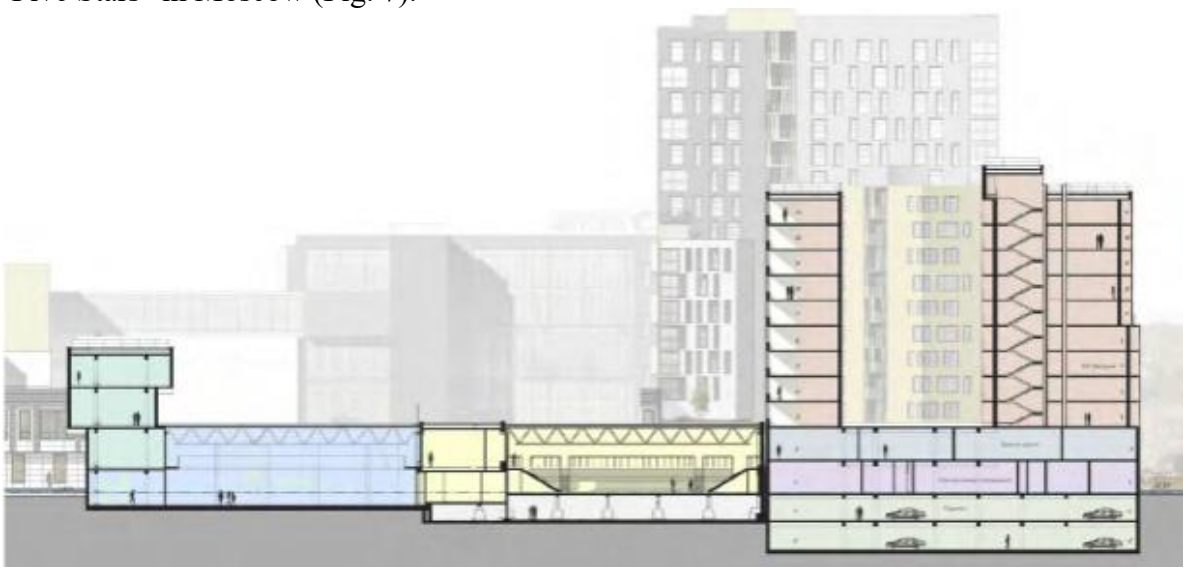

Fig. 7. Longitudinal section of the multifunctional residential complex "Five Stars," Moscow [11]

In addition to residential premises, the complex includes sports and exhibition facilities and a multi-level parking lot.

As the analysis of several multifunctional objects has shown, there is no common approach to their design:

- what should be the composition of premises and the areas of service establishments;
- where and how service groups should be located within the building's volume;
- whether an open or closed type of functioning system is preferable;
- how the climatic features of the construction area should be reflected in the spatial and planning solution of the residential group of premises;
- how the adjacent territory should be developed, etc.

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RESEARCH METHODOLOGY

The study utilized theoretical and practical materials reflecting the principles of designing multifunctional residential buildings and complexes in domestic and foreign practice.

The main research methods adopted were systematic and comparative functional-compositional analyses of design solutions for multifunctional residential complexes.

RESULTS AND DISCUSSIONS

Multifunctional residential buildings and complexes are a response to the complex and unsafe life in megacities. As V. Kuznetsov, Sales Director at RDI, states: "The classic multifunctional complex encompasses a person's entire life, allowing them to save a significant amount of time on city commutes. Here, one lives, works, rests, studies, and engages in sports" [12].

At the same time, analysis of the experience in designing and operating multifunctional residential buildings and complexes has shown that they have both positive and negative aspects.

The positive aspects of such complexes are manifested in the following points.

1. **Convenience and Time Saving**. The main advantage of multifunctional buildings is the concentration of all necessary services in one place. Residents can purchase groceries, receive medical services, engage in sports, use household services, kindergartens, offices, and various other services without going far from home. This significantly reduces the time spent on everyday tasks, simplifies lifestyle, and increases its efficiency.
2. **Reducing transport load.** The availability of services within the complex reduces the need to use private or public transport. As a result, traffic congestion decreases, the load on roads is reduced, and the pressure on the city's transport system is eased. This improves the environmental situation and reduces the amount of harmful gases in the air.
3. **Rational use of urban land resources.** Complexes of this type ensure the effective use of urban land, as they combine several functions in one area. Unlike low-rise, scattered buildings, such complexes allow for vertical development. This contributes to saving valuable urban space, expanding green zones, and ensuring compactness and functionality of city centers.
4. **Increasing social and economic activity.** Trade and service facilities accumulate around buildings, creating new jobs, developing entrepreneurship, and strengthening economic activity. Such areas typically become active centers of urban life. With the increase in population inflow, favorable conditions are created for local businesses, investments are attracted, and the economic environment stabilizes.
5. **High level of security.** Typically, multifunctional buildings and complexes are equipped with modern security systems, including elements such as video surveillance, access control, automatic fire suppression systems, and security services. This allows residents to feel safer.
6. **Development of social integration and community life.** The presence of various service facilities in the complex strengthens interaction between residents. Cafes, sports centers, children's playgrounds, and public areas all contribute to the formation of social ties and the strengthening of good neighborly relations. As a result, the area becomes a socially active, safe, and comfortable place to live.
7. **Availability of modern infrastructure and technologies.** Multifunctional buildings are constructed based on new standards, including high energy efficiency, modern elevators, engineering systems, environmentally friendly materials, and "smart home" technologies. This ensures residents' comfort, efficiency, and safety.

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8. **Improving the quality of living conditions.** These complexes typically include landscaped green areas, recreation zones, children's playgrounds, and wellness areas. This has a positive impact on the psychological and physical health of residents. The proximity of various services, along with a clean and well-organized environment, enhances the quality of life.

Although multifunctional residential buildings are an important product of modern urbanization, their complex functionality can sometimes lead to various negative consequences. Such complexes exert certain pressures on urban infrastructure, the social environment, and the ecosystem. Their main negative aspects are presented below.

1. **High construction costs and economic burden.** Since multifunctional complexes are technically and structurally complex, the costs of their construction are very high. Modern engineering systems, multi-level parking lots, shopping areas, and security systems require increased investment. As a result, housing prices in such complexes become high and unaffordable for broad segments of the population with average income levels.

2. **Increased likelihood of medical and psychological disorders.** This type of residential complex will serve a large number of people, resulting in an increased probability of transmission of various airborne diseases (pneumonia, acute respiratory viral infections, ARVI, tuberculosis, etc.). Additionally, regular noise exposure can lead to the development of cardiovascular diseases [13]. According to medical and psychological studies, the population living in multifunctional residential buildings and complexes showed higher incidences of anxiety, predisposition to diabetes, and suicidal tendencies [14].

3. **Increased population density, traffic congestion, and noise.** The concentration of housing, commerce, offices, and public services in a single area attracts a large influx of people. This leads to traffic jams at the entrances and exits of the complex, as well as on nearby streets. Inside the building, due to the large number of people, there is a decrease in comfort, an increase in noise, and the area is constantly occupied by pedestrian and vehicular traffic, including trucks and service vehicles. All this can negatively affect residents' peace, disrupting nighttime and rest periods. There is a particularly high likelihood that shops and restaurants located on the ground floors will be sources of noise.

4. **Overload of service infrastructure.** Multifunctional buildings simultaneously accommodate residents, workers, and visitors. This increases the load on water supply, electricity supply, sewerage, elevators, security systems, and other engineering networks. If the project is not meticulously planned, and malfunctions and insufficient capacity are observed in the systems, this leads to a decrease in service quality.

5. **Increased risk in emergency situations.** Multifunctionality means that many people are present in the building at the same time. In the event of a fire, earthquake, or other emergencies, rapid evacuation of people becomes difficult. Access roads for fire trucks can also be narrow. If these factors are not taken into account during design, the safety level significantly decreases.

In the Republic of Uzbekistan, the design of such multifunctional buildings is in its developmental stage. Unfortunately, for now, the priority is solely on increasing the profitability of structures. At the same time, there is no apparent justification for decisions made regarding the location of various non-residential premises within the building and the areas allocated for them, or for the planning solutions of apartments considering natural-climatic and national characteristics [15]. Furthermore, the use of an open functioning system in design does not contribute to increasing the level of comfort for residents. Additionally, the impact of multifunctional buildings on reducing the transport load in the city is not noticeable.

In this regard, a new approach to the design of multifunctional residential buildings in Uzbekistan's cities is proposed, which consists of the following provisions:

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1. Design a multifunctional residential building as a self-sufficient environment for residents, while calculating public spaces (determining their composition and areas) based on the current urban planning standards SHNK 2.07.01-23 "Urban Planning for Development and Construction of Settlement Territories."
2. The number of floors in a multifunctional building or complex should be determined based on a technical and economic feasibility study for a specific city, taking into account its physical and geological features.
3. When developing layout solutions for apartments, consider the experience of traditional Uzbek architecture, as well as the requirements of SHNK 2.08.01-05 "Residential Buildings," including the provision of summer rooms.
4. The composition and number of apartments should be determined based on the socio-demographic characteristics of the construction area.
5. Design a multifunctional building with a mixed functioning system - for commercial premises and offices located on the lower floors, organize entrances from the street side (open functioning system); for apartments, school and kindergarten facilities, playgrounds, and sports halls - access should be only from the inner enclosed courtyard or through internal communication routes (closed functioning system).
6. Create green recreational spaces, placing them in a buffer zone between residential and public premises, on the roof of the building, as well as sparsely on floors between apartments or adjacent to apartments.
7. The structural design of the building must meet the requirements of seismic resistance, energy efficiency, and environmental friendliness.
8. It is mandatory to create multi-level parking for personal vehicles that fully meets the needs of residents.
9. The area of the adjacent territory and its equipment should be determined based on SHNK 2.07.01-23 "Urban Planning for the Development and Construction of Territories of Settlements."

CONCLUSION AND RECOMMENDATIONS

Thus, a multifunctional residential building should correspond to the socio-demographic composition and lifestyle of the population. Its size should be justified by technical and economic calculations, and the number of infrastructure levels by the real needs of residents. At the same time, it is necessary to find a balance between public and commercial zones to ensure the construction is cost-effective.

Moreover, the most important aspects of designing multifunctional residential buildings remain ensuring the seismic resistance, fire resistance, and durability of the structure, environmental friendliness, ensuring compliance with noise protection, insolation, and ventilation standards, as well as energy efficiency.

The research is of interest for improving the spatial planning solutions of multifunctional residential complexes, as well as for understanding their role in modern society.

LIST OF REFERENCES

1. Architecture Classics: Unite d'Habitation / Le Corbusier. URL: https://www.archdaily.com/85971/ad-classics-unite-d-habitation-le-corbusier
2. Smolnikova, V. T. Multifunctional residential complex - a new type of modern comfortable housing / V. T. Smolnikova // Master's Journal. - 2024 - No. 1 - Art. No. 17

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 12,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

3. Multifunctional Building: Definition, Advantages & Benefits URL: https://www.blue-id.com/en/blog/multifunctional-building
4. Dubinin N.V. Architecture of Multifunctional Buildings and New Construction Systems // Housing Construction. - 2014. - No. 5. - pp. 63-66.
5. Compositional Rigidity URL: https://archi.ru/russia/69203/kompozicionnaya-zhestkost
6. Vuscan, S.; Muntean, R. Multifunctional Homes: A Sustainable Answer to the Challenges of the Future. Sustainability 2023, 15, 5624 URL: https://www.researchgate.net/publication/369500004_Multifunctional_Homes_A_Sustainable_Answer_to_the_Challenges_of_the_Future
7. The ultimate home, in the ultimate setting URL: https://www.odeon.mc/en/index.html
8. The country's first skyscraper URL: https://uza.uz/ru/posts/pervyy-neboskreb-strany_539653
9. Gordiyenko L. V., Nagapetyan K. S. Research on the features of planning the territory of a high-comfort residential complex // Engineering Bulletin of Don. 2020. No. 5. URL:ivdon.ru/ru/magazine/archive/N5y2020/6470.
10. Multifunctional residential complex "Leninskie Kholmy" URL: https://stroy-mosreg.ru/projects/leninskie-kholmy
11. Multifunctional Complex "Five Stars" URL: https://archi.ru/projects/russia/10935/mnogofunkcionalnyi-kompleks-pyat-zvozd
12. 12. Derivative of the megapolis URL:
13. https://www.kommersant.ru/doc/3694249
13. Kardash O.F., Kardash G.Yu. Noise has a harmful effect on the cardiovascular system of workers // "Labor Protection. Safety Technologies"; electronic resource: otb.by. https://www.kiout.ru/info/publish/25861
14. Robert Gifford. The Consequences of Living in High-Rise Buildings - URL: https://www.researchgate.net/publication/233490985_The_Consequences_of_Living_in_High-Rise_Buildings
15. Lekombat M.E., Chayko D.S. Modern principles of forming the architecture of multifunctional residential complexes in countries with a hot climate // Innovations and Investments. - 2023. - No. 4. - pp. 447-451. URL: https://cyberleninka.ru/article/n/sovremennye-printsipy-formirovaniya-arhitektury-mnogofunktsionalnyh-zhilyh-kompleksov-v-stranah-s-zharkim-klimatom/viewer