

Evolution of Almaty's housing architecture influenced by solico-economic, political, and technological processes, and proposes priority directions for urban planning in the city's residential zones, emphasizing the integration of the "Smart City" plan within resource conservation and environmental policies.



An overview of the evolution of Almaty's housing architecture influenced by socio-economic, political, and technological processes, highlighting the city's integration of 'Smart City' plans with resource conservation and environmental policies in urban planning

Dwelling architecture in the context of socio-economic and technological conditions of modern Kazakhstan (on the example of Almaty city)

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Abstract: The relevance of this research is highlighted by Almaty's continuing status as a historical and cultural centre and a financially independent city, despite no longer serving as the capital of the Republic of Kazakhstan. Currently, an important issue is the formation of the "Smart City" plan in the context of modern concepts of resource conservation and environmental policy. The research aims to substantiate changes in the formation of housing architecture under the influence of socio-economic, political, and technological processes in the context of gradual historical changes in the example of Almaty, as well as to determine the priority directions of development of urban planning processes, in particular on the territory of the residential zone. The following methods of scientific research were used: abstract-logical method; comparative method; historical method; method of system analysis and synthesis. To achieve the research aims, the elements of the socio-economic development of Almaty in the context of historical, cultural, and educational centres were defined. The peculiarities of dwelling architecture from the 1920s to the present day are analysed. This research proposes priority directions for urban planning in Almaty's residential area by analysing historical architecture influenced by socio-economic and technological factors.

Keywords: typology of dwelling; architecture development; planning solutions; residential zone; architecture of Almaty.

1. Introduction

The modern development of Almaty city is characterised by a high level of branching of residential development, engineering and communication, transport infrastructure, placement of structures and buildings of public purpose, educational institutions, and medicine, which is conditioned not only from the point of view of economic, social development or concentration of cultural cell but also with natural conditions. Almaty is located within the unique natural landscapes of southern Kazakhstan, surrounded by the Tien Shan Mountain range. In particular, the region is characterised by the presence of productive land with high levels of soil fertility, as well as large areas of water resources. The city became an important industrial centre, particularly after the Second World War. The growth in the proportion of urban dwellers has increased significantly over the last century. There has been a migration of people from rural areas to the urbanised centre for better housing conditions, higher education, and professional development. At the same time, the development of the construction industry and increased investment in the development of residential complexes were determinants in meeting the needs of citizens. Almaty served as the capital of Kazakhstan for almost 70 years, a fact that has shaped its development and its blend of historical heritage and modern infrastructure. Despite losing its administrative functions and political influence when the capital moved to Akmola (now Astana) on December 10, 1997, following the Decree of the President of the Republic of Kazakhstan (1997), Almaty remains a historical and cultural capital and a financially robust urban centre. It is worth noting that the city as the political, economic, cultural, and educational centre of Kazakhstan has defined the country's development strategy for many decades to come.

S. Donchenko and K. Samoilov (2020) considered the peculiarities of the identification of historical and cultural heritage objects in the development of residential zones while characterising the stylistic features of buildings and structures built in specific periods of the historical development of the city. G.S. Abdrassilova (2021) considers the period of implementation of the state programme of providing the population with housing on the territory of the Republic of Kazakhstan up to 1991 and independence. The Soviet planned economy was aimed at serial development of the housing stock, the expansion of which was possible only by solving the socio-economic problems of the population. The mass series houses built in 1990 are multi-apartment residential buildings, which have a sufficient safety margin. If properly maintained, the life cycle of these buildings can be extended. Following these findings, the architecture of Almaty has been analysed and it has been shown that mass-produced residential

buildings were not only a solution to a socio-economic problem but also became an integral part of the city's image (Abdrassilova & Danibekova, 2021). According to the author, it is necessary to further investigate the possible directions of adaptation of residential buildings of mass series built before the 1990s following the modern needs of the population and effective formation of the spatial environment of the city.

K. Murzabayeva et al. (2022) investigated the issues of modernisation of the living environment of Kazakhstan's territories during the great Soviet period of construction in the 1960s. The existing residential architecture of that time was formed based on the need to ensure the comfort of residents and harmonisation with the surrounding natural landscapes. It was also necessary to consider the main goals of revolutionary development, which were to improve socio-psychological, aesthetic, and ecological conditions. B.A. Glaudinov et al. (1987) consider the formation and implementation of housing architecture projects in Kazakhstan. The authors carry out a detailed analysis of the experience of design, and construction of residential and public buildings, and industrial complexes in cities and villages of Kazakhstan in the context of the typology of buildings of that time. The authors note the formation of progressive traditions and innovative trends in the field of architecture of residential and public buildings at each stage of historical development.

The research aims to substantiate the principles of modern development and functioning of Almaty in the context of the formation of housing architecture, which was formed in different periods under the influence of socioeconomic, technological, historical, and political aspects, as well as the justification of the directions of planning and forecasting of a favourable living environment of the population in terms of housing architecture.

2. Materials

The information base of the research was formed by the data of the official portal of the Internet project Qazaqstan Tarihy (Kalybekova, 2014) under the Information Committee of the Ministry of Information and Public Development of the Republic of Kazakhstan, which is dedicated to the historical formation of Kazakhstan and functions for the historical education of the population. Materials of the Internet project Tip Doma (141 series houses (121-141), 2023), which is a non-profit network project and contains up-to-date information about the typical architecture of the countries that were part of the Soviet Union, were used during the study. To analyse the current typology of residential architecture, data from the real estate portal of Kazakhstan KN was studied (Residential Complex "Exclusive Time", 2023).

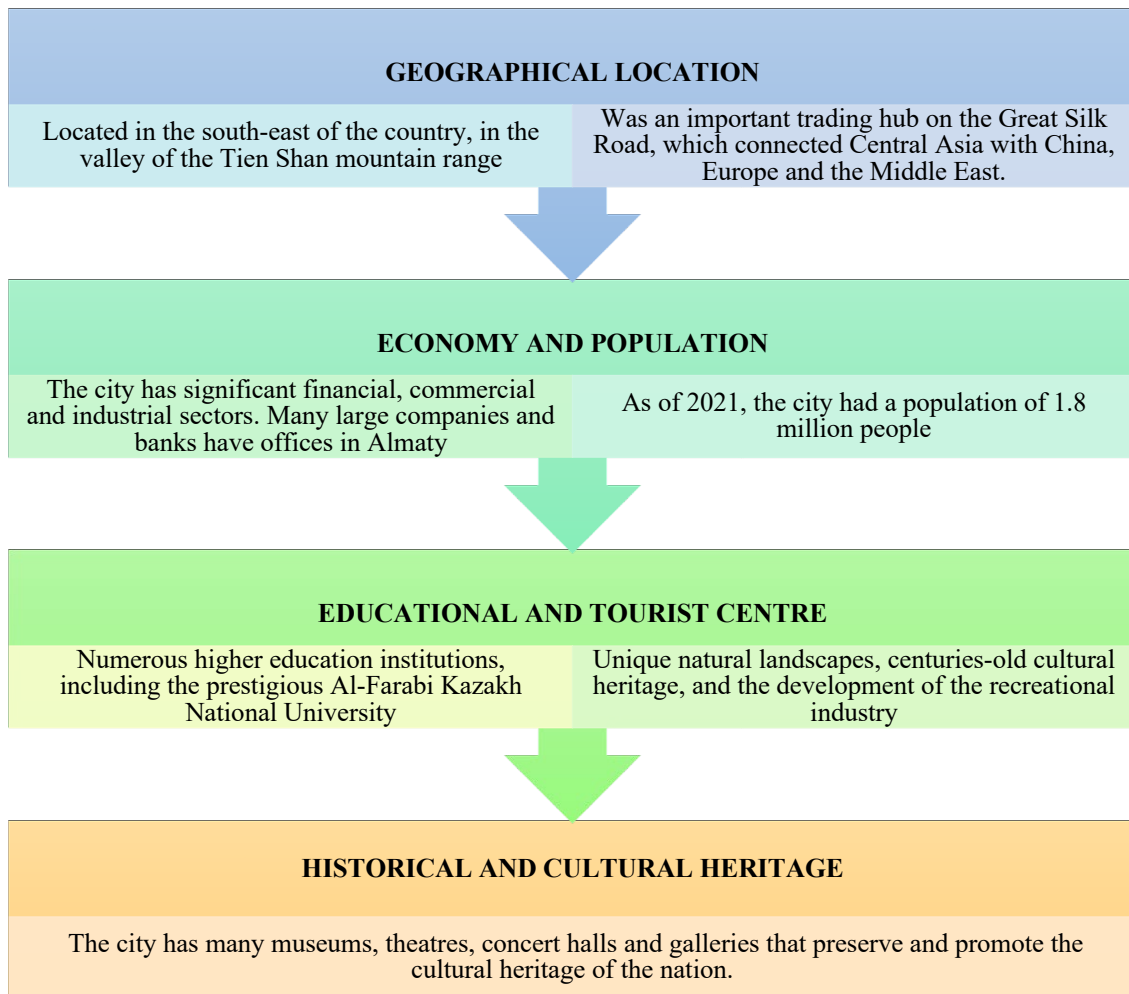


Figure 1 | Elements of Almaty's socio-economic development in the context of a historical, cultural and educational centre.
Source: compiled by the authors based on A. Kalybekova (2014).

Google Earth online application was used to compare changes in the area of built-up areas in Almaty city. Building on this data foundation, the formation and establishment of residential architecture in Almaty have been influenced by various factors over many decades, as presented in Figure 1.

3. Methods

The research was based on historical, economic, and ecological laws, their concepts, and categories, as well as the basics of the modern theory of architectural composition. The theoretical basis of social laws and political laws regarding the establishment of objective and recurring cause-and-effect relationships between social phenomena and processes arising as a result of the mass

activity of people or their actions were used. In particular, the peculiarities of the influence of scientific and technological progress on the formation of the architectural environment in housing, considering different historical stages of development of Almaty were considered. As a methodological basis, the general scientific methods of research based on the system approach to the solution of the problem have been applied.

The studies of scientists from the Republic of Kazakhstan, Pakistan, England, Poland, and Albania, which highlighted the issues were also considered:

- Establishing urban identity in a post-socialist context.
- Establishing alternative housing strategies based on national carbon and biodiversity targets.

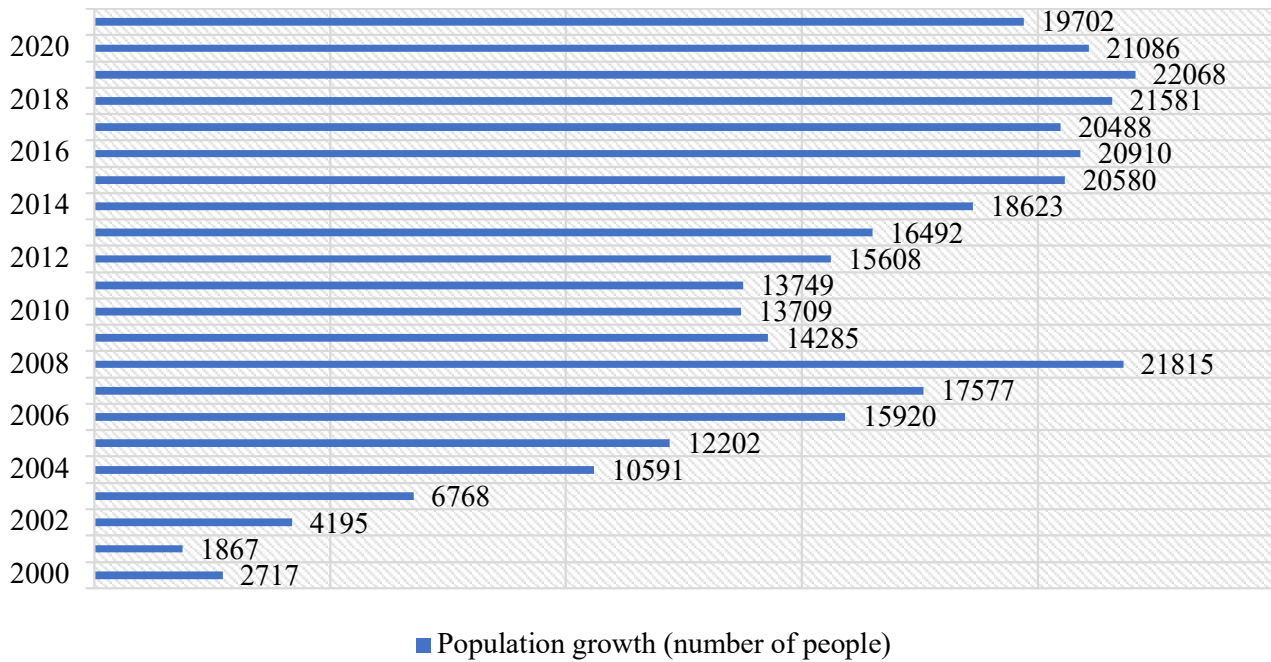


Figure 2 | Analysis of population growth in Almaty city in the period from 2000 to 2020.
Source: compiled by the authors based on Bureau of National Statistics (2023).

- The effectiveness of using conventional and sustainable building technologies in housing architecture with low levels of financial capacity.
- Energy consumption systems in the design and use of buildings are characterised by energy efficiency and resource conservation from a socio-technical point of view.

As a methodological basis, the general scientific methods of research based on the system approach to the solution of the problem were applied:

- Abstract-Logical method – clarification of the essence of basic concepts, definitions and categories in the field of architectural composition of residential areas of Almaty; substantiation of elements of socio-economic development of the city in the context of historical, cultural and educational centre; in generalisation and formation of conclusions. The abstract-logical method is particularly useful in understanding the architectural development of residential areas in Almaty, which were largely influenced by Soviet-era construction and modernization efforts (Amangeldikyzy et al., 2023).
- Comparative method – characterisation of similarities and differences between architectural and planning solutions in the city of Almaty in the context of the

needs of the population depending on the specific historical stage, socioeconomic, political and cultural factors (Abdrasilova & Danibekova, 2021).

- Historical method – characterisation of the stages of formation of architectural and planning solutions considering socio-economic, political, and technological changes in the city of Almaty from the 1920s to the present day (Bekenov, 2021).
- Method of system analysis and synthesis – characterisation of the general concept of architectural solutions in housing development and justification of individual changes in connection with trends and opportunities of scientific and technological progress in different stages of historical development in the context of cultural heritage preservation; generalisation of the main aspects in the system of urban development of Almaty and peculiarities of Smart City system planning (Abdrasilova & Danibekova, 2021).

4. Results

Almaty has developed into a modern metropolis with diverse residential areas, including central districts, dormitories, industrial zones and other infrastructure (Figures 2, 3).

Table 1 | Stages of formation of architectural and planning solutions considering socio-economic, political, and technological changes in the city of Almaty.

Stage	Characterization
1920-1930	Significant changes in the city's infrastructure in terms of architectural and planning solutions were observed during the formation of the Soviet Union. In particular, industrialisation and intensive construction of new residential areas took place. Standardised apartment buildings are characteristic of this period.
1940-1960	During and after the Second World War, Almaty developed in the context of technological change as an industrial centre, which led to a higher proportion of urban dwellers and the expansion of residential areas. During this period, apartment buildings were designed considering the existing architectural solutions and the historical centre to ensure the beautification of the settlement.
1970-1980	Industrial sectors became key industries in the city's economy. During this period, a large number of panel apartment blocks were built, which met the standards of socialist realism.
1990s	After Kazakhstan's independence, the development of the city and its housing infrastructure changed. New neighbourhoods with modern houses and infrastructure emerged. In particular, individual construction began to develop.
2000s – modern days	Almaty during this period is characterised by high activity in the construction of residential complexes of different comfort levels. The city's residential architecture is characterised by apartment complexes, cottage settlements and modern houses with exterior design and innovative artistic and architectural decoration.
Plans for 2030	The Smart City is planned to be designed in the context of modern concepts of development and improvement of residential areas to ensure high comfort for the population. Such a concept includes environmentally sustainable construction, the use of energy-efficient technologies and the integration of information systems. The planning programme aims to design modernised residential complexes in the context of sustainable use of natural landscapes and land and resource potential.

Source: compiled by the authors based on A. Kalybekova (2014).

As such, the highest rate of population growth in the city of Almaty, starting from 2000, took place from 2006. After 2008, the value of growth began to decrease sharply, and then again gradually rise. This indicates constant changes in political sentiment and the level of socio-economic development. As of 2020, the population growth rate is 19702 people. The information in Figure 3 confirms that a sharp jump in the increase in the area of housing stock in Kazakhstan occurred from 2012 to 2013, and then there was a gradual, but not significant growth of indicators. It is also important to note that these statistics relate to large megacities such as Astana, Almaty. Starting from 1920 and during the next 100 years, the vector of development of architectural and planning solutions of Almaty city was determined by the needs of the population, which depended on the specific historical stage, socioeconomic, political, and cultural factors (Table 1).

In the 1920s, there was a shortage of residential property in Almaty, which had already been commissioned at that time, and the city faced a housing crisis even though the level of socio-economic development in the 1920s was accompanied by a food crisis and high levels of poverty. However, during the above period, the first industrial enterprise – Almaty Tobacco Factory – was established, and the city's infrastructure was rapidly developing, which meant the need to expand the housing stock. Already from the beginning of 1927, after the decision to grant Almaty the status of the capital of the Kazakh SSR was approved, population indicators began to grow rapidly (Tabynbaeva & Abdrassilova, 2021). The years 1931-1935 were characterised by a large influx of specialists from various fields,

including architects, engineers, and builders because at that time the city's tasks included architecture and construction. Later, to accommodate the large number of invited specialists and intellectuals, two blocks of two-storey houses with comfortable living conditions were built in the central part of the city. It should be noted that these were the first residential buildings with all amenities and communications. Later, these buildings were popularly called "oblique houses", because they were located at an angle to the street front, rather than facing the streets with their facades, as was customary in the already established rectangular regular system of city planning (Figure 4).

The city construction plan approved in 1928 by the authorised state authorities was not intended to expand the boundaries of the city, but to design new buildings on unused land plots. At the same time relocation of the city to the southern part of the city was acceptable to build the city centre on the site of the former Cossack Square. Already in 1929, the architectural organisation of the city was determined by the construction of land plots by workers' villages, which included tents and yurts, adobe houses for designers and special construction organisations as part of the residential architecture. Considering the original plan to locate the central part of the city in the eastern district within the capital, single-storey cottages and barrack-type apartment blocks began to appear (Basenov et al., 1973).

As early as the 1930s, during the period of agricultural collectivisation and industrialisation, Almaty was characterised as a major industrial centre of Central Asia and included new enterprises, in particular the Almaty

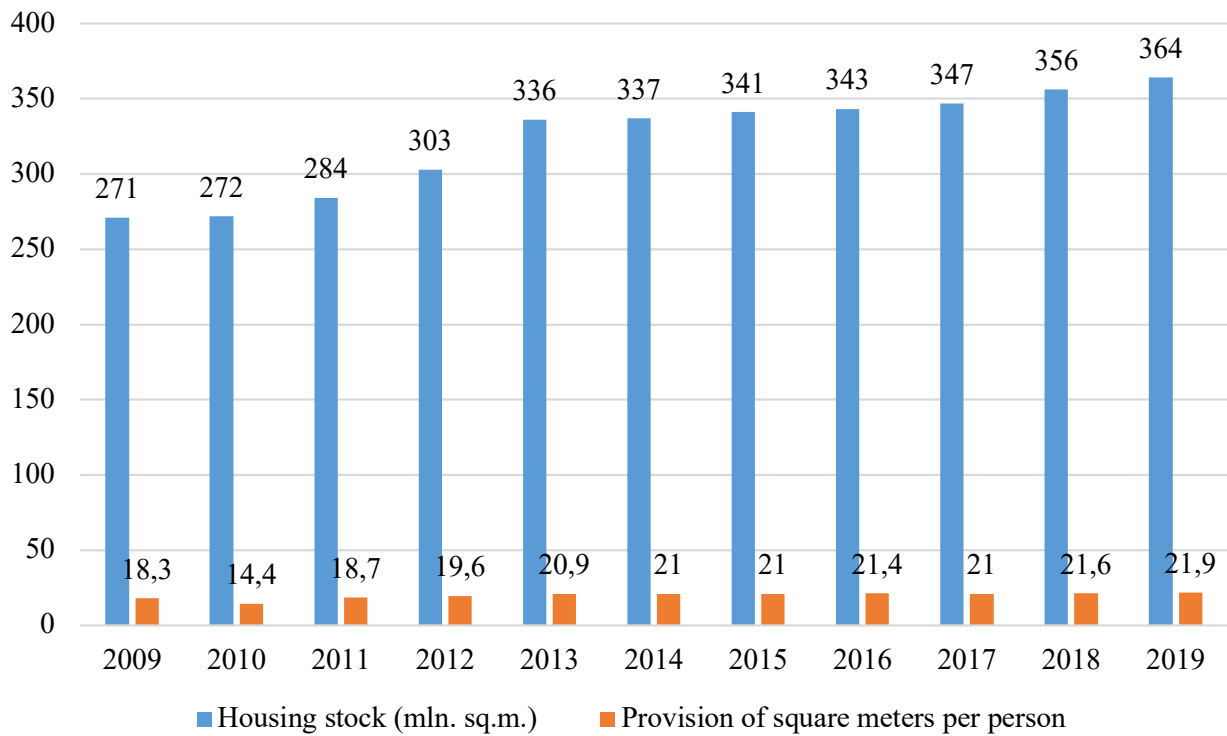


Figure 3 | Analysis of the area of total housing stock in Kazakhstan from 2009 to 2019.

Source: compiled by the authors based on Bureau of National Statistics (2023).



Figure 4 | Depiction of specialist houses, also known as 'slanted houses' (1931-1935).

Source: compiled by the authors.

Automobile Plant. This was the time of economic growth and migration of the workforce to the centre of urbanisation. In 1936, led by architects A. Repkin and I. Gurevich, the Architectural Planning Workshop No. 1 of the RSFSR People's Commissariat of Education prepared a master plan for the development of Almaty, which was approved in 1937 (Tuyakbaeva, 2008). The plan showed the main planning characteristics of the central district of the city,

outlined in the urban planning activities of the designers of the late 1920s and mid-1930s. In the aftermath of the project, it was supposed to expand the territory mainly in the western direction (beyond the Yesentai River) and slightly in the southern direction, completing the development of Abaya Avenue (Figure 5). In the northern direction, due to unfavourable hydrogeological and seismic conditions, further growth of the territory was impossible (Ordabayev, 2023).

Considering the 1930s, the residential property types for this period were:

- Communal-type houses – flats of the area for several families with separate living rooms and common bathrooms and kitchens.
- Wooden houses – small one-storey buildings, simple in their construction, made in different architectural styles, from traditional Kazakh to European, which were usually located in the private sector or the suburbs.
- Communal dormitories – these houses were designed for workers and students who had individual bedrooms and shared in the use of kitchens, and bathrooms.

In the period from 1940 to 1960, Almaty experienced significant changes in the formation of housing architecture caused by socio-economic, political, and technological processes. In particular, the events of the Second World War made significant adjustments in the formation of the housing architecture of the city. After all, to organise the All-Union rear and to concentrate production and material resources, the housing stock was compacted by releasing 45 thousand m² of space to accommodate more than 26 thousand evacuated citizens (Bureau of National Statistics, 2023). The post-war period saw the beginning of the design and construction of predominantly residential architecture. Much attention was paid to the issues of city improvement, in particular, landscaping of rural areas. Large arrays of green spaces were planned at the base of the Vesnovka and Malaya Almatinka rivers, which were supposed to serve as channels for clean mountain air to the residential areas. Since 1948, the planning and architectural solutions in the design of residential buildings have been significantly improved by using built-in equipment, providing through and corner ventilation of flats, and using balconies and loggias (Meuser, 2002).

From the 1950s onwards, the main areas of design were standard designs for housing and civil needs. From that time onwards, the construction of brick dwellings began to be introduced due to the typification and industrialisation of construction on a large scale (Tabynbaeva & Abdrassilova, 2021). Significant changes in demographics have influenced the need to expand construction. In particular, Almaty saw improvements in medical services in the second half of the 1960s, which led to a reduction in infant mortality rates and a total fertility rate of 4.4 by the end of 1959. In December 1954, the All-Union Conference in the field of construction and architects was held, which became the impetus for planning a new path in the radical restructuring of the architectural and construction business.

In terms of economic development in general, the 50s and 60s saw active industrialisation and agricultural development. In 1954, the first phase of the Almaty power plant complex was launched (Meuser & Zadorin, 2015). At the same time, the city continued to develop as an important centre of scientific and educational institutions. A large industrial base was established, including electronics production, mining and metallurgical complex and light industry. Also, during this period, the development of the tourism and sports industry took place (Ordabayev, 2023). As such, in the period from 1940 to 1960, the following changes took place in residential architecture (Tabynbaeva & Abdrassilova, 2021):



Figure 5 | Residential building by architect J. Stankevich (1938).

Source: compiled by the authors.

- Social programme – during this period the Soviet authorities implemented large-scale housing construction programmes to meet the housing needs of the population. Based on a single unified section for Almaty, projects of three- and four-storey residential buildings of the I-275 and I-275-A series were developed.
- As part of the campaign to increase labour productivity in 1948, new micro-districts with apartment buildings were created in Almaty, where advanced workers lived.
- Typical series of houses – due to the growth of the city population, the I-142, I-141, and I-144 series of houses were commissioned, which were characterised by the uniformity of the facade layout.
- Wooden and brick houses – typical one-storey and two-storey houses of D-1 and D-2 series with small-sized flats, which were intended for family living (Bureau of National Statistics, 2023).
- Housing architecture was dominated by the classical style of socialist realism, using Stalinist classicism and rational planning, which included C-1 series houses (typical houses with single-family and multi-family

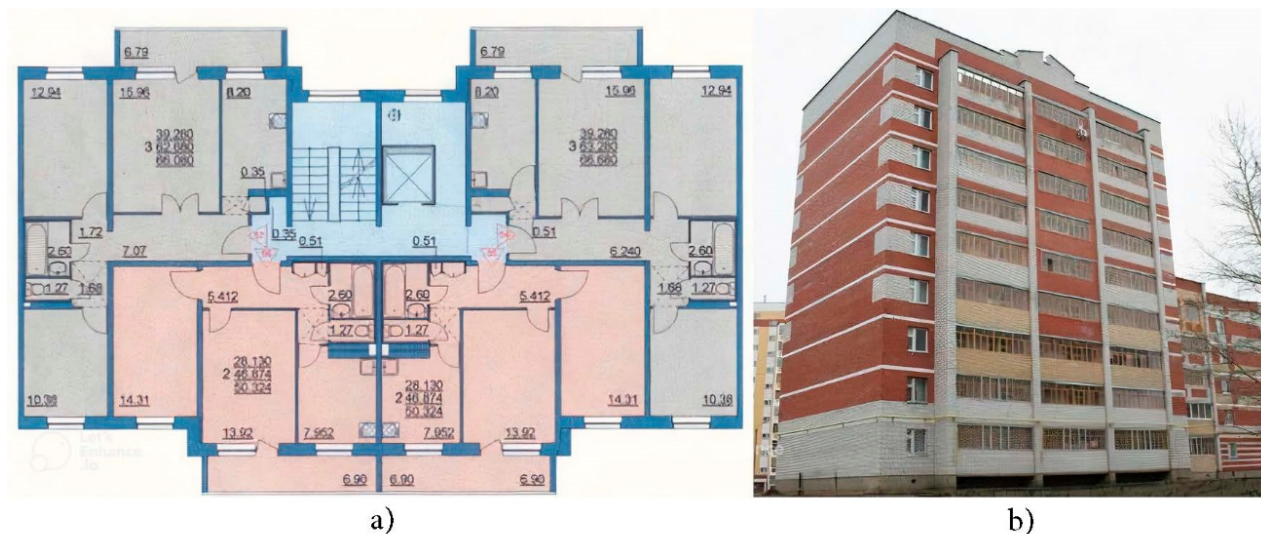


Figure 6 | Flat planning scheme (a) and real residential building (b) of the I-141 series.
Source: compiled by the authors.

units built of brick and had several floors) and panel houses made of lightweight aerated concrete, which were more efficient in construction and flat layout).

During this period, residential houses were built in Almaty for prominent cultural and state figures, such as Chokan Valikhanov's house, the Zhambyl Museum (Figure 6).

In 1970-1980 in Almaty volume-planning architectural solutions consisted in the development of the western part of the territory. Attention was also devoted to the reconstruction of existing districts after specifying the engineering characteristics of the development of new eastern territories, which gave impetus to the formation of the public centre of the city and obtaining a logical completion. During this period of development, the third version of the city's general plan was approved, following which Almaty was divided into four functional zones: Central, Southern and Western – areas of capital construction, Northern – area of low-rise housing stock, and Eastern – area of prospective development of the city. It should be noted that at the end of 1970-1980, there was serious pressure from the first demographic wave in Almaty. It was during this period that the generations born in the late 50s and 60s began to enter the reproductive age. However, the growth in the absolute number of marriages did not at all indicate an increase in fertility. At the end of the 70s, the total fertility rate was 4.8, which was almost equal to the indicators of 60 and did not correspond to the expected forecasts judging by the rather high indicators of socio-economic development of the city. After all, Almaty was still a major

industrial, educational, cultural, and leading financial centre, which was preparing for the status of the capital of the Kazakh SSR (Kalybekova, 2014).

Thus, the 70s and 80s were characterised by certain changes in terms of the architecture of residential areas:

- Mass housing development – mass construction of residential complexes and neighbourhoods to meet the needs of a growing share of the population. Many panels multi-storey houses were built, especially in the new neighbourhoods,
- Standard series of houses – use of a standard series of residential buildings that had similar layout and design solutions. In 1970, the project of a four-storey large-panel house of series No. 69 was developed. In particular, based on the experimental series E-147, a series of 5 and 9 multi-storey apartment blocks labelled No. 158 was developed and put into production (Ordabayev, 2023).
- Increased living comfort – there was an improvement in living conditions in residential areas. More attention was devoted to the layout of flats, expansion of living space, installation of household appliances and improvement of engineering systems.
- Development of residential complexes – construction of residential complexes that included not only residential buildings but also necessary social and communal infrastructure such as schools, kindergartens, shops, clinics.

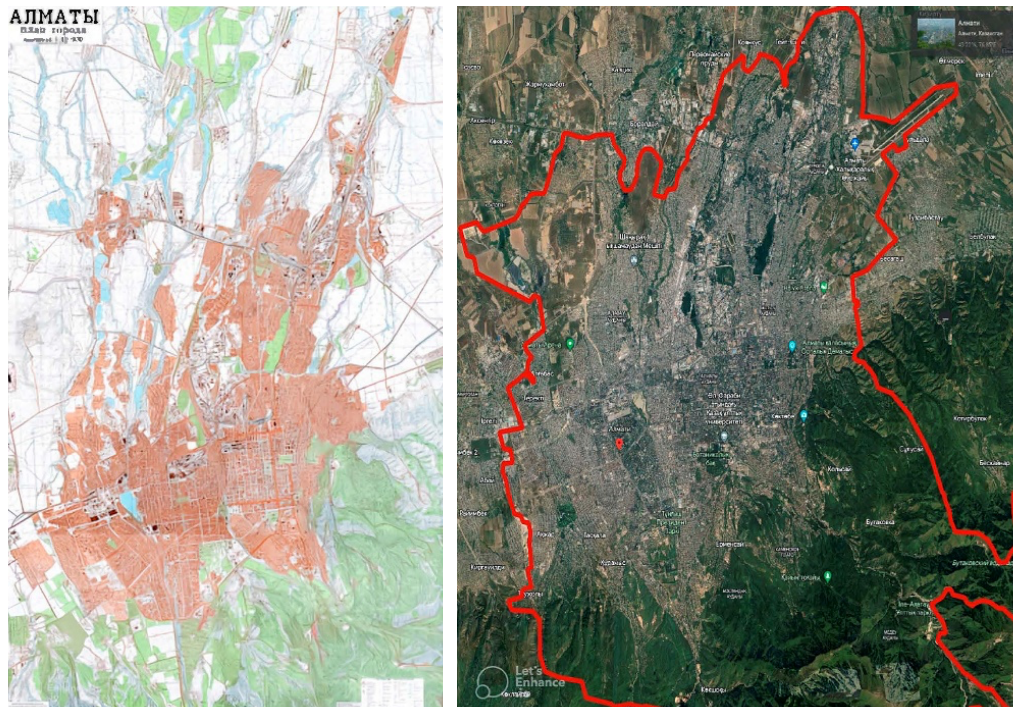


Figure 7 | Topographic map of Almaty city for 1997 and satellite image of Almaty city for 2023.
Source: compiled by the authors.

- Green areas and landscaping – an important component of the formation of housing architecture in this period was the creation of green areas and landscaping. Space was set aside for parks, squares, and alleys, which gave a pleasant atmosphere to the residents of the city.

In 1990, during the transition period after the collapse of the Soviet Union, the city's housing architecture system included the following elements:

- Multi-storey panel houses – buildings made of concrete panels were widespread in residential areas of Almaty. They usually had 5-9 floors and included flats of different sizes (Ordabayev, 2023).
- Custom houses – designing private homes in the 90s was all too common and accessible in terms of financial solvency, social status and the economic challenges of the period.

The topographical map of Almaty as of 1997 and a satellite image of the city as of 2023, which was obtained using the Google Earth online application to compare changes in the areas of built-up areas, are shown in Figure 7. Thus, on the topographic map of 1997 different types of buildings are shown in orange-brown colour, and on the

satellite image in grey and dark grey colour, which indicates a significant development of the city's infrastructure over the last 25 years.

However, in the late 1990s, Almaty and Kazakhstan as a whole experienced a 17.6% decline in birth rates and a 14.3% increase in mortality rates, which was due to the political and socio-economic crisis affecting all segments of the population (Kalybekova, 2014). Yet, after the capital moved to Astana in 1997, Almaty continued to be a major economic and cultural centre of the country. The city became the main financial hub of Kazakhstan, concentrating many banks, companies, and stock exchanges. Large-scale construction and modernisation of infrastructure, including the airport, roads, and residential and commercial complexes, was carried out. Starting in 2000, the general concept of architectural solutions in residential development has changed significantly due to new trends and opportunities for scientific and technological progress in the context of historical and cultural heritage preservation. Precisely the key aspects of the changes in this period were (United Nations, 2018):

- Construction of multi-storey residential buildings – ensuring the efficient use of sufficiently suitable to provide a sufficient number of dwellings.



Figure 8 | Project of Modern Residential Complex “Exclusive Time”, Almaty.
Source: Residential Complex “Exclusive Time” (2023).

- Residential complexes – creating zones for the population to live in, which included not only residential buildings but also infrastructure such as shops, schools, kindergartens, sports grounds, and parks. This created a comfortable level of living, which had not been properly considered before in the formation of volume-planning solutions.
- Preservation of historic districts – restoration and preservation of historic buildings and monuments to preserve the cultural heritage of the city.
- Environmental policy – new residential neighbourhoods focused heavily on green spaces, parks, and recreational areas. The planning and design of buildings took place in the context of preserving natural landscapes, which contributed to the formation of environmentally friendly neighbourhoods.
- Infrastructure development – significant improvement of infrastructure. New roads, bridge structures, efficient transport hubs and rational operation of public transport were built, thus providing convenient access to residential areas with a corresponding increase in the mobility of residents.
- Expansion of the urban area – Almaty was constantly expanding by incorporating neighbouring territories into the city limits. This occurred as a result of population growth and the development of new industrial and residential areas.

In general, the development of residential development in Almaty from 2000 to the present day is characterised by a combination of modernisation and preservation of historic districts, expansion of the urban area, construction of high-rise buildings and creation of comfortable residential complexes of such classes:

- Elite residential complexes – characterised by a high level of comfort and infrastructure. They often include multi-storey apartments with modern design, secured territory, underground car parks, swimming pools and other amenities.
- Business class and economy class – defined by different flat layouts and comfort levels, and may also have additional services such as parking, fitness centres and playgrounds.
- Low-rise cottage settlements – prioritising individual housing with spacious houses, and private plots of land, usually located on the outskirts of the city (Ordabayev, 2023).

The modern residential complexes in Almaty reflect modern construction trends and meet the requirements of comfortable, multifunctional living (Figure 8). Thus, one of the main trends is the increased use of energy-efficient technologies and materials in construction. This situation is inherent in a modern city due to the rising prices of energy resources. In particular, to meet the needs of environmental friendliness, designers and developers take



Figure 9 | Project image of the modern residential complex Mega Tower Almaty.

Source: Residential Complex “Exclusive Time” (2023).

into account such a concept as energy efficiency through the use of insulation materials, solar panels, energy-efficient lighting and heating systems.

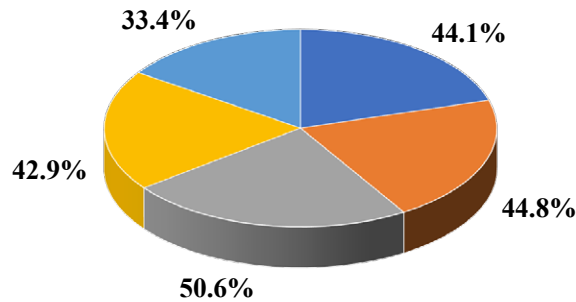
Another important trend is the development of so-called smart housing. Due to technological progress and the worldwide network, residential buildings have started to use automated control systems (Hermoso et al., 2020). These systems allow for control of lighting, heating, security, audio-video monitoring, and other parameters with the help of modern gadgets. The smart city policy allows it to comply with the principles of energy efficiency and comfort for city residents (Figure 9).

The last few years of residential architecture development have been characterised by the fact that developers have started to actively use the concept of building much taller complexes, ensuring optimal use of space, and allowing many residential units to be accommodated in a limited area. Such complexes often have integrated infrastructure facilities such as shops, catering facilities and sports centres. Due to population growth and urban planning constraints, Resolution of the Government of the Republic of Kazakhstan No. 736 “On approval of the Concept of development of housing and communal infrastructure until 2026” (2022) was approved. 736 “On approval of the Concept of development of housing and communal infrastructure until 2026” (2022), the main provisions of which regulate the main issues affecting the interests of the population in terms of the development of communal and housing infrastructure. According

to the Bureau of National Statistics (2023), the number of respondents was analysed in percentage terms, in particular their attitude to the modern improvement of the city of Almaty (Figure 10).

The provision of public utilities to the population is regulated by the requirements stipulated by national, and state standards, sanitary and epidemiological requirements, technical regulations, and normative legal acts in the relevant areas.

The most significant aspect of the transition from standardised Soviet-era apartment blocks to contemporary high-rise, multi-functional complexes is the evolution of urban planning priorities towards creating more diverse, integrated, and livable residential environments. While Soviet-era apartment blocks prioritised rapid, mass-produced housing solutions with little consideration for local context or community needs, contemporary complexes in Almaty are embracing mixed-use elements, sustainable design, architectural diversity, and integration with public spaces. This shift reflects a move towards creating vibrant, self-contained neighbourhoods that promote walkability, reduce car dependency, and cater to the evolving preferences of residents. Thus, the comparative study underscores the changing emphasis from homogeneous, utilitarian structures to more inclusive and aesthetically pleasing urban developments, reflecting a broader shift towards prioritising quality of life and sustainability in urban planning and design.



- Respondents are satisfied with the quality of drinking water
- Respondents are satisfied with the level of air cleanliness
- Respondents are satisfied with the level of cleanliness of the territory adjacent to the dwelling.
- Respondents are partially satisfied with the possibility to purchase housing on their own
- Respondents are partially satisfied with the possibility to purchase housing through government support measures

Figure 10 | "Quality of life of the population in the Republic of Kazakhstan (2023)" analysis study.
Source: compiled by the authors based on Bureau of National Statistics (2023).

5. Discussion

Over the past 90+ years, Almaty has experienced significant socio-economic, technological, and political changes that have influenced the formation of major concepts in the architecture of residential areas. In particular, the key aspects of such changes are:

- Political changes – in 1929 Almaty became the capital of the Kazakh SSR, and in 1991, after Kazakhstan gained independence, it became the capital of an independent state. In 1997, the capital was moved to the new city of Astana. A. Volkmann (2015) notes that similar political transformations in Berlin following reunification demonstrate how changes in political centres may influence urban development and architectural agendas, emphasising the universality of political effects on urban environments.
- Economic changes – Since Kazakhstan's independence in 1991, Almaty has seen economic development and modernisation of infrastructure, including urban planning and architecture. According to V. Tomakh and H. Veretennykova (2020), this economic boom is reminiscent of what happened in Warsaw when the city moved from a centrally planned to

a market-driven economy, revitalising its urban environment and architectural advancements in the process.

- Social changes – Almaty has become a central hub for culture, education, and science, similar to Kuala Lumpur, which also experienced significant growth in these sectors. Both cities have seen how these changes impact architectural designs, particularly in creating educational and cultural spaces that cater to a growing urban population (Urban Mobility Readiness Index, 2023).
- Infrastructural changes – similar to Seoul, Almaty has made large expenditures in infrastructure modernization, resulting in significant improvements to urban transportation and residential comfort. Comparing these projects reveals a consistent tendency towards prioritising infrastructure to enhance living conditions in rising cities (Urban Mobility Readiness Index, 2023).

Overall, Almaty has undergone significant transformations in politics, economics, and social development over the last 100 years, which has significantly affected its status and role, as well as the formation of a comfortable residential area.

R. Khalid and M. Sunikka-Blank (2020) study the characteristics of the energy consumption system in the design and use of buildings characterised by energy and resource efficiency from a socio-technical perspective. They uncover the intricate relationship between existing residential development solutions and the imperative for transitioning towards more sustainable lifestyles, particularly in Lahore, Pakistan. Their analysis highlights the necessity of integrating adaptable housing practices that prioritise ecologically balanced environmental management, a facet largely overlooked in the city's architectural evolution. The researchers highlight the inefficiency of economically driven techno-deterministic models in meeting residential energy demands and emphasise the importance of socio-economic, political, and technological factors in shaping household practices for sustainable development. In particular, in our results, it was found that only since the 2000s have the directions of greening policy in the architectural and infrastructural development of the city begun to develop. Already, modern building technologies include autonomous solutions to maximise energy efficiency and the use of materials with energy-saving features. This considers the socio-economic opportunities and financial capacity of a particular residential neighbourhood.

The scholars of S.O.S.E. zu Ermgassen et al. (2022) stress the significance of safe housing as a fundamental human right and a cornerstone of sustainable development goals. They analyse the impact of current housing policies in England on carbon reduction and biodiversity targets, projecting that housing alone will consume a significant portion of England's carbon budget by 2050. The authors concur with the importance of the research of scientists from England in the context of the evaluation of the prospective development plan and the creation of a programme for the formation of alternative housing strategies for national purposes. They highlight the stage of improvement and development of the city's housing architecture in the context of the 2030 development programme, but the priority was to analyse the formation of a modern city with extensive residential areas in the context of socio-economic, technological, political, and historical changes.

E. Manahasa and O. Manahasa (2020) tackle urban identity issues in post-socialist contexts characterised by informal settlements and high-rise buildings. They highlight the significance of urban zoning and residential typologies in shaping urban infrastructure and identity. The scholars emphasise the importance of older urban layers and housing typologies in fostering a sense of belonging and identification with the city, contrasting them with newer post-socialist developments, which often lack the same level of identification. The research relevance of Albanian scientists is undeniable because the historical peculiarities of the development and formation of the city determine the location of various zones, particularly residential. It is the historical and cultural heritage of the city that determines the vector of the city's movement, as well as the ethnic features of the modern development of the urban centre.

6. Conclusions

This study confirmed that socio-economic transformations in Almaty have significantly influenced its dwelling architecture, validating the hypothesis. The city's residential architecture and planning was shown to have been influenced by every socio-economic stage, from the Soviet era to modern independence, and to be in line with more general strategic objectives like resource conservation and sustainability. Overcoming challenges like limited historical data required a robust multi-methodological approach, allowing to comprehensively achieve the research objectives. Findings support the need for future urban development in Almaty to prioritise environmentally sustainable and culturally integrated living spaces, catering to diverse socio-economic demographics. In summary, Almaty's urban planning and architectural evolution reflect its adaptability and commitment to sustainable development, providing a model for future growth that harmonises heritage with modern urban needs. Improvement should be carried out through reorganisation and improvement of the territory of Almaty, reconstruction of the built-up area, and improvement of the quality characteristics of the living environment.

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