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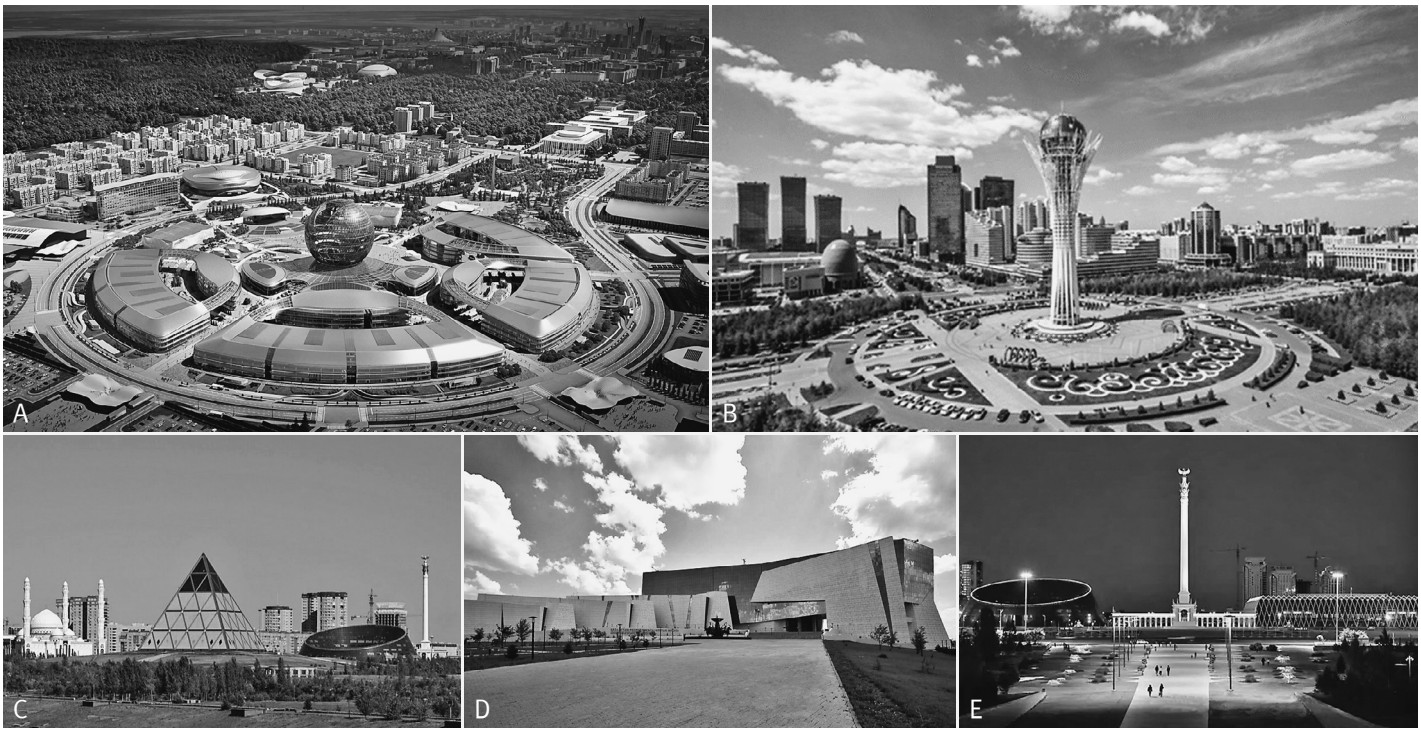

Fig. 1 Modern landmarks of Astana: a) Expo-2017, b) Baiterek, c) Palace of Peace and Reconciliation, d) National Museum of the Republic of Kazakhstan; e) Independence Square and the "Kazakh Ely" Monument

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Philosophy of Urbanization and Socio-Cultural Dynamics Issues of a High-Tech Capital

The Case of Astana, Kazakhstan

Astana, Kazakhstan
digital inclusivity
philosophy of the city
socio-cultural groups
technological transformation
urbanization

The research aims to identify the impact of urbanization and technological change on the socio-cultural structure of the city. The applied methodology was based on two data sources: 1) interviews with 18 specialists from six fields; 2) a survey of 250 residents using the PREQ scale ("Perception of Residential Environment Quality"). Experts invited to participate in the research represented diverse spheres: urban planning, architecture, information technology, sociology, economics, and ecology (n = 18). The findings confirmed that technological changes in the city of Astana (Kazakhstan) contribute to its harmonious development. Experts in urban planning, architecture, and information technology noted positive changes in urban infrastructure, visual appearance, and digital services. The results confirm that the working-age population and more vulnerable groups have different evaluations of urban environmental aspects, emphasizing the need to consider multiple perspectives in urban planning and management. The research findings are crucial for informed urban planning and the development of more inclusive and equitable urban strategies.

Introduction

In recent decades, global urbanization has taken on a rapid pace, accompanied by the integration of high technologies into urban society (Preston, 2023; Wang et al., 2021). This phenomenon not only sharpens the economic and technological aspects of urban development but also affects the socio-cultural foundations of society (Jacobs and Malpas, 2019). In the context of such changes, cities exert significant influence on the lives of their inhabitants. However, despite the evident gains in technological progress (Martin, 2019), issues related to socio-cultural dynamics require more detailed investigation. Socio-cultural changes have a substantial impact on the values, identity, and lifestyle of urban communities.

Astana, the capital of the Republic of Kazakhstan, is undergoing a process of intensive development and modernization, including advancements in high technology (Ghalib et al., 2021). As a capital city, Astana has become a place where various cultures and ethnic groups converge. Numerous modern buildings and monuments, such as Baiterek, Expo-2017, the Palace of Peace and Reconciliation, and the National Museum of the Republic of Kazakhstan (Fig. 1), have been constructed to emphasize the innovative character of the new capital (Abdrassilova and Danibekova, 2021).

At the same time, many residents of Astana still remember a time when urbanization did not yet touch the city. Considering their experiences and knowledge, an important task is to investigate how technological transformations have affected the lives and interactions of citizens in the city, as well as to identify optimal strategies for combining high technologies with respect to cultural heritage (Manassova and Karipbaev, 2023).

Literature Review

Surrealism, a philosophical approach to studying the phenomenon of urbanization may have various starting points, but they all intersect in some way with the Philosophy of the City Ð a contemporary concept in social philosophy, based on the social dimension of urban life (Elsayed et al., 2023; Lehtinen, 2020). This area of philosophy also deals with questions about the meaning and purpose of the city, its influence on human identity, and the interaction between the individual and the urban environment (Jacobs and Malpas, 2019). Researchers (Enssle and Kabisch, 2020; Mumford, 2020) raised questions about the interplay between the city's influence and the lifestyle of its inhabitants, the formation of a sense of belonging, social relationships and individuality. The philosophy of urbanization also addresses issues of sustainable urban development (Hariram et al., 2023; Trovato, 2021). Zuziak (2020) emphasized the importance of the "meeting" of urban planning and philosophy, building a philosophical stance on the social and ecological problems of the modern city, from epistemological, ontological, and axiological perspectives of new urban policies. The philosophy of urbanization also encompasses questions of cultural identity in cities. Researchers (Ragheb et al., 2022; Theodora, 2020) are interested in how cities preserve their cultural heritage and how they adapt to and integrate new elements into their cultural background.

The study of transformations in large urban centres brings together three distinct disciplines: urban sociology, cultural anthropology, and ecological urbanism. Evaluation methods integrate measurable infrastructural data with residents' subjective assessments (Mouratidis, 2021). The spatial distribution of urban facilities directly affects social cohesion, as the degree of street connectivity determines the frequency of encounters among individuals from different social groups (Medeuov, 2021).

This interplay has resulted in a new conceptualization of urban space. The legacy of the Soviet past continues to shape urban development, as administrative structures often persist even after formal political reforms

(Kinossian, 2022; Ranjan, 2023). In Kazakhstan, where more than 130 ethnic groups coexist and communicate in diverse languages, research methodologies must be sensitive to cultural heterogeneity. Moreover, urban development faces tensions between state planning priorities and market-driven interests, producing a juxtaposition of grand boulevards with irregular, unregulated construction (Gerten et al., 2022).

Western theoretical frameworks require adaptation to local contexts. Soviet-era standardized housing, centralized heating systems, and public services continue to influence residents' everyday practices. Assessments of urban quality must also account for unequal access to services among the elderly, low-income populations, and individuals who do not speak the state language. Collectively, these factors signify a fundamental reorientation in approaches to urban research.

With the development of technologies and smart city concepts, researchers (Cugurullo, 2021; Epting, 2021) also consider the ethical and philosophical aspects of technology integration into the urban environment. The working-age population typically utilizes technology more actively and may assess its impact and the quality of the urban environment differently from less affluent segments of the population (Song et al., 2020). Sociocultural factors such as age, financial status, ethnic background, and the presence of limited capabilities may affect the assessment of urban environment quality (Chakraborty et al., 2020; Raiden and King, 2021). Therefore, the second research hypothesis suggests that significant differences exist in the perception of urban environment quality among different socio-cultural groups in the context of Astana (H2). The study aims to identify the influence of technological transformations in the context of urbanization on the socio-cultural dynamics of the high-tech capital, with a focus on the case of Astana.

The philosophical perspective links the practical evaluation of the urban environment with the theoretical analysis of cultural transformation. The examination of individuals' lived experiences reveals the realities that lie beyond statistical indicators, as perceptions of urban space are shaped by cultural background. This orientation has determined the choice of research methodology.

Methodology

• **Research design** – The study combined both qualitative and quantitative analysis (Fig. 2). Experts from six disciplines – urban planning, architecture, information technology, sociology, economics, and ecology – provided assessments during in-depth interviews, with their professional perspectives being compared to the opinions of survey respondents. City residents completed questionnaires using the PREQ scale, with a total of 250 participants. This two-tiered approach allows for a comparison between professional judgments and the real-life perceptions of various sociocultural groups regarding the urban environment.

Fig. 2 Research design scheme

In the context of digital inclusivity, researchers have identified several population groups that are more likely to encounter challenges in accessing digital technologies and digital literacy: elderly individuals, economically disadvantaged populations, people with limited abilities, low-skilled workers, and ethnic minorities.

• **Participants** – The expert sample comprised (1) specialists in urban planning, (2) architecture and design, (3) information technology, (4) sociology, and (5) economics and business, ecology, and sustainable development. Three individuals were invited for each domain. Experts were selected according to the following criteria: at least five years of professional experience, completed projects or scholarly publications on Astana, and demonstrated knowledge of local specificities. Recruitment was carried out through referrals from colleagues affiliated with professional associations and universities. Ultimately, the sample comprised eleven practitioners and seven researchers. Thus, the expert sample consisted of 18 individuals, 10 males and 8 females. The average age of participants was 44 years, with an average work experience of 16.9 years. The demographic data of the participants are presented in Table I.

The local population sample consisted of two groups of participants, who, according to the researchers, may experience varying levels of access to digital technologies and digital literacy: the working-age population aged 25-60 (Group A) (n = 126) and the elderly, eco-

Table I Demographic data of expert sample

Specialization	Names	Sex	Age	Years of experience
Urban Planning	Daneesh	M	44	21
	Diana	F	38	12
	Zara	F	34	8
Architecture and Design	Anna	F	45	7
	Rustem	M	39	14
	Timur	M	55	21
Information Technology	Amir	M	37	11
	Sania	F	51	24
	Taiyr	M	66	41
Sociology	Leyla	F	58	16
	Olga	F	32	7
	Mustafa	M	44	19
Economics and Business	Alexander	M	49	26
	Gyuzel	F	39	13
	Daniyar	M	35	14
Ecology and Sustainable Development	Vasily	M	50	28
	Zhanazar	F	41	16
	Timofey	M	34	6

Table II Demographic data of the local population sample

		Group A n	Group B n
Sex			
	Male	59	60
	Female	67	64
Age			
	18-29	31	27
	30-44	43	29
	45-59	36	19
	Older than 60	16	49
Education Level			
	Secondary	42	42
	Bachelor's	59	63
	Master's and above	25	19

nomically disadvantaged segments of the population, individuals with disabilities, low-skilled workers, and representatives of ethnic minorities (Group B) (n = 124). The demographic data of the local population sample are presented in Table II.

In both groups, there is a balanced number of men and women. The average age of participants in Group B is 52.6 years, while that of Group A is 44.2 years. Group B includes a larger number of elderly individuals (aged over 60) compared to Group A.

• **Procedure** – Interviews with experts were conducted by researchers either in person or through video conferencing tools. Experts were invited through open sources or personal channels of communication of the researchers. Participation of experts was voluntary. In order to maintain anonymity, the names of the experts were changed. The interview for each category of specialist concerned their vision of the impact of technology on the development of the city in relation to their area of expertise.

Residents completed self-report questionnaires using the Perceived Residential Environment Quality (PREQ) scales (Fornara et al., 2010). For Group A, a representative sample was drawn from various districts of the city, considering diversity in socio-economic and demographic parameters. This involved random selection of houses, neighbourhoods, and workplaces, but with consideration for age and employment status. For Group B, the sample was based on data from social services, support centres, charitable organizations, and other institutions working with representatives of this category.

• **The assessment scales** – PREQ consists of 11 scales, totalling 66 items. Each scale comprises items with both positive and negative formulations. Responses were provided on a scale ranging from 1 = strongly disagree to 7 = strongly agree. The structure and reliability of the PREQ scales are presented in Table III.

• **Data analysis** – The first hypothesis (H1) was formulated: technologies contribute to the development of the city as a unified social space. To test this assumption, interviews with experts were conducted, and the responses were analysed using content analysis. This involved converting the interview recordings into text format, identifying categories for content analysis based on key themes (urban planning, architecture, information technology, etc.), coding the interview text, analysing patterns, and assessing the consistency of opinions among experts.

To test the hypothesis that there are significant differences in the perception of urban environment quality among different sociocultural groups (H2), an independent t-test was used. Using the t-test, the survey results were compared between two groups: the working-age population aged 25-60 (Group A) and more vulnerable sociocultural groups, including the elderly, low-income populations, people with disabilities, low-skilled workers, and ethnic minorities (Group B).

The analysis was conducted in three stages, progressing from specific observations to broader conclusions. At the first stage, 247 individual ideas were extracted from the interview transcripts. At the second stage, these ideas were grouped into 31 categories through comparative analysis. At the third stage, eight overarching themes were identified concerning the relationship between technologies and social stratification.

This process led to a breakthrough in understanding the problem. The interview results were cross-validated with numerical data from the PREQ surveys to ensure the robustness of the findings. The experts highlighted differences across population groups. Practitioners pointed to challenges with digital technologies among individuals over the age of 60 (correlation with "Accessibility Organization," d = –0.417), while sociologists emphasized the influence of economic stratification on service utilization (correlation with "Commercial Services," d = –0.515).

Table III Structure and reliability of PREQ scales

Scale	Categories	Number of Items	Cronbach's Alpha
Architectural and Urban Planning Space	Building Aesthetics	3	0.78
	Building Density	3	
	Building Volume	3	
Organization of Accessibility and Roads	Internal Functionality	3	0.81
	External Connections	3	
Green Areas		4	0.75
Social Relational Features	Security	3	0.86
	Discretion	3	
	Sociability	3	
Welfare Services	School Services	3	0.81
	Social Care Services	3	
Recreational Services	Sport Services	3	0.74
	Social-Cultural Activities	3	
Commercial Services		4	0.79
Transport Services		4	0.85
Pace of Life	Relaxing Versus Distressing	3	0.76
	Stimulating Versus Boring	3	
Environmental Health		4	0.80
Upkeep	Macroupkeep	4	0.82
	Microupkeep	4	

• **Ethical issues** – All participants provided consent to participate. Anonymity was guaranteed to participants, and personal data were neither collected nor stored. Participation in the study was voluntary. The names of experts were changed, and no remuneration was provided.

• **Limitations** – The study has several limitations that should be acknowledged. The survey included only 250 residents and 18 experts from a single city, which may restrict the generalizability of the findings to other urban contexts in Kazakhstan. While the sample size was sufficient to identify trends, a larger participant pool is required to draw definitive conclusions. Although the experts represented diverse professional domains, perspectives from peripheral areas were underrepresented.

In addition to the main findings, the study revealed methodological challenges. Conducted at a single point in time, the research design does not allow for a precise determination of whether technologies directly caused the observed social changes; longitudinal observation would be necessary to establish causality. Furthermore, the PREQ questionnaire captures individuals' perceptions, which may diverge from actual conditions.

Future research should, therefore, pursue longitudinal studies with consistent participant groups, integrate sensor-based data to validate survey responses, and extend the analysis to other cities such as Almaty, Shymkent, and beyond.

Results

Technological transformations amid urbanization will contribute to the harmonious development of the city as a socio-cultural space (H1)

The responses of urban planning specialists to questions about changes in the urban environment, infrastructure, and overall city composition resulting from technological changes generally reflect positive developments associated with technological innovations in Astana.

"Technological changes have led to the modernization of urban infrastructure. The implementation of efficient traffic light systems, the development of digital city maps, and digital schedules for public transportation have made the infrastructure more resilient and adaptive to the needs of citizens." (Diana)

"The city has transformed, acquiring a modern appearance." (Danesh)

Among the areas for improvement, all three experts unanimously recommend improving public transportation, accelerating the implementation of electronic tickets for public transport, and enhancing the safety of pedestrians and cyclists. Two out of three experts also emphasized the need to expand urban spaces for socializing and recreation:

"Innovative urban parks with modern art design for family leisure – that's exactly what, in my opinion, Astana lacks." (Zara)

Experts in architecture and design, like urban planning specialists, also noted that the city's external appearance has only improved in recent years.

"Light installations, digital building facades, and the use of next-generation materials create unique visual elements." (Timur)

At the same time, each of the experts in architecture and design had their own recommendations for improvement.

"I recommend paying attention to the use of 'smart' materials in the city's architecture, which is currently practiced very rarely as far as I know. Such materials can react to changes in the environment, adapting to various conditions, such as severe frost or strong winds. This will not only increase the efficiency of buildings but also create unique forms and textures that harmoniously blend with the technological spirit of Astana." (Rustem)

"Old factories can be transformed into modern cultural centres, while preserving elements of industrial design." (Timur)

Experts in the field of information technology spoke about the advantages of digital infrastructure, smart technologies, and the optimization of urban systems in the context of urban life in Astana and emphasized the importance of involving the wider public in the process of digital transformation.

"The direction of development of digital infrastructure in Astana is chosen correctly, but further strengthening is necessary." (Sania)

"It is important to conduct educational programs on the use of digital technologies, as well as actively engage with the community to gather feedback and suggestions." (Amir)

Sociology specialists noted new opportunities for obtaining information, communication, and entertainment.

"First and foremost, I can mention modern media and social networks as new means of communication and cultural exchange." (Olga)

At the same time, the aspect of digital accessibility and inclusivity was emphasized:

"There is a problem that elderly people cannot actively use technologies, and this creates a certain social imbalance. It is neces-

Table IV Descriptive statistics and independent t-test results between Group A and Group B

	Group A		Group B*					
	M	**SD**	**M**	**SD**	**t**	**p**	**d**	***95% CI (Lower - Upper)***
Architectural and Urban Planning Space	3.77	0.75	3.82	0.88	0.84	0.805	0.061	-0.187 – 0.309
Organization of Accessibility and Roads	3.11	0.78	2.77	0.85	5.96	0.033*	-0.417	-0.668 – -0.166
Green Areas	3.19	0.82	3.23	0.75	0.79	0.712	0.051	-0.197 – 0.299
Social Relational Features	3.23	0.76	3.04	0.82	1.30	0.061	-0.228	-0.476 – 0.021
Welfare Services	3.25	0.78	3.01	0.62	3.07	0.045*	-0.34	-0.59 – -0.091
Recreational Services	3.39	0.74	3.56	0.81	1.44	0.066	0.219	0.029 – 0.468
Commercial Services	3.52	0.66	3.12	0.88	6.17	0.028*	-0.515	-0.767 – -0.263
Transport Services	3.20	0.74	3.05	0.78	1.38	0.09	-0.197	-0.446 – 0.051
Pace of Life	3.46	0.68	2.87	0.69	7.79	0.01*	-0.861	-1.121 – -0.602
Environmental Health	3.31	0.77	3.28	0.73	1.06	0.707	-0.04	-0.288 – 0.208
Upkeep	3.21	0.54	3.77	0.68	8.96	0.001*	0.913	0.652 – 1.173

* p ‹ .05

Table V Alignment between expert assessments and public perceptions

Expert Theme	**Corresponding PREQ Scale**	**Difference between groups (Cohen's d)**
Digital Infrastructure (IT experts)	Accessibility Organization	-0.417*
Technological Inclusiveness (Sociologists)	Commercial Services	-0.515*
Pace of Modernization (Urban Planners)	Pace of Life	-0.861*
Ecological Innovations (Environmental Scientists)	Environmental Health	-0.040

sary to assess how accessible technologies are for all layers of the population and what barriers exist for certain groups. This is important to ensure equal opportunities and prevent possible socio-cultural inequalities." (Mustafa)

Economists and entrepreneurs focused on the economic efficiency of innovations and improvements in the functioning of the business environment.

"I can note the improvement of production processes, logistics optimization, as well as the use of technologies for data analysis." (Alexander)

"Simplified procedures for registration and licensing support for innovative projects through tax incentives – these are the main improvements that I have noticed." (Daniyar)

Recommendations for improvement included funding for innovation ("Availability of additional investments and grants for startups", Alexander) and strengthening the training and development system for personnel ("Support for educational programs in the field of innovation", Gyuzel).

Ecologists and specialists in sustainable development noted new opportunities for monitoring the environmental situation in the city and energy conservation.

"Sensors and remote sensing systems collect data on air, water, and soil quality; residents can access pollution data using their smartphones." (Zhanazar)

"Solar panels, wind turbines, and other renewable energy sources contribute to the transition to clean energy." (Timofey)

Among the proposals, there were innovative methods of waste management, the development of electric transportation, and the promotion of eco-technologies implementation in enterprises.

Among different socio-cultural groups, significant differences exist in the perception of urban environment quality (H2)

According to the results of statistical analysis (Table IV), regarding the Architectural and Urban Planning Space, Green Areas, Social Relational Features scales, Recreational Services, Transport Services, Environmental Health the ratings between the two groups are *similar,* with statistically insignificant differences. Group A evaluates the Organization of Accessibility and Roads, Welfare Services, Commercial Services, Pace of Life and Upkeep higher than Group B, and the differences are statistically significant, with a medium effect size *(d = -0.417),* small effect size *(d = -0.34),* noticeable effect size (*d = -0.515),* strong effect size *(d = -0.861)* and the strongest effect size observed *(d = 0.913)* accordingly.

The comparison of expert interviews with survey statistics revealed consistent patterns (Table V). Concerns were raised regarding the exclusion of certain groups from digital life. The statistical analysis confirmed these concerns: population groups differed significantly in their assessments of the accessibility of urban services (d = –0.417, p ‹ 0.05) and commercial services (d = –0.515, p ‹ 0.05). Modernization also affects population groups unevenly, most notably reflected in the "Pace of Life" indicator (d = –0.861).

Discussion

Experts from different fields concur that technologies contribute to Astana's development. This finding supports the research hypothesis (H1). At the same time, insights from the experiences of other countries were also identified. The results also indicated significant differences in the perception of the urban environment between the working-age population and more vulnerable socio-cultural groups. This reflects the concept of urban philosophy as a place where not only structures and technologies interact but also di-

verse socio-cultural contexts (Jacobs and Malpas, 2019). The obtained results draw attention to digital divides among different population groups. This aligns with urbanistic philosophy, which asserts that the urban environment, its resources, and amenities should be accessible for use by all segments of society, regardless of their social status, age, physical abilities, and other characteristics (Hariram et al., 2023; Trovato, 2021). The results indicating differences in the assessment of parameters such as "Pace of Life" and "Upkeep" suggest that urbanization changes affect the perception of quality of life by different groups. This serves as a cautionary note that urbanization is not uniformly perceived by all population strata.

Research conducted in various countries reflects the diversity of the impact of technological changes and urbanization on sociocultural dynamics. In Singapore and Atlanta (USA), technologies are widely utilized to create smart cities (Johnston, 2019). In Indian cities such as Bangalore and Hyderabad, the rapid development of technological innovations, especially in the field of information technology, affects urban culture by facilitating communication and access to services (Subrahmanya, 2017). Nairobi (Kenya) demonstrates how technological changes, such as mobile payments, impact economic and socio-cultural spheres, improve financial inclusion and alter lifestyles (Wong et al., 2023). São Paulo in Brazil also undergoes technological transformations, influencing transportation, education, and interaction with urban infrastructure (da Silva et al., 2020). Thus, in Kazakhstan and several other countries with different typologies of economic development, technological changes are accompanied by various challenges and opportunities, and socio-cultural aspects are influenced by innovations depending on the context of economic development and cultural characteristics.

The experience of digitalization in European cities offers valuable lessons for Astana, with many solutions that can be adapted to local conditions. European practices provide benchmarks for urban development. In Barcelona, for example, the Decidim platform enables citizen participation in urban governance, with 31,259 registered users. However, the ambitious promises of authorities are not always realized in practice (Alizadeh et al., 2024). In Copenhagen, 98% of buildings are connected to district heating, a system that reuses waste heat and is managed through digital technologies. This model is particularly relevant for Astana, where temperatures fluctuate between –40 °C in winter and +35 °C in summer (Maliszewska-Nienartowicz et al., 2024). In Vienna, 60% of residents live in municipal housing. The city continues to modernize technologies while maintaining affordable housing prices, successfully combining social policy with innovation (Felt and Sepehr, 2024). The European "New Bauhaus" program defines specific urban development goals, allocating 15% of the budget to green areas, converting 80% of abandoned industrial sites into usable spaces, and ensuring that all basic services are accessible within a 15-minute walk (Rosado-García et al., 2021).

Astana, however, has its own particularities: sharp temperature fluctuations, a complex urban layout consisting of nearly 80,000 plots, and a multiethnic population. European experiences must therefore be carefully selected and adapted, as direct imitation is unlikely to succeed. The legacy of the Soviet period remains evident in large residential blocks and district heating, while administrative systems have inherited Soviet operational principles. These structural features continue to shape the implementation of new technologies in the city (Sandu, 2024).

Conclusions, Recommendations, and Prospects for Further Research

The study has certain limitations, namely a small sample size and a focus on a single city. Within these constraints, however, the findings highlight the need for targeted support for the elderly population. This includes the provision of accessible sidewalks and resting benches, as well as improving the availability of public services for older citizens. Continuing to develop digital infrastructure to enhance citizens' quality of life, including mobile applications and digital services, is recommended, as well as expanding the use of eco-technologies. The preliminary findings outline tasks for urban planners and architects. These conclusions remain tentative and require further validation. To ensure reliability, a larger research sample is necessary. Comparative analysis with other cities – such as Almaty, Shymkent, and regional centres – will strengthen the evidence base. Incorporating diverse urban contexts will also allow for testing the universality of the identified patterns. Future researchers can focus on conducting additional statistical tests to identify more detailed differences in the perception of the urban environment among sociocultural groups. Expanding the study to other high-tech capitals can provide a comparative analysis and more general conclusions about the impact of technological transformations on sociocultural dynamics in cities.

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Bibliography and sources

1. Abdrassilova, G. and Danibekova, E. (2021) "The transformation of modern architecture in Kazakhstan: From Soviet "Internationalism" to post-Soviet understanding of the regional identity". *Spatium,* 46, pp. 73-80. https://doi.org/10.2298/SPAT2146073A
2. Alizadeh, T., Dutia, E. and Clements, R. (2024) "Smart Barcelona: The gap between inspiring rhetoric and lackluster implementation in transformative approaches". *Planning Practice & Research*, 39(5), pp. 839-854. https://doi.org/10.1080/02697459.2024.2369977
3. Chakraborty, L., Rus, H., Henstra, D., Thistlethwaite, J. and Scott, D. (2020) "A place-based socioeconomic status index: Measuring social vulnerability to flood hazards in the context of environmental justice". *International Journal of Disaster Risk Reduction,* 43, 101394. https://doi.org/10.1016/j.ijdrr.2019.101394
4. Cugurullo, F. (2021) *Frankenstein urbanism: Eco, smart and autonomous cities, artificial intelligence and the end of the city*. London: Routledge. https://doi.org/10.4324/9781315652627
5. da Silva, C.A., dos Santos, E.A., Maier, S.M. and da Rosa, F.S. (2020) "Urban resilience and sustainable development policies: An analysis of smart cities in the state of São Paulo". *Revista de Gestão,* 27(1), pp. 61-78. https://doi.org/10.1108/REGE-12-2018-0117
6. Elsayed, W., Sokolovskiy, K. and Gavrilova, Y. (2023) "Religious practices in the effectiveness of social service workers: A subjective assessment". *Public Organization Review*, 23(4), pp. 1385-1398. https://doi.org/10.1007/s11115-022-00668-z
7. Enssle, F. and Kabisch, N. (2020) "Urban green spaces for the social interaction, health and well-being of older people – An integrated view of urban ecosystem services and socio-environmental justice". *Environmental Science & Policy,* 109, pp. 36-44. https://doi.org/10.1016/j.envsci.2020.04.008
8. Epting, S. (2021) *The morality of urban mobility: Technology and philosophy of the city*. Lanham: Rowman & Littlefield. https://doi.org/10.5040/9798881816704
9. Felt, U. and Sepehr, P. (2024) "Infrastructuring citizenry in Smart City Vienna: Investigating participatory smartification between policy and practice". *Journal of Responsible Innovation*, 11(1), pp. 1-23. https://doi.org/10.1080/23299460.2024.2313303
10. Fornara, F., Bonaiuto, M. and Bonnes, M. (2010) "Cross-validation of abbreviated perceived residential environment quality (PREQ) and neighborhood attachment (NA) indicators." *Environment and Behavior,* 42(2), pp. 171-196. https://doi.org/10.1177/0013916508330998
11. Gerten, C., Boyko, D. and Fina, S. (2022) "Patterns of post-socialist urban development in Russia and Germany". *Frontiers in Sustainable Cities,* 4, p. 846956. https://doi.org/10.3389/frsc.2022.846956
12. Ghalib, H., El-Khorazaty, M.T. and Serag, Y. (2021) "New capital cities as tools of development and nation-building: Review of Astana and Egypt's new administrative capital city". *Ain Shams Engineering Journal,* 12(3), pp. 3405-3409. https://doi.org/10.1016/j.asej.2020.11.014
13. Hariram, N.P., Mekha, K.B., Suganthan, V. and Sudhakar, K. (2023) "Sustainalism: An integrated socio-economic-environmental model to address sustainable development and sustainability". *Sustainability,* 15(13), p. 10682. https://doi.org/10.3390/su151310682
14. Jacobs, K. and Malpas, J. (2019) *Philosophy and the city: Interdisciplinary and transcultural perspectives*. Lanham: Rowman & Littlefield.
15. Johnston, K. (2019) "A comparison of two smart cities: Singapore and Atlanta". *Journal of Comparative Urban Law and Policy,* 3, pp. 191-206.
16. Kinossian, N. (2022) "Rethinking the post-socialist city". *Urban Geography*, 43(8), pp. 1240-1251. https://doi.org/10.1080/02723638.2022.2102332
17. Lehtinen, S. (2020) "Editorial introduction to the topical issue "Philosophy of the City". *Open Philosophy,* 3(1), pp. 730-735. https://doi.org/10.1515/opphil-2020-0148
18. Maliszewska-Nienartowicz, J., Michalak, B., Modrzyńska, J., Piechowiak, J. and Szpak, A. (2024) "The energy transition in the cities of Copenhagen, Helsinki and Stockholm: Similar or different pathways towards the EU's 2030 targets?". *Urban Climate*, 55, p. 101887. https://doi.org/10.1016/j.uclim.2024.101887
19. Manassova, M.M. and Karipbaev, B.I. (2023) "Socio-philosophical analysis of the phenomenon of the capital in the national picture of modern Kazakhstan". *Bulletin of the Karaganda University History. Philosophy Series*,

109(1), pp. 284-290. https://doi.org/10.31489/2023HPh1/284-290

20. Martin, G. (2019) "A sustainability interrogation of the autonomous vehicle at its society-technology interface". *Bulletin of Science, Technology & Society,* 39(3-4), pp. 23-32. https://doi.org/10.1177/0270467620965466
21. Medeuov, D. (2021) "Friendship via a bus ride: urban mobility and social life in Nur-Sultan, Kazakhstan". *Eurasian Geography and Economics*, 65(3), pp. 398-423. https://doi.org/10.1080/15387216.2021.1954537
22. Mouratidis, K. (2021) "Urban planning and quality of life: A review of pathways linking the built environment to subjective well-being". *Cities*, 115, p. 103229. https://doi.org/10.1016/j.cities.2021.103229
23. Mumford, L. (2020) ""The Urban Drama": From the city in history: Its origins, its transformations, and its prospects (1961)". In: *The City Reader*, edited by R.T. LeGates, F. Stout, 106-110. London: Routledge. https://doi.org/10.4324/9780429261732-14
24. Preston, B. (2023) "Technology and human agency: Sustainable technology as microcosm". *Techne: Research in Philosophy & Technology,* 27(1), p. 115. https://doi.org/10.5840/techne202369178
25. Ragheb, A., Aly, R. and Ahmed, G. (2022) "Toward sustainable urban development of historical cities: Case study of Fouh City, Egypt". *Ain Shams Engineering Journal,* 13(1), p. 101520. https://doi.org/10.1016/j.asej.2021.06.006
26. Raiden, A. and King, A. (2021) "Social value, organisational learning, and the sustainable development goals in the built environment". *Resources, Conservation and Recycling,* 172, p. 105663. https://doi.org/10.1016/j.resconrec.2021.105663
27. Ranjan, N. (2023) "Understanding epistemology and methodology in Adolph Lowe's political economics". *Journal of Economic Sciences: Theory & Practice,* 80(1), pp. 35-53. https://www.ecosciences.edu.az/jfdownloads.php?url=TkRNMo9nPTo=
28. Rosado-García, M.J., Kubus, R., Argüelles-Bustillo, R. and García-García, M.J. (2021) "A New European Bauhaus for a culture of transversality and sustainability". *Sustainability*, 13(21), p. 11844. https://doi.org/10.3390/su132111844
29. Sandu, A. (2024) "The post-socialist cities from Central and Eastern Europe: Between spatial growth and demographic decline". *Urban Studies*, 61(5), pp. 821-837. https://doi.org/10.1177/00420980231189261
30. Song, Z., Wang, C. and Bergmann, L. (2020) "China's prefectural digital divide: Spatial analysis and multivariate determinants of ICT diffusion". *International Journal of Information Management,* 52, p. 102072. https://doi.org/10.1016/j.ijinfomgt.2020.102072
31. Subrahmanya, M.B. (2017) "Comparing the entrepreneurial ecosystems for technology startups in Bangalore and Hyderabad, India". *Technology Innovation Management Review,* 7(7), pp. 47-62. http://doi.org/10.22215/timreview/1090
32. Theodora, Y. (2020) "Cultural heritage as a means for local development in Mediterranean historic cities – The need for an urban policy". *Heritage,* 3(2), pp. 152-175. https://doi.org/10.3390/heritage3020010
33. Trovato, M.R. (2021) "An axiology of residual green urban areas". *Environments,* 8(6), p. 53. https://doi.org/10.3390/environments8060053
34. Wang, D., Zhou, T. and Wang, M. (2021) "Information and communication technology (ICT), digital divide and urbanization: Evidence from Chinese cities". *Technology in Society,* 64, p. 101516. https://doi.org/10.1016/j.techsoc.2020.101516
35. Wong, Z.Z.A., Badeeb, R.A. and Philip, A.P. (2023) "Financial inclusion, poverty, and income inequality in ASEAN countries: Does financial innovation matter?". *Social Indicators Research,* 169(1), pp. 471-503. https://doi.org/10.1007/s11205-023-03169-8
36. Zuziak, Z.K. (2020) "An introduction into the new philosophy of urbanism". *Teka Komisji Urbanistyki i Architektury Oddziału Polskiej Akademii Nauk w Krakowie,* 48, pp. 181-206. https://doi.org/10.24425/tkuia.2020.135413

Sources of figures and tables

Fig. 1	Compiled by the authors based on photos from ASTANA PASS
Fig. 2	Compiled by the authors
Tables I, II	Compiled by the authors
Table III	Developed by the authors based on Fornara et al., 2010
Tables IV, V	Developed by the authors

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