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RESEARCH ARTICLE

INNOVATIVE APPROACHES AND ARCHITECTURE OF MODERN RESIDENTIAL COMPLEXES, THE CITY OF BAKU

K.Y. Tabynbayeva[1,*], F.V. Mustafayeva[2]

[1]International educational Corporation, 050043, Almaty, Kazakhstan
[2]Azerbaijan University of Architecture and Construction (AzUAC), Baku, Azerbaijan

Abstract. *The article discusses the features of the formation of Baku city housing architecture. During the study, the influence of new socio-economic and technological factors on the residential architecture of the capital of Azerbaijan was determined. The objective of this article is to examine the architecture of Transcaucasia's largest residential complex, "Port Baku Residence," to identify current trends in the construction of modern housing in Baku, and to evaluate future directions for their growth. The phenomena of multifunctionality in housing, its origins, evolution, current state, sources of formation, and benefits are discussed. It compares the concepts and substance of multifunctional residential formations in Azerbaijan with advanced foreign housing theory and practice. The quickly developing capital, in keeping with the times, has proven that the architecture of the house is a response to the socioeconomic and aesthetic needs of the inhabitants, and it sets relatively high standards for planning, novel technology incorporated, and building quality. The example of the Port Baku Residence residential complex shows the architectural and planning features of a modern luxury dwelling in the rapidly developing largest city of Transcaucasia.*

Keywords: *luxury residential complex, architecture of a modern dwelling, modern technologies, architecture of Baku city, dwelling.*

***Corresponding author**
Karlygash Tabynbayeva, e-mail: tabynbaeva.k@mail.ru

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ҒЫЛЫМИ МАҚАЛА

ИННОВАЦИЯЛЫҚ ТӘСІЛДЕР ЖӘНЕ БАКУ ҚАЛАСЫНЫҢ ЗАМАНАУИ ТҰРҒЫН ҮЙ КЕШЕНДЕРІНІҢ СӘУЛЕТІ

Қ.Е. Табынбаева[1,*], Ф. В. Мустафаева[2]

[1]Халықаралық білім беру корпорациясы, Алматы, Қазақстан
[2]Әзірбайжан сәулет және құрылыс университеті (ӘзСҚУ), Баку, Әзірбайжан

Андатпа. *Мақалада Баку қаласының тұрғын үй архитектурасының қалыптасу ерекшеліктері қарастырылған. Зерттеу барысында Әзірбайжан астанасының тұрғын үй архитектурасына жаңа әлеуметтік-экономикалық және технологиялық факторлардың әсері анықталды. Мақсаты - Закавказьедегі ең ірі «Port Baku Residence» тұрғын үй кешенінің архитектурасын қарастыру, Бакудегі заманауи тұрғын үй құрылысының ағымдағы тенденцияларын анықтау және олардың дамуының перспективалық бағыттарын бағалау. Тұрғын үйдің көп функционалдылық құбылысы, оның шығу тегі, эволюциясы, қазіргі жағдайы, қалыптасу көздері мен артықшылықтары қарастырылады. Әзірбайжандағы көпфункционалды тұрғын үй құрылымдарының тұжырымдамалары мен мазмұны тұрғын үй құрылысының озық шетелдік теориясымен және тәжірибесімен салыстырылады. Қарқынды дамып келе жатқан астана заман ағымына ілесе отырып, үй сәулеті тұрғындардың әлеуметтік-экономикалық және эстетикалық қажеттіліктеріне жауап екенін дәлелдеп, жоспарлаудың, жаңа технологияларды енгізудің және құрылыс сапасының айтарлықтай жоғары стандарттарын белгіледі. Порт Баку резиденциясы тұрғын үй кешенінің мысалында Закавказьенің қарқынды дамып келе жатқан ірі қаласындағы заманауи сәнді тұрғын үйлердің сәулеттік және жоспарлау ерекшеліктері көрсетілген.*

Түйін сөздер: *люкс тұрғын үй кешені, заманауи тұрғын үй сәулеті, заманауи технологиялар, Баку қаласының сәулеті, тұрғын үй.*

***Corresponding author**
Табынбаева Карлыгаш, e-mail: tabynbaeva.k@mail.ru

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НАУЧНАЯ СТАТЬЯ

ИННОВАЦИОННЫЕ ПОДХОДЫ И АРХИТЕКТУРА СОВРЕМЕННЫХ ЖИЛЫХ КОМПЛЕКСОВ, ГОРОДА БАКУ

К.Е. Табынбаева[1,*], Ф.В. Мустафаева[2]

[1]Международная образовательная корпорация, 050043, Алматы, Казахстан
[2]Азербайджанский архитектурно-строительный университет (АзАСУ) Баку, Азербайджан

Аннотация. *В статье рассматриваются особенности формирования жилой архитектуры города Баку. В ходе исследования определено влияние новых социально-экономических и технологических факторов на жилую архитектуру столицы Азербайджана. Цель данной статьи - рассмотреть архитектуру крупнейшего в Закавказье жилого комплекса «Port Baku Residence», выявить актуальные тенденции в строительстве современного жилья в Баку и оценить перспективные направления их развития. Рассматривается феномен многофункциональности жилья, его истоки, эволюция, современное состояние, источники формирования и преимущества. Проводится сравнение концепций и содержания многофункциональных жилых образований в Азербайджане с передовой зарубежной теорией и практикой жилищного строительства. Быстро развивающаяся столица, идя в ногу со временем, доказала, что архитектура дома является ответом на социально-экономические и эстетические потребности жителей, и задает достаточно высокие стандарты планирования, внедрения новых технологий и качества строительства. На примере жилого комплекса Port Baku Residence показаны архитектурно-планировочные особенности современного элитного жилья в быстро развивающемся крупнейшем городе Закавказья.*

Ключевые слова: *жилой комплекс класса люкс, архитектура современного жилища, современные технологии, архитектура г. Баку, жилище.*

***Corresponding author**
Табынбаева Карлыгаш, e-mail: tabynbaeva.k@mail.ru

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CONFLICT OF INTEREST

The authors state that there is no conflict of interest.

АЛҒЫС / ҚАРЖЫЛАНДЫРУ КӨЗІ

Зерттеу жеке қаржыландыру көздерін пайдалана отырып жүргізілді

МҮДДЕЛЕР ҚАҚТЫҒЫСЫ

Авторлар мүдделер қақтығысы жоқ деп мәлімдейді.

БЛАГОДАРНОСТИ / ИСТОЧНИК ФИНАНСИРОВАНИЯ

Исследование проводилось с использованием частных источников финансирования.

КОНФЛИКТ ИНТЕРЕСОВ

Авторы заявляют, что конфликта интересов нет.

1 INTRODUCTION

New socio-economic and technological conditions contribute to the development of Azerbaijan's housing architecture in a new way. The existing functions of the political, industrial and cultural capital provoked a powerful migration of the young population, as well as specialists and foreign companies. 40% of the country's population lives in the city of Baku and its suburbs, making the capital the largest city in the Caucasus, which owes its prosperity over the past ten years to the development of oil and gas resources. In this connection, a rapid expansion of the housing stock began in Baku. The quantitative growth of the population is accompanied by changes in the qualitative structure of the population of the capital. The changed qualitative composition of the residents affected the supply and demand in the housing market: from standard apartments to high comfort class (**Berna Yaylali Yildiz, Fatma Ipek EK, Işın Can, 2018**).

The rapidly developing capital, keeping up with the times, has shown that the architecture of the dwelling is a response to the socio-economic and aesthetic needs of the population and forms quite high requirements for planning, innovative technologies introduced and the quality of construction.

Also the primary goal of architecture is to organize living spaces for individuals, irrespective of their citizenship, social rank, age or physical ability. The quality of settlements' architectural and spatial environments is determined by variety of factors one of which is the need to consider the interests of specific groups of the population and seek architectural and planning solutions that ensure accessibility (safety and convenience) for immobile groups of the population, including senior citizens and parents with children in a pushchair (**Abdrassilova G., Murzagaliyeva E., 2020**).

The purpose of the article is to analyze the architecture of the largest residential complex in Transcaucasia - "Port Baku Residence", to identify current trends in the construction of modern housing in Baku and to determine the directions for their further development. The phenomenon of multifunctionality in housing, its origins, evolution, current state, factors of formation and advantages is considered. It compares the concepts of multifunctional residential formations and their content in Russian and advanced foreign housing theory and practice. The link between the forms of multifunctionality and market prerequisites forming them (supply and demand) is established (**Kiyanenko, K., 2018**).

2 MATERIALS AND METHODS

In the process of studying the features of the modern architecture of Baku residential complexes, based on the study of statistical data, field survey materials and design and graphic materials, we analyzed the architectural, planning, structural and technical characteristics of the Port Baku Residence residential complex built in the capital of Azerbaijan (**Abdrassilova G., Tabynbayeva K, 2022**).

3 RESULTS AND DISCUSSION

The idea of combining different functions in a residential environment has its roots in the traditional structure of cities, where housing, trade, crafts and social life existed in close interrelation. In eastern cities, including Baku, this was expressed in the organization of mahallas - compact residential formations with shops, baths, mosques and workshops within walking distance (**Baku Urban Development Plan 2020-2040**).

In contrast, XXth century modernist architecture sought functional zoning, separating housing, work and leisure (**Koolhaas, 2014**). However, as cities grew and became more complex, there was a renewed need for integrated residential formats.

The second half of the twentieth and early twenty-first century saw a shift from mono-functional housing to mixed-use complexes in response to changes in lifestyles, urbanization and societal needs. The evolution has gone through several stages:

1. The first mixed-use projects in the US and Europe (1970-90s) with the integration of housing and offices.

2. Integration of commerce and leisure (2000s), especially in Asian megacities. 3.

3. New post-COVID formats: flexible spaces, home offices, shared services (**European Commission, 2021**).

Today, multifunctionality of housing is perceived as a key to sustainable and flexible urban development. In Baku, this is facilitated by 'city within a city' developments, where residents have access to all major services within one complex, from shops and gyms to kindergartens and cafes (**Pasha Construction, 2022**).

Mixed-use projects are becoming particularly relevant in the context of high density, land scarcity and the desire to reduce transport dependency (**Gehl, 2011**).

The phenomenon of multifunctionality is shaped by many factors: economic - optimization of development, increasing the profitability of facilities (**UN-Habitat, 2020**); social - changing habits (flexible schedules, remote working, and demand for 'everything nearby'); technological - introduction of BIM, digital services and smart infrastructure; cultural - return to the traditional urban structure with rich local life (**Bartenev, 2018**).

The advantages of multifunctional housing are:

1. Saving time and resources: residents get access to basic functions within one environment.

2. Livable urban environment: activity during the day, development of public spaces.

3. Environmentally friendly: reduced need for transport, compact land use.

4. Social sustainability: building of communities, reduced isolation.

5. Architectural expressiveness: the diversity of functions requires a thoughtful architectural approach.

One of the key trends of recent years in Baku is the active densification of the city centre districts and the formation of new high-rise residential complexes. This is caused by population growth, expansion of the megacity and limited land in historical zones (**Baku City Development Plan 2020-2040**).

High-rise buildings and multi-storey complexes allow efficient use of the territory, but require new approaches to transport accessibility and infrastructure.

New-generation housing is increasingly being designed according to the principle of multifunctionality: residential, commercial, public and recreational functions are combined in one complex. The Port Baku Residence, White City, Neftchilar Towers and other projects are prime examples. (**Pasha Construction, 2022**). This approach not only increases the level of comfort, but also contributes to the formation of an urban environment with round-the-clock activity (**Gehl, 2011**). Modern residential buildings in Baku are increasingly being equipped with smart home systems, digital security systems, automated parking and climate control systems (European Commission, 2021). This improves energy efficiency, safety and living comfort.

There is a trend towards sustainable building solutions - thermal insulation, solar panels, rainwater harvesting systems and green roofs (**UN-Habitat, 2020**). Although this is still predominantly in the luxury housing segment, interest in sustainable construction is growing.

Modern construction in Baku seeks to combine international architectural trends with elements of national identity. The use of traditional ornaments, forms and materials becomes an important part of the architectural concept (**Domus, 2022**). This emphasises the uniqueness of the Baku residential landscape.

Comparing the concepts and content of multifunctional residential formations in Azerbaijan with advanced foreign theory and practice, it was revealed that:

The architectural and planning concepts of Azerbaijan are designed according to the principle of 'vertical city': the lower floors are allocated for trade, public services and offices, the upper floors - for residential flats. The architecture emphasises prestige and visual expressiveness (**Pasha Construction, 2022**).

Overseas practice in developed countries, especially in Scandinavia, Japan and the Netherlands, actively applies horizontal mixing of functions - residential clusters integrated into the urban fabric with a priority on pedestrian accessibility and small-scale architecture (**Gehl, 2011; European Commission, 2021**). The principles of the '15-minute city' are utilised, where all necessary functions are available within walking distance.

The social orientation and accessibility of residential complexes in Azerbaijan and its multifunctionality is characteristic mainly of premium segment properties. Affordable housing, as a rule, is designed according to traditional schemes without integration of additional functions (**Ministry of Urban Development of Azerbaijan, 2020**).

Whereas foreign practice shows that multifunctional approaches applied in social housing allow for the creation of balanced neighbourhoods in terms of functions and population (**UN-Habitat, 2020**).

The use and integration of technologies in housing construction in Azerbaijan occurs mainly within the framework of premium complexes (smart home systems, digital access control, video surveillance) (**Pasha Construction, 2022**).

Foreign practice shows that BIM modelling, digital design, automated building management, applications for tenants, digital platforms for the management of housing and communal services even in budget construction allow for much more efficient management and provision of quality housing operation, and this works in the long term. (**UN-Habitat, 2020**).

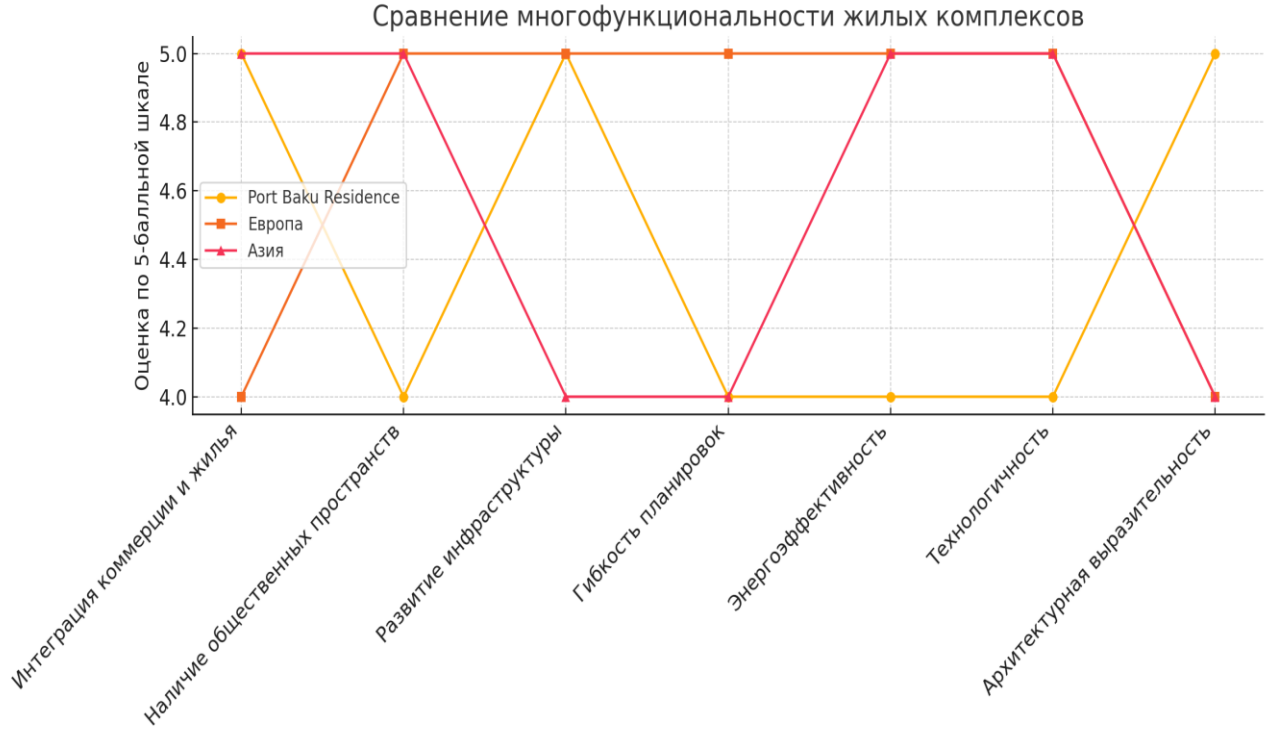


Figure 1 – Comparison of the level of multifunctionality.

Table 1
A comparison of the characteristics of mixed-use housing (explanation of the graph1)

Parameters	Port Baku Residence (Azerbaijan)	Medium level (Europe)	Middle level (Asia)
Integration of commercial and residential	5	4	5
Availability of public spaces	4	5	5
Infrastructure development	5	5	4
Flexible layouts	4	5	4
Energy efficiency	4	5	5
manufacturability	4	5	5
Architectural expression	5	4	4

Table 2
Comparison of concepts and content of multifunctional residential formations in Azerbaijan with advanced foreign theory and practice

Parameters	Azerbaijan	Best foreign practices
Approach to zoning	Vertical	Horizontal, 15-minute city
Spread	In premium segment	In all segments
Eco-friendliness	Basic solutions	Systemic green standards
Technological efficiency	Implemented in luxury housing	Implemented in all –types of housing
Integration into urban environment	With some limitations	Organic
Social inclusiveness	Medium	High

Baku is the capital of the Republic of Azerbaijan, the largest industrial, economic, scientific and technical center of the Transcaucasus, as well as the largest port on the Caspian Sea and the largest city in the Caucasus.

The housing sector of Azerbaijan is one of the sectors of the economy, the main and general purpose of which is to provide living space for the citizens of the Republic of Azerbaijan. This branch of the economy is closely connected with the construction sector of the country.

Azerbaijan's construction sector is experiencing significant growth, both through the opening of new industrial and service facilities and through the renovation of the housing stock, being the second largest investment after the oil sector. The increase in the housing stock is one of the main indicators of the socio-economic development of the country. In 2019, the volume of new housing commissioned amounted to 2.230.784 sq.m. Also, for the first six months of 2020, the figure has already amounted to 2.586.000 sq.m., of which 1.228.778 sq.m. goes to housing.

The architectural and construction experience of the capital has become a leading element in the development of Azerbaijan: socio-economic transformations, the implementation of the Decree of the President of Azerbaijan Ilham Aliyev on simplifying the issuance of permits for the commissioning of a number of multi-apartment buildings dated February 19, 2019. The introduction of new international standards in design and construction have made numerous adjustments and affected the quality of architecture in all regions of the country (**Abdrassilova G., Kozbagarova N., Tuyakaeva A., 2017**).

Requirements and demand in the housing market determine the introduction of the latest technologies in construction, which is what the largest commercial and state developers offer in various projects of the now popular multi-storey residential complexes.

According to the current world trends of housing development, the following points of prospective development directions could significantly improve and accelerate the development and achievement of clear progress in the housing sector of Azerbaijan.

1. Expansion of affordable mixed-use housing: introduction of principles multifunctionality in economy and comfort class projects.
2. Sustainable design at all levels: environmental standards, certification of buildings according to international systems (LEED, BREEAM).

3. Development of the micro-district approach: creation of autonomous residential clusters with kindergartens, schools, offices and public spaces.
4. Digitalization of residential building management: housing management systems, digital document management, applications for tenants.
5. Regeneration of old housing stock: modernization of Soviet quarters using modern architectural and technical solutions (Ministry of Urban Development of Azerbaijan, 2020).
6. Developing standards for flexible layouts.
7. Using BIM for design.
8. Development of public spaces in existing residential areas.
9. Formation of functional neighborhoods rather than individual buildings.

The luxury residential complex "Port Baku Residence", from the leading developer engaged in the construction of commercial and residential buildings of international class in Azerbaijan - the construction company Pasha Inshaat. The company has completed a number of exceptional projects with a prestigious location, which are distinguished by excellent architecture and quality of construction. Pasha Inshaat designed and built such facilities as «Dinamo» hotel, «Boulevard Hotel», «Four Seasons», «JW Marriott Absheron» hotel, «Ganjlik» shopping malls, «Port Baku Mall», «Caspian Waterfront», residential complexes "Knightsbridge", "Nizami Residence", "Absheron Apartments", sports and recreation centers, restaurants and business centers (**Griz, C.; Amorim, L., 2015**).

The unique prestigious multifunctional residential complex "Port Baku Residence", which offers a beautiful view of the Caspian Sea and the seaside boulevard, is located on Neftchilar Avenue, in an area with excellent infrastructure (**Figure 2**).

Figure 2 – Port Baku Residence multifunctional residential complex.
(Electronic resource: http: **www.portbaku.az**)

The complex has become a symbol of the new urban vector of the capital of Azerbaijan, where housing is considered not only as a place of residence, but also as an element of the urban ecosystem (**Bartenev, 2018**). In Azerbaijan, there is a close interaction of the residential function with prestigious retail and office formats, which forms high standards of comfortable living for certain segments of the population.

One of the challenges is the insufficient prevalence of such solutions in the segment of affordable housing. In this aspect, international practice, in particular the Scandinavian model of mixed-use development, can serve as an example of a more socially oriented approach (**UN-Habitat, 2020**).

The residential complex features such indicators as: closed territory with controlled access; high density of building with preservation of visual space due to the vertical structure; developed system of parking and services; as well as the use of advanced engineering solutions and sustainable technologies.

In the immediate vicinity there is a large business center with restaurants, supermarkets, hospitals, a gymnasium, a secondary school and a kindergarten, branches of various banks, development and educational centers for children.

Located within the business part of the city, a residential complex with a total area of 382,300 sq.m. consists of 3 floors of commercial premises, including a sports and recreation complex, multifunctional halls for events, various shops and offices. Green podium with an area of 15,000 sq.m. with recreational areas, gazebos, playgrounds, as well as a vast walking area is located on the 3rd floor, where families can spend their free time and relax in the shade of gardens with modern landscape design (**Hermoso, V., Morán-Ordóñez, A., Lanzas, M., & Brotons, L., 2020**). (**Figure 3**).

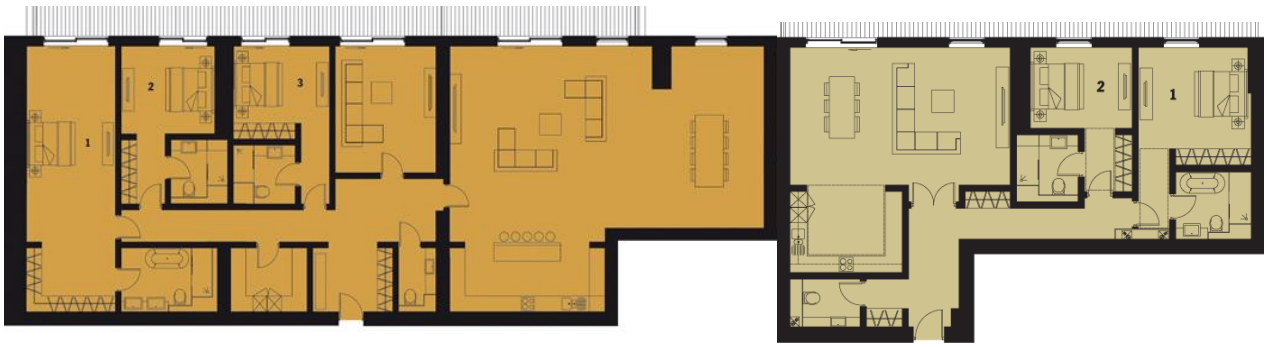
Figure 3 – «Port Baku Residence» multifunctional residential complex.
(Electronic resource: http: **www.portbaku.az**)

The living spaces consist of three buildings, the number of storeys of which decreases from twenty-eight to nine storeys towards the sea. The complex has a monolithic frame structure, has good seismic resistance and high energy efficiency. During the construction of the facility, environmentally friendly materials were used, innovative technologies were introduced, thanks to which the dwelling has high ergonomics and comfort.

Additional functions of the residential complex are guest parking; underground parking for residents, designed for more than 2000 parking spaces [11].

From the side of Uzeyir Gadzhibekov Street, the buildings of the complex are surrounded by shops, cafes, restaurants, offices, a private club with a cinema and other infrastructure facilities. There are numerous bus routes around the complex. The metro station is within walking distance from the complex (**Sakharova A., 2019**).

The three residential towers of the complex house 800 apartments and luxury penthouses, with different planning structures and area from 83 sq.m. up to 259 sq.m., designed in accordance with strict international standards (**Figure 4** (**a, b, c, d**)).



(a)

(b)

(c)

(d)

Figure 4 – (a) «Port Baku Residence» multifunctional residential complex. Apartment plans. (Electronic resource: http: **www.portbaku.az**); (b) Plan of the penthouse of the residential complex «Port Baku Residence» [Electronic resource: http**: www.portbaku.az**]; (c) «Port Baku Residence», terrace. [Electronic resource: http: **www.portbaku.az**]; (d) «Port Baku Residence» multifunctional residential complex. Residential floor plan (Electronic resource: http: www.portbaku.az)

The residential complex with a great location includes not only a club for residents of the complex, but also an atrium for receiving guests, designed by the world famous interior designer David Collins (**Figure 5**)

For the first time in the real estate market of Azerbaijan, modern approaches of Western management in housing construction were introduced: apartments appeared, completely ready for living, which included designer renovation; smart home system; built-in and controlled air purification equipment, 2.92 m high ceilings; installed and configured mechanical, electrical and plumbing equipment.

All apartments are provided with satellite TV, ADSL connection and wireless broadband internet.

Figure 5 – «Port Baku Residence» multifunctional residential complex. Interiors of public spaces of the residential complex. (Electronic resource: http: **www.portbaku.az**)

The residential complex has an extensive security system: video surveillance in elevators, playgrounds, access control system for cars, emergency call buttons, modern intercoms with digital locks, etc. The engineering equipment of the residential complex includes advanced technological developments in the field of ensuring the comfort and safety of residents. Thus, the residential complex "Port Baku Residence" demonstrates a qualitative breakthrough in architecture, based on new technologies for understanding the internal and external environment of the home (**Khalid, R., & Sunikka-Blank, M., 2020**).

The complex is located next to the largest recreational area in the central part of Baku, the seaside boulevard. For the large-scale development of luxury residential complexes, it is necessary to pay attention to the details of the design of recreational areas in the structure of the city.

To ensure the process of sustainable development of the recreational areas of the city of Baku, which includes the ancient architectural heritage and modern architectural criteria that currently attract the attention of tourists from all over the world, it is necessary to pay special attention to planning issues. These recreational zones will enrich not only the architectural and compositional solution and environmental indicators of the given territory, but also the architectural, planning and urban planning solution of the city as a whole. At the same time, one should take into account the statistics of population growth in megacities and take into account proposals aimed at dynamic development for the sustainable development of these recreational areas (**Mustafayeva F.V., 2020**).

5 CONCLUSIONS

An analysis of multifunctional residential developments in Azerbaijan compared to leading international theories and practices indicates that the architectural and planning strategies in Azerbaijan follow the ‘vertical city’ concept. The social accessibility and multifunctional nature of residential complexes in Azerbaijan are primarily evident in higher-end properties. Typically, affordable housing is developed using conventional designs without the incorporation of additional features. The application and combination of technologies in residential construction in Azerbaijan are predominantly found in premium complexes, which include smart home technologies, digital access systems, and video surveillance.

However, the study of the modern residential complex of Baku "Port Baku Residence" shows that the architecture of the dwelling is a response to the socio-economic and aesthetic needs of the population and forms quite high requirements for planning and quality of construction. The architecture of the considered residential complex is distinguished by a high level of technological

solutions, the use of innovative elements in providing an accessible, safe environment, and the environmental friendliness of building materials and systems.

Innovative technologies have become widely used in the practice of housing construction (the "smart house" system, video surveillance of the adjacent territory, air purification system and other automated systems and technologies.) (**Zu Ermgassen, S.O.S.E., Drewniok, M.P., Bull, J.W., Corlet Walker, C.M., Mancini, M., Ryan-Collins, J., & Serrenho, A.C., 2022**).

The design and high-quality construction of new residential complexes in the capital of Azerbaijan are focused on the introduction of environmentally friendly and energy-saving principles (air purification control system, energy saving, water collection and reuse).

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