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ORIGINAL PAPER
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CHARACTERISTICS OF THE DEVELOPMENT OF THE ARCHITECTURAL ENVIRONMENT OF ASTANA: AN URBAN PLANNING PERSPECTIVE

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ABSTRACT

Motives: The study was motivated by the architectural development of Astana, particularly in the context of socio-political changes following the relocation of Kazakhstan's capital.
Aim: The aim of the study was to analyze the unique features of the development of the architectural environment of residential areas in Astana and the factors influencing its development. During the research, a comprehensive analysis of the influence of historical, social, political, cultural, and ethnic factors on the development and transformation of the architectural and planning ensemble of Astana was carried out.
Results: The study showed that the evolution of civilization leads to changes in the typology of buildings and structures, creating unique architectural objects using innovative constructive and artistic solutions, which, in turn, contribute to the development of innovative scientific and industrial complexes with a multifunctional structure focused on the sustainable development of the urban environment. Historical trends in the development of urban space using innovative buildings and methods of their creation included an analysis of the levels of development of such buildings and the identification of the main differences between them, and the specificity of creating buildings with an innovative approach, taking into account the sustainable development of the urban environment. Urban space was considered as a system of residential areas with innovative design, focused on information and activity needs.
Conclusions: The study identified the unique elements of the architectural environment, which are not only associated with the status of the capital, but also reflect strategic national development, being key elements in the development of a common urban identity. In addition, the study included an analysis of the relationship between architectural development and economic factors influencing the development of the urban environment, including examples of successful integration of innovative buildings into the economic life of the city and their contribution to strengthening its competitiveness on the world stage. The influence of environmental aspects on the architectural concept of Astana was revealed. The results of the study may help identify unique features and patterns, thus contributing to the development of effective strategies for managing urban infrastructure and creating a comfortable living environment.

Keywords: development, infrastructure, cultural and historical heritage, reconstruction, differentiation

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INTRODUCTION

Since the early 2020s, the urban environment has continued to have a significant impact on people, whose daily movements between home, transport and office usually take place in standardized conditions (Bollano, 2024). In the field of mobile urban infrastructure, such as the metro and public transport, this is conditioned by the desire for technical excellence. However, monumental and chaotic structures are often found in office buildings in the city, which block open spaces and negatively affect the psychological state of people. The market economy and business are striving to expand retail and office space, which leads to an oversaturation of the city center and reduced accessibility for pedestrians. The practice of urban planning, which ignores the relationship with the surrounding nature, does not meet the requirements of sustainable urban development. Over the years, various innovative complexes have been created in the country, but their effectiveness has not always been justified due to the lack of competition and market conditions. Considering the development of the information society and the transition to the "knowledge economy", there is a new round of creation of domestic innovation centers, which should play an important role in the economy and society. Traditional forms of organization of innovative activities require modernization. The design and construction of scientific and industrial buildings must meet increasing requirements, which emphasizes the importance of studying world experience and developing appropriate recommendations.

Previously, the topic has already been considered by researchers. Abusaada and Elshater (2022) investigated the architecture of the administrative center of Astana, where unique construction solutions were highlighted in the construction of buildings and the development of the general character of administrative buildings. The study by Almusaed and Yitmen (2023) considered the living environment in regional conditions, where a conceptual model of the development of the architectural environment was developed to optimize the system depending on the region to create a unified architectural structure for future buildings. Ghalib et al. (2020) analyzed the level of urbanization of the social structure of Astana and its indicators over the past 20 years, which are important for further decisions regarding architecture and modernization of the city as a whole. Moreover, possible architectural solutions were identified in the Astana master plan until 2035, where issues of preserving cultural, historical and architectural heritage, features of greening the city, improvement of the transport system, development of engineering infrastructure, housing regions, and state institutions and enterprises were considered in detail (Zhakiyev et al., 2022).

Laszczkowski (2016) highlighted the features of the historical patterns of the creation of modern architecture of buildings in the urban environment of Astana, where the key characteristics of the current state of the architectural environment of the city, the specifics of its formation, and promising areas for the creation and development of innovative solutions in the construction or restoration of buildings are highlighted. Kooi (2022) describes in detail the main typological structures of buildings with modern architectural solutions, and their differentiation, after which the principles and trends of improving the architectural environment in the city were highlighted, which in the near future can be used to restore the outdated architecture of administrative buildings and the wild environment for modernization. Driscoll (2024) conducted an analysis of the level of landscaping in Astana, and also identified areas for the introduction of "green" architecture and opportunities to create a better green zone in the future. Abylkassymova (2020) analyzed the features of the organization of general education institutions in Astana to create an improved system of decoupling institutions by city regions, and also identified a fundamental model of the organization of the structure for the modernization of schools of different levels of education and their reconstruction to create a safer, modern, and convenient environment for students.

This topic attracts considerable attention from researchers and practitioners in the field of archi-

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tecture and urban planning. Undoubtedly, previous research has provided valuable knowledge about how the residential environment in the capital of Kazakhstan is developing. However, in the context of constant changes and development of the city, there is always a need for a new look at this issue. Recent scientific research has identified key factors and trends affecting the architectural environment of residential areas in Astana, but many issues remain open and require further study.

The purpose of this study was to analyze the features and regularities that shape the architectural environment of all districts in Astana, and factors that affect the appearance of the modern infrastructure of the city. The objectives of the goal-based research include a systematic analysis of the architectural features of each district in the city of Astana and the identification of repetitive or unique characteristics that define the architectural environment in its various parts. It is also necessary to identify problematic aspects, such as inconsistency of style, insufficient functionality, in the development of the architectural environment, and develop recommendations for improving the visual appearance and functionality of urban infrastructure. In addition, it is required to propose urban planning strategies for managing the development of the architectural environment, considering the specifics of each district and general trends in the development of the city.

MATERIALS AND METHODS

The study of historical trends in the development of the urban environment, considering innovative buildings and methods of their creation, has become a key aspect of the study. The analysis of the past development of the city identified not only trends, but also key stages affecting the development of a modern architectural environment. The unique features and patterns of urban architecture were considered at various levels, including historical and cultural heritage, and the impact of economic and social factors. The differentiation of innovative buildings by their functionality, structure and architectural solutions was determined, which helped to understand the diversity of their contribution to the development of the urban environment. This aspect of the study revealed not only the evolution of urban architecture, but also its importance for creating a modern and sustainable urban environment that meets the challenges of our time.

The city of Astana, which serves as the epicenter of innovative and architectural transformations in Kazakhstan, was chosen for a study. The analysis of urban planning provided an opportunity to look at the urban environment as a whole and identify key development trends. The study of architectural projects and documentation provided an idea of specific construction plans and their implementation. The studied data were analyzed considering historical, socio-cultural, and economic aspects, which helped to identify the main trends and factors influencing the development of the architectural environment in the capital.

This helped to assess the context in which the architectural environment is developing and to determine which regulations and laws have the greatest impact on this process. In addition, reports on the state of the city's infrastructure and housing stock were investigated. The analysis of these data provided an idea of the current situation and identified areas that require special attention and improvement in the context of architectural development. The results obtained were used to develop recommendations for improving urban planning policy and improving the quality of life of city residents. The recommendations include proposals for the modernization of infrastructure, the development of green areas and public spaces, and the promotion of sustainable and innovative construction. In addition, the proposals were aimed at improving housing affordability, especially for young families and low-income groups, and improving the standards of comfort and safety of the existing housing stock. These measures are planned as part of a broad urban development program, considering the views and needs of the local community.

The data obtained during the study were applied in several key aspects. The data were used to analyze

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the features of the development of the architectural environment of residential areas of the city. This included the study of architectural designs, building plans, and analysis of changes in urban development and residential infrastructure. Within the framework of this study, a comprehensive assessment of the impact of various aspects, including historical, social, cultural and economic factors, on the evolution of the city's architecture was carried out. The main purpose of this analysis was to identify the most significant factors determining changes in the urban environment. During the research, special attention was paid to the interaction of various aspects and their impact on the development of the unique appearance of the city, which contributed to a deeper understanding of the dynamics of its development and orientation towards optimal urban space management strategies.

RESULTS

The collapse of the Soviet Union in 1991 influenced the emergence of new states from former Soviet republics. The development of their own cultural values and traditions, contributing to the strengthening of national identity, is attributed to the newly independent nations. Architecture plays a special role in this context, because it can express ideas and innovations without words, reflecting the events and aspirations of the people and their government. The former capitals of the republics became the capitals of new states, which required the creation of a new image for these megacities, reflecting their new status and character.

For decades, the architectural setting of major cities throughout the Soviet Union had similar features. Standardization of planning and construction processes helped to effectively develop and build up cities. Unification in construction ensured cost-effectiveness, and the typification system of design solutions created a uniform architectural environment. Regional and national specifics were most often manifested in the decorative decoration of facades. The functional approach defined the architecture of all cities, giving a common style. The new political status of the former capitals requires the adaptation of architecture to international standards. Many new capitals have undergone significant changes. The decision to form a new architectural appearance of the capital of Kazakhstan was radical: the transfer of the capital's functions to a new city with the possibility of creating a unique architectural environment.

Kazakhstan, as a country with a developed democracy, a relatively stable economy, and a moderate political environment, has provided fertile ground for significant changes, such as the relocation of the capital. By moving the capital from Almaty to Akmola, a small city in the north of the country, the government used a strategic move to solve a variety of political and economic problems. This step drew the attention of the world community to the new sovereign and democratic republic. The decision to establish Astana as the center of the Eurasian region reflected the country's political, social, and economic strategies and ambitions. Almaty, the previous capital, ceased to meet the new requirements of the capital status: the city had exhausted its resources, seismic activity created problems, and its geographical location complicated management due to its remoteness from the central regions and proximity to borders with other countries (Damezhan & Fatih, 2021).

There may be ulterior motives for which the President of Kazakhstan decided to move the capital from Almaty. One of them was the need to limit the influence of certain political forces concentrated in the southern regions of the country due to their national and social characteristics. The relocation of the capital to the north of the country mitigated this pressure and contributed to the emergence of a new city with a convenient geographical location in the center of the country, provided with a developed transport infrastructure and access to international transcontinental highways. In addition, the choice of Astana (now Akmola) as a priority capital was determined by a number of other factors, such as the availability of water and mineral resources, a favorable environment, and the availability of affordable land for construction and development (Harris-Brandts, 2020). The potential for solving political and economic

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problems on the periphery of the country and the possibility of balancing the national composition of the population between the northern and southern regions were also important. It was interesting to note that even in Soviet times, planning for the development of the city began in anticipation of its status as the future capital. Nomadic settlements on the territory of Astana have ancient roots, while the foundation of the city of Akmolinsk as a military fortress dates back to 1830. Since 1961, when the city became the center of the virgin land, it was renamed Tselinograd (Mariotti & Leetmaa, 2023).

In world history, there are many examples of the transfer of the capital in order to solve various problems – political, economic, and in recent years also demographic and environmental. In ancient times, the transfer of the capital was often used to strengthen the central government and unite the state, as, for example, in Egypt, Assyria, and the Roman Empire. During the Renaissance, theoretical foundations were developed for the construction of cities in new places, known as "ideal cities". An example of newly formed capitals of democratic states is Washington, where classical compositions defined the urban structure. A similar classical approach was used in the construction of Canberra, the new capital of Australia. New capitals of the mid-20th century, such as Brasilia, Chandigarh, and Islamabad, have become especially significant in the history of urban planning. When planning these capitals, the leading architects adhered to clear geometric modular structures (Pojani, 2021). It was noted that since the beginning of the last century, in developed countries faced with the problem of overpopulation and deterioration of the environmental situation in metropolitan cities, it has become common to move the capital to existing cities or build it on unused territories. Examples include Malaysia, Ivory Coast, and the Philippines.

Thus, Astana is not the only example of a city to which the capital's functions have been transferred for various reasons. However, the process of forming the architectural environment of Astana attracted the attention of the world community, since the capital's functions have been transferred to the already existing architectural and planning structure of a small but relatively developed provincial city. This represented the main obstacle for architects and urban planners from different countries, including Kazakhstan, who participated in the international competition for the development of the "sketch idea of the master plan of the new capital", organized by the Government of the Republic of Kazakhstan (Kurokawa, 2006). They had to submit a project proposal that would be most organically linked to the existing structure of Tselinograd (Akmola), but at the same time would contain new planning solutions that meet the status of the capital. As a result of the competition, the project of the Japanese architect Kise Kurokawa won, who considered all aspects and areas of the future development of the city, and also found the most harmonious way to connect the new administrative center with the old one. To ensure the free and dynamic development of urban infrastructure in the new capital, Kurokawa used the principles of metabolism in planning and functional separation, combining a stable base with flexible, easily replaceable elements.

In his metabolic concept of the sketch idea of a plan for Astana, Kise Kurokawa discussed the idea of symbiosis and interaction of various architectural legacies, including pre-revolutionary and Soviet, with elements of modern architecture (Glaudinove et al., 2022). He offered a combination of unchangeable and changeable elements of the architectural complex, and a combination of Eastern national tradition with Western philosophy, natural forms, and human influence on the environment. This idea became the basis for the general plan developed by Kazakh architects. According to this plan, intensive development of Astana is envisaged until 2030, including the organization of a large urban development of the republican administrative and business center and new residential areas on the left bank territories. The river plays an important role in this new planning structure, becoming the central element that organically fits green spaces and water spaces into the urban environment (Fig. 1).

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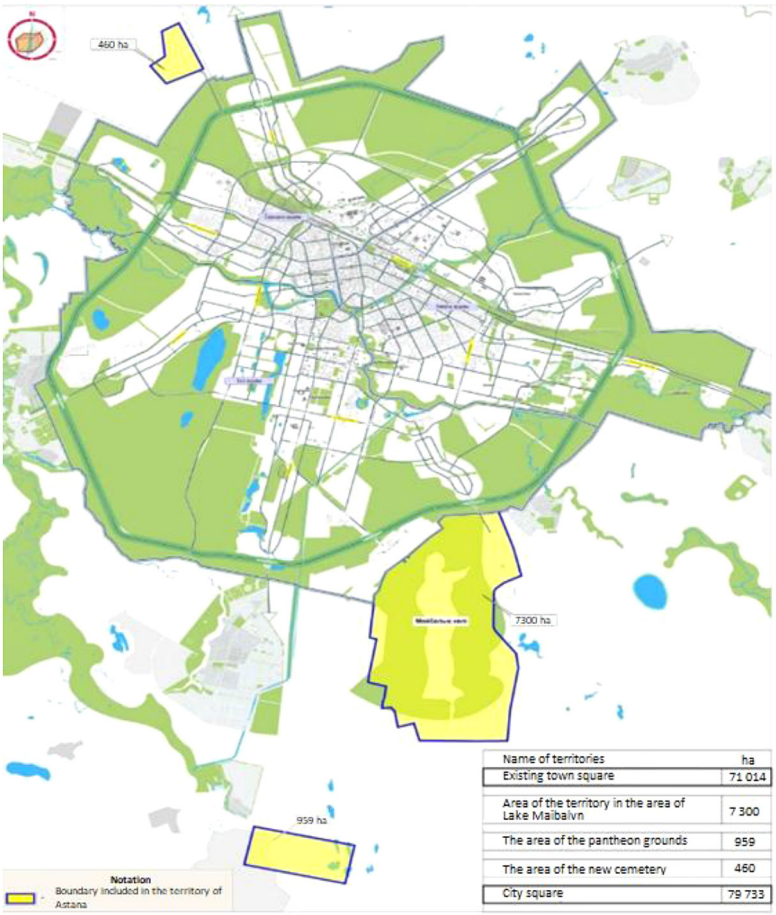

Fig. 1. General plan of development and expansion of Astana
Source: General plan of Astana city still 2035 "Baseline scenario of environment in Astana city and forecast of its changes till 2035" (2023).

Astana is connected to the key cities of the country through wide highways that stretch in three directions: to the south, leading to the airport of the city, and two main directions to the north and south-east towards Karaganda. Along these routes, a vigorous expansion and development of the urban area is envisaged in accordance with the idea of linear zoning put forward by Kurokawa. This concept is being built along the main waterway of the city – the Yesil River (Ishim) and is aimed at providing convenient access and optimal organization of traffic flows (Yacher, 2010). It was noted that certain features in the architectural appearance of Astana determine its character and way of perception. The visual perception of the architectural appearance of the linear center, including the Avenue of the Republic, depends on the direction of movement, the main of which is the southern one. As the center bridge is approached, the height and density of the development increases and the open space in front of the bridge opens up with a panoramic view of the left bank. In accordance with the principle of a linear urban planning structure, secondary streets intersect the main one perpendicularly, forming nodes of intersections and squares around which important citywide structures requiring significant spaces are located. The special thematic zoning of the territories that make up the central street (business zone, shopping

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zone) was developed based on the historical layout of Tselinograd, and some areas of development could not be changed for new functional purposes.

The example of Astana shows that when creating a new capital from a provincial city, difficulties arise that affect its structure, architecture and perception. Densely built-up areas in the city center do not correspond to the scale of the new metropolitan functions. However, the complete removal of these sites is impossible due to the presence of significant architectural monuments on them. The location of tall buildings in the city center violates the natural sequence of their placement. An even more difficult situation arises in residential areas that were previously the center of Tselinograd: the introduction of the necessary number of high-rise structures into existing buildings seems extremely difficult, therefore, construction is possible only on vacant lots. Kazakh architects have developed a structure for the visual appearance of urban space, including an analysis of the location of high-rise elements in the main urban planning nodes (Tolegen et al., 2021). High-rise dominants focus on the main street, squares, and important intersections. They are also marked at the intersection points of the visual axes in key urban planning nodes. Despite the analytical research, the transformation of the old building to a new scale has led to the development of a complex and disparate silhouette of the center of the right bank.

The administrative center in Astana is a central axis connected to the main avenue of the Republic through an overpass over the Ishim River and a wide transport highway. Spacious steppe landscapes contribute to the formation of extensive panoramic views, and a smooth turn of the transport highway from the bridge opens up a new administrative center from various key viewing points. The new area of the city is characterized by a more organized layout, which includes green areas along the Ishim River, the riverine city, and the administrative center itself. The administrative quarter in Astana occupies a vast territory, which is connected by an extended esplanade known as the "water-green boulevard". Along the central part of the esplanade there is a row of fountains surrounded by greenery, and the esplanade itself is divided into three functional zones: central, western, and eastern (Fig. 2).

Upon entering the city from the western side, the view is immediately attracted by the Western Square, which is one of the outstanding attractions.

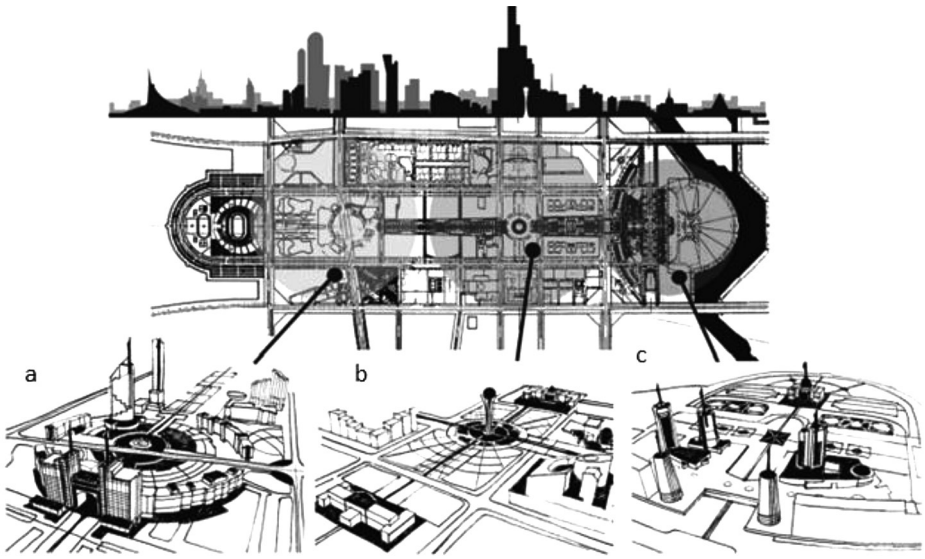

Fig. 2. New administrative centre of Astana: a) Western Square; b) Central Square; c) Eastern Square
Source: Koch (2013).

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This square is distinguished by a unique "gate" in the form of an arch formed by the majestic semi-circular building of the Ministry of Energy. The structure of the square itself is a complex system of intersecting spaces at various levels, which creates unique opportunities for perceiving the landscape from different angles. Due to this, every visitor can enjoy spectacular views that are revealed from time to time from unexpected viewpoints. The exquisite high-rise building of the Ministry of Transport and Communications, standing out on the horizon of the administrative center, serves as an unsurpassed landmark pointing to the highest point of the western part of the city. Moving along the esplanade, attention will be attracted by the following impressive object – the Baiterek monument, which rises majestically at the intersection of the main perpendicular axes of the Central Square, becoming a symbol of the city and its desire for development (Fig. 3a). This square is an open space bounded to the north and south by two low-rise ministry buildings. The plane of the square is uniform, which allows enjoying wide views of the Esplanade, the Western and Eastern Squares, and the surrounding functional areas (the World Trade Centre, residential complexes, and the Islamic Cultural Centre). The covering on the square is made in the national geometric ornament, which emphasizes the main compositional axes and directions of movement. The entrance to the Eastern Square from the esplanade is marked by a special "gate" formed by semi-circular buildings of ministries, flanked by high-rise towers of the Senate and the Mazhilis of Parliament. Along the main axis of the square there are skyscrapers and the buildings of the Supreme Court and the Concert Hall. In the perspective of the square, the Presidential Palace stands out, located on the main axis, emphasizing its central position in the composition of the Eastern Square and the administrative center as a whole (Fig. 3b). The only two structures that stand out clearly on the main axis of the center are the Baiterek monument and the Presidential Palace.

The main axis of the center extends far beyond its central part, crossing the water spaces, and in the east turns into a hill on which the Palace of Peace and Accord is located. In the west, this center ends with a spacious square, where the Khan Shatyr shopping and entertainment complex rises, 150 meters high, designed by architect Norman Foster.

New architectural objects in Astana were integrated into the existing urban structure of Tselinograd, which created additional difficulties in forming a unified and expressive image of the capital. The specificity of the architectural environment of the new capital is conditioned by the initial principle of synthesis and mixing of various styles and concepts, and a combination of architectural traditions and innovative approaches. Astana is distinguished by the presence of many elements that can be considered as symbols of the capital's identity, which are visual or verbal designations indicating that this environment belongs

a b

Fig. 3. Buildings of the new administrative center of Astana: a) "Astana-Baiterek" monument; b) Presidential Palace

Source: Zanna (2015).

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to a city of special status. A feature of the architectural appearance of Astana is not only the use of innovative forms characteristic of global architectural trends, the city is enriched with elements reflecting the Kazakh national cultural tradition.

This custom combines the unique aspects of the culture of the Turkic nomadic peoples and the "oriental" and Muslim cultural norms and values common among the peoples of Central Asia. It includes traditional forms of architecture, graphic symbols, ornamental compositions, and elements of ancient art and folklore (Laruelle, 2021). Significant components of the architectural and spatial environment of the capital are symbols of the state, such as the flag, coat of arms, and state colors. The presence of these symbols facilitates the identification of objects of national importance, government and administrative structures in the environment. In addition, conceptual and verbal symbols can become part of the appearance of the urban environment – for example, the name of the city "Astana" is translated from Kazakh as "capital", which reflects its status already in the name itself. Many aspects of the meaning of urban space are shaped by Kazakh legends and historical events. These influences are manifested in the names of squares, streets, parks and squares, and in the organization of the spatial structure of the environment.

Architects actively use a variety of techniques inherited from ancient Turkic architecture and architectural forms, not only to embody national artistic features, but also as following the traditional principles of design and construction in this region (Zhang et al., 2022). Stylized elements such as domes, tents, drums, fours, eights, and constructive techniques and decorative elements have become an integral part of many modern architectural compositions of Astana. An example is a number of administrative buildings in the new center, built in the form of towers with a golden mirror surface of the facades, which is clearly associated with elements of ancient Turkic art. For example, the shape of the helmet of an ancient warrior known as the "golden man" served as inspiration for the design of these buildings.

The yurt, as a symbol of the Kazakh national culture, is often embodied in architectural forms to emphasize the cultural affiliation of the object. For example, the upper part of the Presidential Cultural Centre has the shape of a yurt with a dome. The shanyrak, part of the latticed skeleton of the yurt, is often used as a symbol in various architectural elements, such as patterns on the plan, the shape of the building's covering, or the decoration of the facade (Gantumur et al., 2018). Its conciseness and geometric logic contribute to easy recognition and are associated with the ancient Turkic culture. Kazakhstani mausoleum, also seen in Figure 4, reflects this same cultural influence. This mausoleum integrates traditional architectural elements, such as the use of domed structures and symbolic motifs reminiscent of the yurt, blending them with modern design techniques to create a unique monument that honors Kazakhstan's historical and cultural identity. The mausoleum serves as a significant example of how ancient cultural symbols continue to shape contemporary Kazakhstani architecture, reinforcing national identity while also adapting to modern needs.

Many significant structures in the new capital embody the symbolism of oriental architecture through the use of domes, especially in buildings of national and cultural significance. The blue domes adopt the traditions of ancient Turkic cultures and reflect the respect for the cult of Sky inherent in Tengrianism (Baiborieva, 2020). For example, the residence of the President of the Republic of Kazakhstan "Akorda Residence" (Fig. 5a). Blue domes crown the building. The left-bank administrative center also has structures with domes, such as the five-domed high-rise building of the Mazhilis of Parliament (Fig. 5c). The passenger terminal of Astana International Airport is one of the main symbols not only of the capital, but also of the whole country, being considered its business card (Fig. 5b). Its image combines the features of modern architecture with a national flavor. The building has a shape resembling the wings of a symbolic bird, with a central dome in the form of a blue hemisphere topped with a glass roof – shanyrak.

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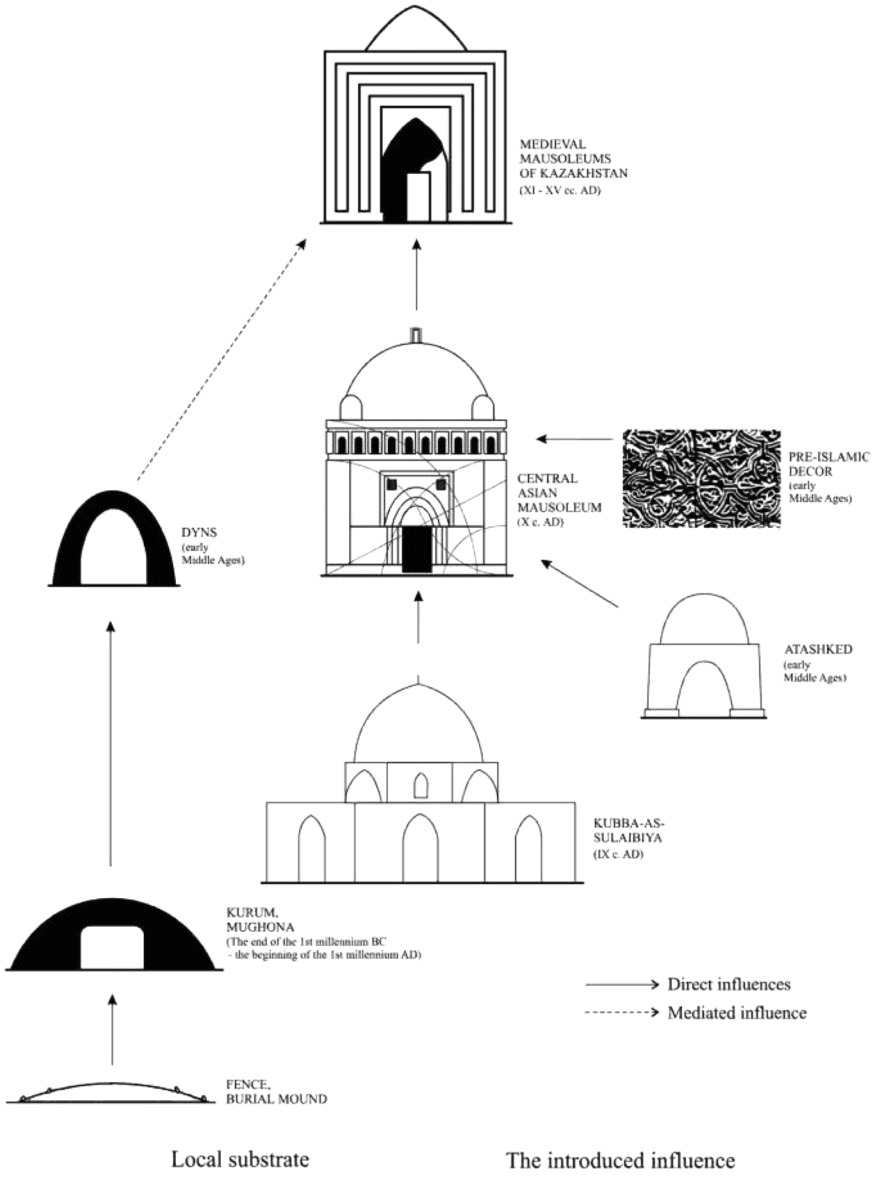

Fig. 4. Formation of the Central-Asian Kazakhstani mausoleum which contain the elements of Kazakh national culture and architecture
Source: Baitenov et al. (2019).

Notably, the modern architecture of Kazakhstan is actively introducing elements of Oriental and Muslim architecture, such as pointed arches and portals. For example, an eight-pointed star, which is a religious symbol of Muslim culture and reflects the ancient Avestan tradition of the eight cardinal directions (Shabani et al., 2018). This symbol, consisting of two squares aligned with a common center and rotated 90 degrees, plays a key role in Muslim architecture. Its geometric symmetry and aesthetic appeal make it a popular choice for decorating buildings, mosques, and for decorating various architectural elements such as arches, walls, and domes. Such a symbol not only gives the buildings an exquisite appearance,

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Fig. 5. Dome architecture of Astana: a) residence of the President of the Republic of Kazakhstan "Akorda Residence"; b) passenger terminal of Astana International Airport; c) building of the Mazhilis of Parliament
Source: Truspekova and Sharipova (2022).

but also has a deep symbolic meaning reflecting the spiritual and cultural values of the ideals of Islamic architecture. This symbol also inspired the design of the fountains that adorn the western part of the water-green boulevard in the new administrative center. The shape of the star became the basis not only for the design of fountains, but also for the general planning of the central part of the building. On a wide platform, decorated in an octagonal style, stands the Astana-Baiterek tower, symbolizing the unity and prosperity of the city (Dorling Kindersley, 2021).

It was observed that the traditional Kazakh ornament is widely used in architecture to decorate facades, interiors, elements of landscaping, and festive decoration of the city. The color shades of yellow and blue, known as the colors of the national flag and traditional to Kazakh culture, are often used in architecture and environmental design. On the right bank of the city, the central avenue is represented by numerous residential and public buildings made in yellow and blue colors. Administrative buildings of national importance, such as government buildings, ministries and other administrative institutions, are also located in the capital. The presence of these structures in Astana, where they are majestic and important, underlines the city's status as the capital of their country (Embassy of Kazakhstan, 2020).

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The historical and geographical features of the Akmola region are determined by its location in the geographical center, at the intersection of ancient trade routes. When forming a new architectural environment of the capital city, not only the latest trends in architecture are considered, but also the rich cultural and historical heritage of the region. This allows creating a harmonious combination of modern architectural solutions with unique traditions and features that have shaped the character of the city for many centuries. The architectural appearance of the buildings of the new capital is a reflection of many factors that have shaped its unique identity. This includes the traditions of Turkic culture that grew out of the nomadic lifestyle, and the impact of cultural and political changes that have had an impact on the urban environment. It is also important to consider the new conditions of development of Kazakhstan itself and its capital, which contribute to the evolution of the architectural appearance. The new architecture not only preserves the nomadic heritage of the Kazakhs, but also integrates it into the global context of the world and modernization trends. The symbolism and urban planning of the new capital not only emphasize the Kazakh identity, but also reflect the idea of Eurasian unity, where cultural diversity becomes the basis for harmonious coexistence and mutual understanding.

The capital, which arose from a provincial city, should reflect the spirit of the promising aspirations of an independent state, combining traditions, ancient culture, and progressive foundations of development in a modern context. The positioning of Astana as a geographical center located at the intersection of Europe and Asia has had a significant impact on the development of its architectural appearance, especially in the new administrative center. This powerful symbolic architecture reflects not only functional aspects, but also a rich heritage of geopolitical, historical, philosophical, and cultural phenomena (Pavlaković & Bădescu, 2019). This fact was reflected in the character of the architectural appearance in the form of stable combinations of borrowed elements such as classicism, traditional Turkic architecture and modern trends, which characterizes the eclectic style.

All these approaches are united by the desire to express the idea of statehood and representativeness, which is a characteristic feature of the architecture of the capital. Astana architecture often uses elements that emphasize this representativeness: a lot of mirrored surfaces, the use of gold, an abundance of ornament on the facades, and an enlarged scale and a combination of expressive forms with classical ones. It can be seen that when forming the semantics of the architectural environment of the capital, the formal approach often prevails over symbolism, leading to compositional harmony, which sometimes sacrifices symbolic content. This process generates a new architectural style created by combining and merging various elements and cultural influences. It manifests itself in samples of architectural structures, where classical forms are combined with elements of Turkic culture, forming a unique symbiosis. These approaches are especially noticeable in the main government buildings of the new administrative center, where expressiveness is achieved through the explicit application of a certain stylistic direction.

In the architectural environment of Astana, elements associated with the image of a provincial Soviet city are disappearing. Offices and administrative buildings previously located in the old center are being moved, freeing up the central areas of the right-bank part of the city to accommodate commercial and entertainment facilities. A network of bypass roads linking these areas with major transport hubs is also being created. The main directions of the development of the city and its new center have been determined. The principles laid down in the master plan for the development of the city (for example, linear layout, metabolic framework) confirm themselves by providing a flexible and developing metropolitan urban planning structure. However, at the level of individual objects, inconsistencies of scale and stylistic discrepancy and the lack of consistency of many architectural complexes are noticeable.

The study reveals that the architectural environment of Astana is shaped by a blend of traditional

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Kazakh cultural elements and modern architectural innovations, reflecting both historical influences and contemporary needs. The design of buildings across the city integrates symbols of the nomadic heritage, such as the yurt, alongside modern materials and construction techniques, creating a unique fusion of past and present. Environmental sustainability is also a key feature, with green spaces and sustainable urban planning embedded in the city's design to ensure functionality and aesthetic appeal for its growing population. The city's architectural landscape is further characterized by a flexible and adaptable urban planning framework, which allows for both common themes and district-specific characteristics. This dynamic approach to development, rooted in cultural identity and modern infrastructure, contributes to Astana's status as a capital city that harmoniously balances tradition with innovation.

Historically, the city's development reflects the transition from a small provincial settlement to a capital city, which necessitated the creation of a distinctive architectural identity that blends Kazakhstan's cultural heritage with modern design principles. Socio-cultural factors reflect in the desire to express national identity through architecture that has led to the incorporation of traditional elements into contemporary structures. Economic aspirations and the push for global competitiveness have driven the use of innovative materials and technologies. Additionally, environmental considerations, such as the need for sustainable urban planning and green spaces, influence the design and layout of the city's infrastructure. These interrelated factors collectively contribute to the dynamic and evolving appearance of Astana's infrastructure, making it a unique blend of tradition and innovation.

DISCUSSION

The study showed that during the evolution of civilization, there are constant changes in the typology of buildings and structures. In different historical periods, unique architectural objects appeared using new design solutions and materials, which made them unique. The features of the development of innovative buildings based on the sustainable development of the urban environment are considered, including various factors and conditions affecting their structure and functionality. As the capital of Kazakhstan, Astana city has undergone significant transformation, embracing both innovative design solutions and elements of its cultural heritage. The architectural evolution, while rooted in the need for functionality and modernization, also serves as a symbolic representation of the country's identity and its aspirations for the future. This discussion aims to delve into the complexities of Astana's urban planning, evaluating how these multifaceted influences contribute to its unique architectural landscape. In doing so, the study examines the integration of traditional and contemporary architectural approaches, while addressing the challenges that arise from rapidly transforming urban spaces.

The current study provides a valuable panorama of historical trends, architectural styles and technological innovations, covering the period from the establishment of the city to its modern status as the capital. This issue has also been considered by Shabolova et al. (2023), Toishiyeva et al. (2023), who studied the features of the development of the architectural environment of residential buildings in the city of Astana. Shabolova et al. highlighted that in order to solve problematic issues regarding the architecture of the city, it is necessary to use digital technologies, after which the concept of a "Smart City" was implemented. Toishiyeva et al., in turn, analyzed the features of the city of Astana at various stages, after which a special strategy for infrastructure development was thought out, considering the socio-economic development of the population.

The current state of the urban environment, as reflected in the results of the present study, reflects trends in the architecture of residential buildings and aspects of the city's development. This may include aspects such as sustainable development, innovative approaches to design and construction, and attention to urban infrastructure and public spaces. In comparison with the historical stages

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of the city's development described in the paper, the current state represents a significant change. In the past, architectural solutions could have been more traditional and focused on existing cultural and historical contexts. However, over time and with modern challenges such as urbanization, climate change, and socio-cultural changes, architectural solutions could become more innovative, functional, and sustainable. Consequently, although historical research provides a valuable knowledge base about the previous stages of the city's development, modern research is likely to focus on more relevant aspects and challenges that the city is currently facing.

As shown in the results of this study, the capital of Kazakhstan, Astana, has been undergoing significant transformations in recent decades, reflecting ambitious development and modernization strategies. These changes affect not only the urban infrastructure as a whole, but also the specific architectural environment of residential areas. New residential complexes and neighborhoods being built in various parts of the city are becoming symbols not only of growth and prosperity, but also of an architectural bold experiment. The urban development of Astana, inheriting the traditions of world architecture, at the same time retains its uniqueness and reflects the national and cultural characteristics of Kazakhstan. This process is not only a technical and engineering challenge, but also serves as an opportunity to realize the high ideas of architectural and urban planning art. These conclusions are consistent with the findings of Semenyuk et al. (2020), Rezaei et al. (2019), O'Brien et al. (2020), Altomonte et al. (2019).

In the context of the rapid and dynamic development of the capital of Kazakhstan, the issues of the architectural environment of residential areas are becoming particularly relevant and important, since the development of modern urban infrastructure and housing environment has a direct impact on the quality of life of citizens and on the overall appearance of the city. The rapid development of Astana requires not only an increase in living space, but also the creation of comfortable and functional spaces that promote harmonious interaction of people with the urban environment. Architectural decisions made as part of this process carry not only technical and aesthetic aspects, but also responsibility for creating a social environment in which people will live, work, and communicate. This has also been highlighted by Nurdubayeva et al. (2022), Salisbury and Gyucha (2022), Kim and Comunian (2022), Parkyn-Smith (2020), who studied in detail the architectural concepts and socio-cultural aspects of the development of the urban environment in Nursultan.

A study conducted by Abdrassilova and Murzagaliyeva (2020) confirms the importance of architecture in ensuring accessibility and comfort for all segments of the population, including low-mobility groups. This is in line with the trend described at the beginning of the paragraph that the modern concept of urban space strives for inclusivity and accessibility for all residents. The authors also confirm the importance of considering the diverse needs and capabilities of all population groups when designing an architectural environment. The researchers draw attention to modern challenges and trends in architecture, such as social aspects and inclusive environment. Thus, both studies are consistent with the general trend towards considering the needs of all population groups and creating an urban space that actively includes all residents. Both emphasize the importance of accessibility and comfort in the architectural environment and highlight practically significant aspects, such as architectural and planning solutions aimed at improving living space in settlements.

In the context of the present study, issues of the architectural environment of residential areas represent a key aspect of the development and well-being of urban societies. The rapid increase in the population of cities, together with the need to develop infrastructure and provide comfortable living conditions, creates an urgent need for adaptive architectural solutions. Residential complexes are becoming not just a place of residence, but also centers of social and cultural life, where public relations are formed, infrastructure for education and recreation is being created, and economic opportunities are

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developing. The architectural environment of residential areas has a direct impact on the quality of life of citizens. It should be not only functional and safe, but also aesthetically pleasing, contributing to the creation of a comfortable and harmonious atmosphere for residents. The development of unique architectural concepts that consider the cultural, social, and environmental characteristics of each region plays a key role in creating sustainable and attractive urban spaces.

A similar study based on the general theory of bioecological territorial systems was conducted by Semenyuk et al. (2023), Ayu (2022), Maurya et al. (2023), Korol (2021), Bohr et al. (2019), who analyzed various aspects of urban development, focusing on Nursultan and other cities of Kazakhstan. Comparing these studies with the analysis of the features of the development of the architectural environment of residential areas, it can be noted that they complement each other, representing various aspects of the impact of the urban environment on people's lives.

The architectural development of Astana exemplifies the intersection of tradition and modernity, where historical influences are seamlessly integrated with cutting-edge innovations. The city's transformation reflects broader socio-political changes, underscoring the role of architecture not just in urban development but also in nation-building and cultural expression. As Astana continues to evolve, it faces the challenge of balancing the preservation of its unique identity with the demands of sustainable, functional urban growth. Future developments must address the city's diverse needs, ensuring that architectural solutions are inclusive, environmentally conscious, and responsive to the evolving socio-economic landscape. The ongoing adaptation of Astana's architectural environment offers valuable lessons for other rapidly developing cities, highlighting the importance of strategic planning and innovative design in shaping the urban future.

CONCLUSIONS

During the evolution of civilization, the typology of buildings and structures was constantly changing. At each stage of historical development, unique architectural objects appeared, using new design solutions and advanced building materials. This led to the creation of individual and unique artistic images of architectural objects and the emergence of innovative buildings.

The innovative building is unique in its design and artistic solutions. Changing values in society, the role of information and technological progress affect the typological structure of buildings, which leads to the emergence of more innovative projects. The trends in the development of such buildings, considering the sustainable development of the urban environment, were studied, and the factors and conditions affecting their development were analyzed. The design considers social, climatic, environmental, architectural, urban planning, technological, aesthetic, and economic factors. While economic concerns have fueled the demand for creative, useful places to sustain the city's rapid growth, historical influences may be seen in the blending of traditional Kazakh components with contemporary architectural solutions. Green areas and eco-friendly technologies have been incorporated as a result of environmental factors, such as sustainable urban design. The urban environment is considered as an information and activity system, and the development of buildings in it is carried out using innovative approaches.

To improve the visual appearance and functionality of Astana's urban infrastructure, it is recommended to focus on enhancing architectural cohesion across districts by addressing inconsistencies in style and scale. This can be achieved by promoting a more unified design language that incorporates both modern and traditional elements while ensuring greater functionality and accessibility. Additionally, prioritizing the development of public spaces, green areas, and pedestrian-friendly zones will improve the livability and aesthetic appeal of the city. The integration of sustainable building practices and smart technologies

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should be expanded to enhance energy efficiency and environmental performance. Finally, fostering collaboration between urban planners, architects, and local communities will ensure that the city's infrastructure meets the evolving needs of its residents while maintaining a distinctive cultural identity.

The study faces limitations, such as limited access to information, which may affect its completeness and depth. Geographical restrictions also exclude consideration of architectural features outside certain areas or residential areas in the city. As a result of the study, it was found that the architectural environment of innovative scientific and industrial complexes is characterized by systemic functioning, change and development due to a multilevel hierarchical structure and the interconnection of the main components. As a result of certain scientific and production processes, their typological organization will evolve in the future.

Further research on the topic may cover several areas. This includes: a study of the influence of the architectural environment on the socio-cultural identity of Astana residents; a study of the principles and methods of integrating the principles of sustainable development into the architectural environment of residential areas; a study of the influence of the development of the architectural environment of residential areas on the transformation of urban space of the city; a study of methods and principles of urban planning of residential areas of Astana to optimize the use of urban space, create a comfortable and a functional living environment.

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