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EVALUATING URBAN COMFORT THROUGH THE LENS OF SMART PEOPLE

Abstract. Modern approaches to creating smart cities are increasingly focused on developing digital infrastructure. At the same time, the important role of humans in ensuring the sustainability of the urban environment is emphasized. The article examines the concept of "smart people" as a key social element of the Smart City model. Special attention is paid to the characteristics of active and digitally competent residents, as well as their participation in city governance and digital transformation processes.

The work is devoted to the study of how "smart people" contribute to the growth of the quality of life and the development of a comfortable, affordable and sustainable urban environment. An integrated comfortable living index based on survey data is used for the assessment. The city of Almaty is given as an example, as it shows how initiatives aimed at involving residents in the processes of digital transformation are being implemented. In addition, the paper examines the role of new technologies such as artificial intelligence, the Internet of Things and blockchain in the development of interaction between citizens and the urban ecosystem. The results highlight the need for strategic investments in human potential along with technological development to achieve balanced and sustainable urban growth.

Keywords: Smart People, smart city, urban environment, digitalization, Almaty, sustainable development, living comfort, civic engagement.

Introduction.

Modern cities are rapidly transforming under the influence of global processes of digitalization, urbanization and sustainable development. With over 68% of the world's population expected to live in cities by 2050, the UN predicts that society will face new difficulties, including the need to build livable, sustainable, and ecologically friendly urban environments. The idea of a "smart city," which is built on cutting-edge technology, effective resource management, and a high degree of citizen participation, was created in response to these issues.

Nevertheless, practice shows that a well-developed technological infrastructure alone does not guarantee an improvement in the quality of life. If residents do not participate in urban processes, smart monitoring systems, digital services, and automated platforms often remain unclaimed or ineffective. Therefore, in recent years, more and more attention has been paid to the Smart People component, that is, citizens who have digital skills, education, critical thinking and willingness to engage in the life of the city.

The concept of smart people includes more than just the ability to use technology. It is associated with the ability to make collective decisions, with the level of trust in society, with the willingness to take the initiative and participate in common affairs. In fact, we are talking about the transition from vertical management to the joint creation of an urban environment, when residents become not only consumers of services, but also full-fledged participants in its formation.

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The relevance of the study is due to the need to adapt the Smart People concept to the conditions of post-Soviet and developing countries, where a high level of digital transformation is often accompanied by a low level of civic engagement and institutional trust. An intriguing example is Kazakhstan, which is actively digitizing its government. While e-government, smart transportation, and digital city maps are being introduced, there is still little public involvement in decision-making.

The purpose of this article is to examine how smart people contribute to the creation of a cozy urban setting. The study's goal is to determine how intelligent people help build a welcoming, secure, and inclusive city and what prerequisites must be met for the development of this kind of social capital. In the framework of Kazakhstani cities, special emphasis is given to global experience and the potential for adaptation.

Materials and Methods.

The empirical part of the study was based on modern digital analysis methods and an online survey in Google Forms. The questionnaire included 22 questions about digital security, infrastructure, security level and environmental conditions. The survey involved respondents of different ages, levels of education, and types of settlements - from rural areas to cities.

Data processing was carried out systematically: duplicates were removed, omissions were replaced with the median to maintain the reliability of the indicators. The answers were converted to numerical form on a five-point Likert scale. In order for the indicators on different scales to be comparable, all variables were normalized in the range from 0 to 1 using the formula:

$$x' = \frac{x-1}{4}, \quad (1)$$

where x represents the initial value on a five-point scale, and x′ denotes the standardized. As a result, the minimum answer was 0, and the maximum was 1.

At the next stage, an integral Comfort Living Index (CLI) was formed based on a weighted combination of normalized variables. he weights reflected the priority of the key areas. This included security, medicine, ecology, and the digital sphere. The reliability of the index was checked through Cronbach's alpha, the obtained value of 0.816 confirmed the high consistency of the indicators and the stability of the final measure.

To identify structural patterns, cluster analysis using the K-means method was performed on standardized data. The optimal division turned out to be into two clusters, which is confirmed by the silhouette coefficient of 0.145. Despite the average level, data segmentation can be traced.

The analysis was accompanied by visualization: histograms showed the distribution of individual indicators, heat maps showed the relationships of variables, a box plot was a comparison of estimates, and a PCA-based scatter plot showed the presence of clusters in a reduced feature space.

Results and Discussion.

This section provides the results of the study and their explanation. Quantitative data is accompanied by analytical comments explaining how the role of “smart residents” and digital technologies affects the perception of urban comfort.

1. Empirical Results of the Comfort Living Index.

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The average CLI value was 0.501 (SD = 0.140), indicating a moderate level of perception of the comfort of the urban environment. The reliability of the index is confirmed by the Cronbach's alpha coefficient of 0.816, which indicates the consistency and stability of the selected indicators.

2. Cluster-Based Interpretation of Urban Comfort.

The first group (cluster A) is characterized by a higher level of comfort: the average value of the CLI index is about 0.60. The participants of this cluster gave higher scores on key parameters. Thus, their sense of security is estimated at 4.5 points on average, the availability of medical care is 4.2, digital data protection is 4.3, and air quality is 4.0.

The second group (cluster B) belongs to the segment with a lower comfort level: the average CLI in this group is about 0.38. Here, lower ratings are observed for all indicators. The most noticeable differences are recorded in access to medical care (2.8 points on average) and digital security (2.9 points). The safety rating is 3.2, and the air quality is about 3.1.

The differences between the clusters show that today digital maturity is becoming a significant factor in shaping the feeling of urban comfort. Access to digital services, trust in data protection systems, and the availability of timely information about the environmental situation and public safety directly affect the perception of the quality of the urban environment.

Correlation analysis confirms these conclusions: there are strong correlations between a sense of security and access to medical care, as well as moderate ones between digital security and the general index of comfortable living (CLI). Thus, comfort in modern urban and suburban areas is determined not only by the state of the physical infrastructure, but also by the quality of the digital and information environment.

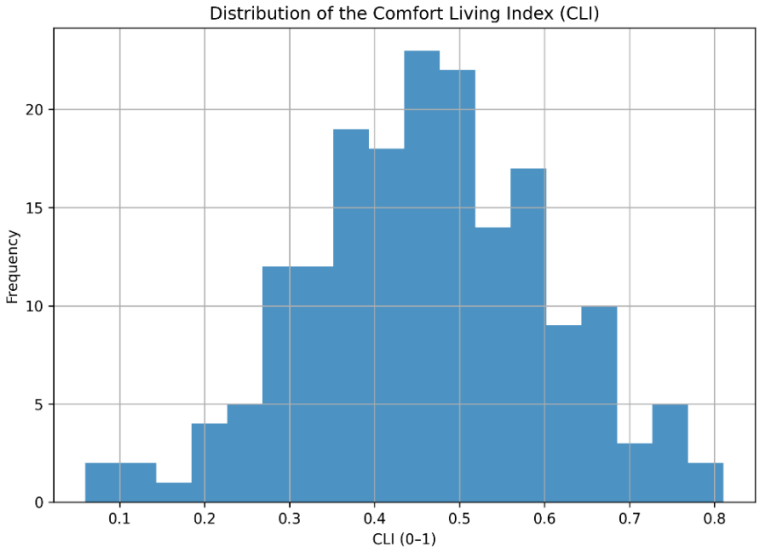

Figure 1 - Distribution of Comfort Living Index (CLI)

Visual materials confirm the identified dependencies: CLI distribution diagram (Fig. 1) shows the concentration of indicators near the average value, which indicates a fairly uniform perception of comfort with moderate variability. The correlation matrix (Fig. 2) clearly shows the relationship between safety, access to medicine, digital protection and environmental conditions.

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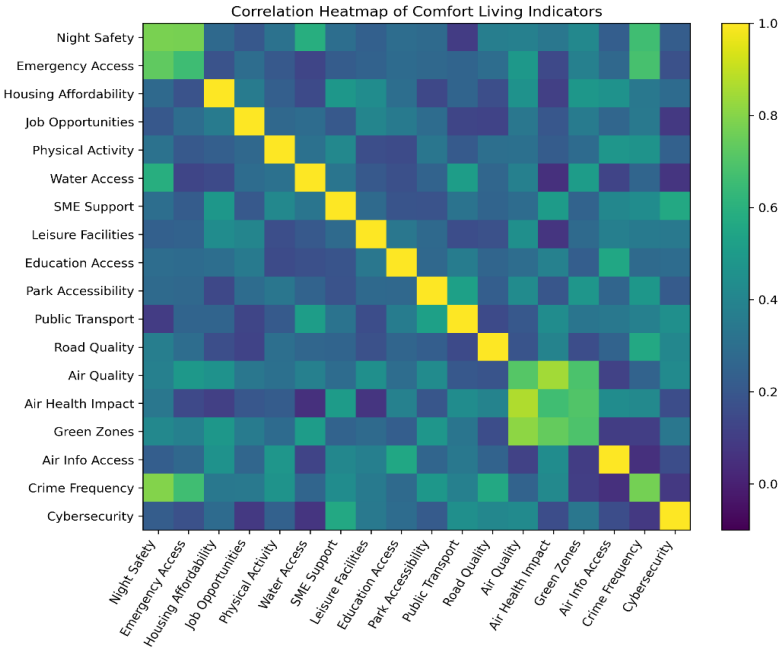

Figure 2 - Correlation Matrix Vizualization for Comfort Metrics

The scale diagrams by type of locality (Fig. 3) show noticeable differences between cities, small towns, and rural areas: in cities, the comfort level is higher. PCA visualization (Fig. 4) also confirms the division of respondents into groups with high and low comfort, which coincides with the results of cluster analysis.

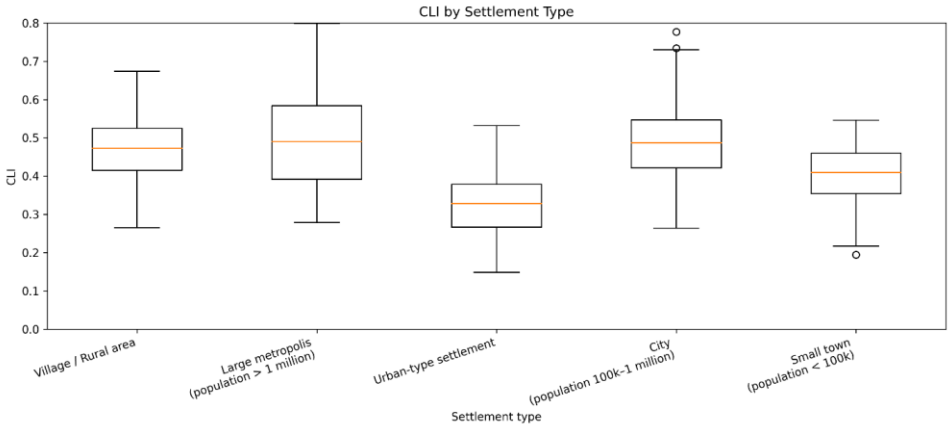

Figure 3 - CLI by Type of Settlement

Overall, the results indicate that the perception of the comfort of the environment is formed by a combination of physical, social and digital factors. The cluster structure reflects differences related primarily to safety, medical accessibility, ecology, and digital protection. This confirms the reliability of the CLI index as an integral tool for assessing differences in living conditions and forms the basis for conclusions and practical recommendations in the next section.

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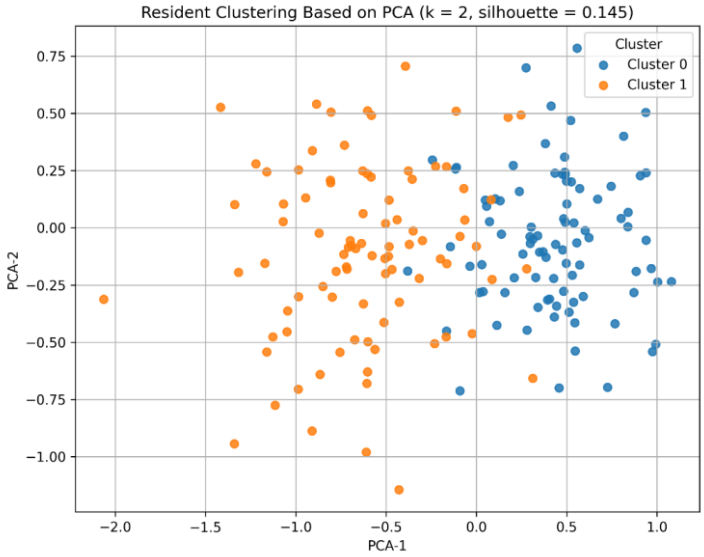

Figure 4 - Respondent grouping based on Principal Component Analysis

3. Role of Smart People in Urban Environment Development.

The Smart People element is regarded as one of the most important elements in the sustainable growth of the urban environment within the framework of the Smart City idea [1]. The Smart People approach places more emphasis on the role of human capital-their knowledge, abilities, values, and degree of participation in social processes-than the conventional emphasis on technology solutions [2].

In Giffinger et al. (2007)'s classification, the term "Smart People" was first used methodically to refer to a group of traits of urban dwellers that support the efficient operation and growth of the city. These include having a high degree of knowledge, being able to learn, being receptive to new ideas, and taking part in public projects. The idea was broadened in later research to incorporate criteria including social activity, civic duty, and digital literacy [3].

The modern understanding of the concept of "smart people" is formed on the basis of an interdisciplinary approach combining information technology, psychology, urban studies and sociology. The key characteristics of this group are active participation in the public life of the city, including interaction with local governments and participation in digital platforms, as well as the confident use of digital tools for communication, obtaining information and involvement in the processes of urban governance. An important role is played by the ability to cooperate and take collective action aimed at developing local communities. Along with this, "smart people" are characterized by environmental and social awareness, a focus on a sustainable lifestyle and a desire to reduce the negative impact on the urban environment. Those who combine critical thinking with adaptability are better involved in the process of transforming urban policy and responding to new challenges. [4].

The idea of social capital, which P. Bourdieu and R. Putnam consider important for stable connections and trust in society, is closely related to the concept of "smart people". In the context of digitalization, digital social capital is of particular importance. It is expressed in the ability of citizens to use digital channels for self-organization, horizontal interaction and communication with government institutions. In addition to helping technological initiatives be successfully implemented, the presence of Smart People in the city also helps to create a welcoming, inclusive, and sustainable urban environment. Even the most advanced solutions could be unclaimed, inefficient, or inaccessible without the active involvement of citizens.

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The full involvement of the populace in the administration, growth, and planning of the urban environment is what Smart People are all about, so their role extends beyond the level of individual users.

Residents with activity, knowledge and technological skills play a key role in the development of the urban environment in the context of digital transformation. In the concept of a smart city, the Smart People component is not an auxiliary element, but the basis for an inclusive, sustainable and efficient functioning of the city. Thanks to smart people, it becomes possible to move from centralized and vertical management methods to more horizontal and networked forms of interaction between citizens, the state and business. It is difficult to build a comfortable city for people to live in without the involvement of knowledgeable and engaged citizens.

By taking part in the planning, execution, and oversight of urban initiatives, smart people help to improve the urban environment. The availability of digital tools and platforms makes it possible to organize public involvement processes where people may voice their opinions, grievances, and ideas for bettering areas, transportation infrastructure, landscaping, and other matters. Effective use of these tools, which ensure rapid communication between society and local authorities, is possible with a high level of civic and digital literacy [5].

The participation of residents helps to identify regional needs that may go unnoticed at the national level. This opens the way to urban planning focused on the real needs and daily lives of the population.

Cities with a high concentration of smart people are more likely to be able to innovate, foster a creative economy, and foster an environment that is conducive to entrepreneurship. Only when there are people resources willing to try and learn new jobs will there be a well-organized system of support for startups, scientific centers, coworking spaces, and technological clusters [6].

Knowledge-intensive sectors like information technology, education, healthcare, culture, and design are built on the foundation of smart people. These industries then develop into engines of economic expansion, closely intertwined with sustainability and urban identity.

A high level of citizen participation in public life helps to strengthen social ties and develop trust between different groups of the population. Local projects that involve enhancing public areas, courtyards, volunteerism, cultural events, and environmental campaigns are started and supported by Smart People. Such actions contribute to the creation of a safe and comfortable urban environment where residents feel community and responsibility for a common space.

Social capital formed by active citizens helps to withstand external challenges such as pandemics, economic crises and climate change. In difficult times, horizontal connections and mutual support within the community become especially valuable. In such cases, mutual assistance and horizontal relations between the population are vital.

The promotion of sustainable activities, such as using public transportation instead of private vehicles, collecting rubbish separately, taking part in environmental campaigns, conserving energy, and maintaining urban green spaces, is one way that Smart People are influencing the urban environment [7]. High levels of awareness and information availability enable people to make eco-friendly decisions in their daily lives, which lessens the anthropogenic load on the city [8].

Pollution levels are considerably lower, quality of life satisfaction is higher, and citizen involvement in sustainable development initiatives rises in cities where environmental culture is embraced at the lifestyle level.

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By removing administrative obstacles and streamlining communication between people and public servants, Smart People help democratize city administration. Open data services and digital platforms make municipal procedures more transparent, and involving citizens in decision-making fosters greater trust and less disagreement [9].

In addition to utilizing the services that are offered, Smart People have a responsibility to set an example of participation in society where interacting with the government is seen as the rule rather than the exception.

4. Digital Technologies as Enablers of Smart People and Urban Comfort.

Building on the empirical findings presented above, this section discusses how emerging digital technologies contribute to the development of Smart People and reinforce perceived urban comfort. The results demonstrate that digital security, access to information, and technologically mediated services are closely associated with higher Comfort Living Index values, highlighting the growing role of human–technology interaction in contemporary cities.

In this context, digital technologies should be viewed not merely as infrastructural tools, but as socio-technical enablers that stimulate civic engagement, learning, and perceived urban comfort.

The development of Smart People is increasingly being driven by artificial intelligence (AI). Today, AI is already being used to adapt city services to the individual needs of city residents: from intelligent transport and smart lighting to energy consumption forecasting systems.

In addition to assisting individuals with navigating the city, artificial intelligence (AI) will eventually be able to consider their preferences, lifestyle, and behavior when offering tailored recommendations and solutions. This will encourage citizens to actively participate in the administration of urban space [10].

Virtual and augmented reality, or VR/AR, technologies create new possibilities for the development of smart people. They can be used to simulate urban transformations where citizens participate in the deliberation and decision-making process [11]. For instance, before work starts, locals can "see" the effects of rebuilding a street or building a new facility. Learning about the urban environment is made easier and more visually appealing by the use of these technologies in public lectures and educational initiatives.

Blockchain technology may serve as the foundation for open communication between citizens and local government representatives. Voting for budget allocation or improvement projects, for instance, using blockchain systems enables process anonymity, authenticity, and transparency [12]. Such infrastructure fosters trust, which in turn encourages more action from Smart People who are prepared to impact urban events.

The growth of the Internet of Things (IoT) enables citizens to establish a habit of using resources sensibly in addition to automating civic infrastructure. With the use of smart meters, air quality monitoring equipment, and lighting and noise control, people can see changes in real time and adopt more ecologically conscious and responsible habits.

Finally, a new ethic of civic engagement is emerging as a result of society's growing digital competencies. Mobile applications for public projects, electronic citizen interaction platforms, and platforms for state feedback are all becoming essential features of the city of the future. However, without developed soft skills (communication, critical thinking, ethics), even the most advanced technologies will remain ineffective.

5. Case of Almaty as an Applied Example.

The biggest city in Kazakhstan, Almaty, is developing into a test site for the application of some aspects of the smart city idea. Although infrastructure and management features (such as intelligent video surveillance, electronic services, and transportation solutions) are

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the primary emphasis of urban digitalization, human capital is progressively playing a bigger part in these processes [13]. The observed initiatives and processes indicate that the idea of "smart people" is gradually taking shape. It has not yet been formally formulated as a separate city strategy.

In recent years, digital platforms have been actively developing in Almaty, aimed at improving interaction between citizens and city structures. One example is the Open Almaty portal, which serves as a digital feedback platform where residents can leave complaints, suggestions and requests regarding the operation of urban infrastructure. Problems with roads, lighting, and landscaping are often recorded through this channel, which indicates an increase in civic engagement and the ability to express opinions in digital form [14].

The iKomek system, which functions as a single contact center combining various city services, deserves special attention. Residents are increasingly using messengers and mobile applications to communicate with this system, which indicates the formation of digital habits among "smart people".

Almaty's Smart People development is greatly aided by communities, innovation hubs, and educational institutions. The city offers resources including Almaty Management University, IT Hub Astana Hub Almaty, Tech Garden, and coworking spaces that encourage young people to engage in project work, entrepreneurship, and the development of digital skills [15].

The foundation for a new generation of engaged citizens who can make their own decisions and take part in city life is being laid by the introduction of STEAM education, digital competencies, and soft skills by several universities and schools. A culture of involvement and accountability is fostered by the hosting of hackathons, city project competitions, and accelerators for students and schoolchildren.

Initiatives in the areas of ecology and sustainable development are particularly noteworthy among the ways that Almaty's Smart People are demonstrating their social participation. The “Almaty Urban Air” project, which aims to gather and analyze data on air pollution, is one example. By bringing together locals, researchers, and activists, the project serves as an illustration of how citizens and the expert community can collaborate online [10].

Active participation is also shown by civil environmental campaigns as “Recycle BIRGE!”, which encourages the sorting of waste, and the “Green TAL” project, which aims to green the urban environment. These kinds of projects, which are frequently organized via social media and online platforms, are an illustration of self-organization and sustainable thinking, two traits that are essential to Smart People.

The city is gradually introducing elements of participatory planning, which allows taking into account the opinions of residents in the process of transforming the urban environment. In particular, public hearings and citizen meetings were held in conjunction with talks on park reconstruction, bike path development, and street repair projects (such as Panfilov, Zhibek Zholy, and Tole bi streets). Despite their episodic nature, these procedures represent the initial stages of inclusive urban governance.

A culture of open communication between citizens, specialists, and officials is also being actively developed by a variety of urban communities, like Urban Forum Kazakhstan. This fosters an atmosphere where citizens' views are considered when formulating policies and helps to build horizontal linkages.

Individual efforts show the expanding potential of this component, even though Almaty does not yet have a complete program for the production of Smart People. An active and conscientious urban community might gradually emerge thanks to the growth of digital infrastructure, educational efforts, and civic and environmental projects. Given population

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increase and the growing complexity of the urban environment, it is critical that these processes be scaled up and supported by institutions.

Conclusion.

The results of the study confirm that the creation of a comfortable urban environment is closely linked to the active role of the residents themselves. Technologies, digital infrastructure and smart services create the basis for the development of the city, but it is the involvement, initiative and competence of people that determine to what extent these tools actually work. The results obtained confirm that the perception of urban comfort is related not only to the state of infrastructure, but also to the availability of digital services, the level of trust in institutions, and the quality of communication between the population and the government.

The experience of Almaty demonstrates that even partial initiatives in digitalization, ecology and education can gradually form an active urban community. At the same time, the further development of the Smart People concept requires institutional support - equal opportunities in education and digital access, open mechanisms for participation and real consideration of public opinion.

Taken together, the results of the study confirm that sustainable urban development should be based not only on technology, but also on human potential. Smart people are becoming not an addition to the smart city, but its foundation. They ensure the liveliness, openness and adaptability of the urban environment. In the future, further research may focus on assessing the level of Smart People development in different cities and analyzing how social activity affects the quality of the urban environment and the effectiveness of decisions made.

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SMART PEOPLE ИНДИКАТОРЫ АРҚЫЛЫ АЛМАТЫ УРБАНИСТИКАСЫН БАҒАЛАУ

Аңдатпа. "Ақылды қалаларды" құрудың заманауи тәсілдері цифрлық инфрақұрылымды дамытуға көбірек көңіл бөлуде. Бұл ретте қалалық ортаның тұрақтылығын қамтамасыз етудегі адамның маңызды рөлі атап өтіледі. Мақалада "smart people" тұжырымдамасы "smart city" моделінің негізгі әлеуметтік элементі ретінде қарастырылады. Цифрлық технологияларда белсенді және құзыретті тұрғындардың сипаттамаларына, сондай-ақ олардың қаланы басқаруға және цифрлық трансформация процестеріне қатысуына ерекше назар аударылады.

Жұмыс "ақылды адамдардың" өмір сүру сапасын жақсартуға және жайлы, қол жетімді және тұрақты қалалық ортаны дамытуға қалай әсер ететінін зерттеуге арналған. Талдау үшін сауалнама деректеріне негізделген жайлы өмірдің интеграцияланған индексі қолданылады. Мысал ретінде Алматы қаласы қарастырылады, онда азаматтарды цифрлық трансформация процестеріне тарту бойынша бастамалардың

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қалай іске асырылатыны көрсетілген. Сондай-ақ, жасанды интеллект, IoT және блокчейн сияқты жаңа технологиялардың тұрғындар мен қалалық экожүйенің өзара әрекеттесуін нығайтудағы рөліне назар аударылады. Нәтижелер қалалардың теңгерімді және тұрақты өсуін қамтамасыз ету үшін технологиялық дамумен қатар адам әлеуетіне стратегиялық инвестициялардың қажеттілігін растайды.

Түйінді сөздер: Smart People, smart city, қалалық орта, цифрландыру, Алматы, тұрақты даму, өмір сүру жайлылығы, азаматтық белсенділік.

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ОЦЕНКА ГОРОДСКОГО КОМФОРТА ЧЕРЕЗ ПРИЗМУ КОНЦЕПЦИИ SMART PEOPLE

Аннотация. Современные подходы к созданию "умных городов" все больше ориентированы на развитие цифровой инфраструктуры. При этом подчеркивается важная роль человека в обеспечении устойчивости городской среды. В статье рассматривается концепция "smart people" как ключевого социального элемента модели "smart city". Особое внимание уделяется характеристикам активных и компетентных в цифровых технологиях жителей, а также их участию в управлении городом и процессах цифровой трансформации.

Работа посвящена изучению того, как «умные люди» влияют на повышение качества жизни и развитие комфортной, доступной и устойчивой городской среды. Для анализа применяется интегрированный индекс комфортной жизни, основанный на данных опросов. В качестве примера рассматривается город Алматы, где показано, каким образом реализуются инициативы по вовлечению граждан в процессы цифровой трансформации. Также уделяется внимание роли новых технологий, таких как искусственный интеллект, Интернет вещей и блокчейн, в укреплении взаимодействия между жителями и городской экосистемой. Полученные результаты подтверждают необходимость стратегических инвестиций в человеческий потенциал наряду с технологическим развитием для обеспечения сбалансированного и устойчивого роста городов.

Ключевые слова: Smart People, smart city, городская среда, цифровизация, Алматы, устойчивое развитие, комфорт проживания, гражданская активность.

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