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SUSTAINABILITY OF URBANIZATION PROCESSES IN THE DIGITAL ENVIRONMENT: FOOD SECURITY FACTORS

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ABSTRACT

Motives: The article examines the potential of the digital environment in the sustainable supply of fresh food to the big city. Urbanization is a difficult process to manage, and adapting it to the demands of sustainable development requires the search for the new opportunities and ways. In this context, it is highly probable to use the opportunities provided by the digital environment through the Internet, digital technologies and devices, or other digital means. The place and role of ensuring food security in cities and the sustainability of urbanization processes have been little studied.
Aim: It is expedient to assess the role of the suburban zone and the zone of transportation of these products to the city in the provision of large cities with fresh food products in terms of sustainable development of urbanization zones.
Results: Research and calculations conducted on the example of the Baku agglomeration (Azerbaijan) have provided an opportunity to comment on the impact of food security factors on the sustainability of urbanization processes in the digital environment. To determine the changes in the transportation zone of fresh milk to this agglomeration, we calculated the proposed "weighted average distance of transportation" indicator. It was revealed that the formation of the digital environment in the agricultural production busines entities is faster in the areas located closer to the Baku agglomeration.

Keywords: urbanization, sustainability, food security, digital environment, Baku agglomeration

INTRODUCTION

The observed undesirable pace of intensification of urbanization processes increases the focus on its sustainability. Digitalization primarily affects the life of big cities [van Winden & de Carvalio, 2017; Kotsanis, 2018; Akindès & Yao, 2019]. In some countries, there is a rapid pace of digitalization in rural areas [Koolhaas, 2020]. This is especially desirable in light of the growing role of food security in sustainable urbanism. However, it is necessary to pay attention to the role of digitalization in the sustainability of urbanization processes.

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That the level of economic activity and activity integration is increasing both in the digital environment and in urban areas with a large urban center and intensive urbanization processes.

The sustainability of urbanization processes is directly related to the quality of life. It is particularly important to identify possible opportunities for the sustainability of these processes in the digital environment. To this end, first of all, it is necessary to assess all the main manifestations of urbanization. Food security factors for the sustainability of urbanization processes in the digital environment have been little studied [Hualin et al., 2021]. However, food security is a factor that has a determining influence on the sustainability of urbanization processes [Maitra & Rao, 2015].

Background

Sustainability of urbanization processes and sustainable development of big cities

The numerous manifestations of urbanization include, first of all, the concentration of the population in cities, the growing role of cities in all spheres of human life, the concentration of productive forces on an industrial basis, the complexity of functions in the settlement network and the integration of activities. Urbanization, despite all its contradictions, is a cost-effective option for the organization of the regional environment. For this and other reasons, urbanization, changes in urban and regional systems, as well as the issues of regional integration shall be examined collectively [Shen, 2018]. In order to assess the economic feasibility of sustainable development of urbanization processes in the digital environment, we believe that the following indicators can be used: agglomeration effect; minimization of displacements as a special case, side effects of co-financing; allocation effect.

Sustainable development must lead to a transition to a new level of quality in economic growth, inclusive society and the environment, with a concerted joint effort to build an inclusive, sustainable and secure future that will not be a problem for future generations. With regard to the sustainable urbanism, this means that the process of population concentration in cities is accompanied by sustainable urban development. The growing role of cities in all spheres of human life, the concentration of productive forces on an industrial basis, the complexity of functions in the network of settlements and the integration of activities – all this meets the basic requirements of indicators of sustainability.

Sustainability of urbanization processes and, as a result, sustainable urbanism can be achieved, first of all, due to the necessary level of living standards and quality indicators. The required level of these indicators is achieved at an acceptable level of human health indicators. In this context, the urban health initiatives should also contribute to the collection and structuring of necessary data [Urban Health Initiative, 2019]. In other words, this initiative contributes to the introduction of digital technologies in urbanization. Sustainable urbanism is notable for its ability to address the environmental impacts of urban development and meet the demand for the resources entirely at the local level [Douglas, 2007].

The management by sustainability criteria of urbanization processes, which take place in an uncertain environment and require the development of very complex mechanisms, increases the demand for joint action [Frantzeskaki et al., 2014, p. 415–416]. This kind of management may affect the interests of everyone in urbanization zones. Therefore, there is an objective demand for innovative approaches that would provide for direct participation of everyone with new ideas to solve the relevant urban problems [Galuszka, 2018]. Advantages of the digital environment expand the scope of perspective search for new forms of common efforts and active involvement to ensure the sustainability of urbanization processes. The inclusion of the urban population in innovative environmental experiments with professionals plays a practical role in promoting joint action for sustainable development [Nesti, 2017, p. 322].

At the same time, it should be noted that the environmental priorities of the sustainability of urbanization processes, no matter how important, can

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not always exceed its economic and social aspects. Otherwise, the environmental impact of job creation due to the economic attractiveness and integration of activities that shape urbanization processes may be overlooked. The relationship between the urban and knowledge economy, the use of the potential of the knowledge economy in cities, the study of the role of universities in this work is a manifestation of the growing attention to knowledge in the sustainability of urbanization processes [May & Perry, 2017].

The use of knowledge in urban management is more effective if it is introduced with the participation of all stakeholders. "The involvement of different players in knowledge co-production thus provides an opportunity for the City Management to leverage on this to enhance governance systems and have a greater impact from its interventions" [Onyango et al., 2021, p. 31]. The development of smart cities and sustainable urbanization take the priorities of the knowledge policy into account [de Hoop et al., 2018, pp. 33–52].

To determine the sustainability of urbanization processes, it is necessary to study the diversity of economic, social and environmental characteristics of rapid urban growth in the digital environment. In order to be ready in reality to choose the best option, research can be carried out mainly on the basis of digital technologies to identify opportunities for the sustainability of urbanization processes. In this regard, it is difficult to disagree with the position stated in the following source.

"Rapidly growing cities and towns are faced with a range of developmental choices that will shape their growth and long-term economic, social and environmental sustainability. Many of these are complex choices with differing short-term versus long-term cost and benefits. these choices are seldom determined by individual actors or agencies, but emerge out of the complex interplay of decisions made by a range of actors across national and local governments, investors and entrepreneurs in the private sector, and a range of local community and civil society voices" [Sustainable urbanization strategy UNDP's Support to sustainable, inclusive and resilient cities in the Developing World, 2016, p. 10].

It should be noted that situation with the inter-urban exchanges is becoming more objective than with the international ones. In other words, "globalization has resulted in both less regulation of industry and, in such areas as trade, investment, and intellectual property, more universal standards of regulation. As a result, location decisions depend less on the particular country and more on the comparative advantages of different cities" [Roberts & Kanaley, 2006, p. 17].

The issues of realization of technological opportunities in terms of supporting the sustainable development of the information society are on the agenda, especially in large cities and megacities. However, it is not appropriate to consider the sustainable development of a large city as an area of digitalization in isolation from the global context. The United Nations has added Goal 11 to its global goals for the sustainable development, "Ensuring the openness, security, resilience and environmental sustainability of cities and towns". In fact, this goal [Sustainable Development Goals], which aims to ensure sustainable urbanization until 2030, is aimed at improving the living standards and quality of life of the population by overcoming the consequences of the environmental crisis.

Research suggests that, from the point of view of sustainable development, the information society must constantly ensure that there is no alternative on the agenda for the joint solution of economic, social, technological and environmental problems, environmental regulation of technological development without exception, information security and preventive measures to improve it. Urbanization of the information society to achieve the goal of sustainable development [UN Azerbaijan. 2030 Agenda for Sustainable Development], which aims to ensure the openness, security, sustainability and environmental sustainability of large cities and other settlements as a residential environment issues of impact on the processes are relevant. In terms of supporting sustainable development, the technological capabilities of the information society, as is well known, are expanding through the integration of activities. The level of this integration is many times higher in large cities, which

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are an active economic zone, a primary testing ground for the formation of an information society and a material result of urbanization processes.

The information society is able to maintain an attentive and emotional approach of the population to socially significant problems in large cities and megalopolises, providing access to high-quality information. For this purpose, the information society, even in the absence of economic motives, "contributes to the transformation of information into public consciousness and its special type of public opinion, the existence of social institutions interested in this or that state of public opinion" [Braliev, 2008, p. 19] provides support.

At present, it can be said that it is necessary to reconsider the possibility of sustainable economic development of competitive economic activity in urban areas, as well as its adaptation to environmental requirements. In this regard, unfounded optimism about the potential contribution of the digital environment to the sustainability of urbanization processes is undesirable. It is no coincidence that the comparison gives some reason to say that the expectations of the information society in solving global environmental problems are higher than in the last century.

The cautious approach to the role that the digital environment will play in the sustainability of urbanization processes stems primarily from the existing inequality in the distribution of information resources and its increasing tendencies. This inequality is a serious problem that threatens the sustainable development of the digital economy. This growing inequality is hampering the narrowing of the gap between living standards in developed and developing countries. Such a situation, of course, does not meet the requirements of sustainable development. However, it can be agreed that the more we understand the vital importance of sustainable development, the more likely the trend towards increasing inequality will weaken [Picketti, 2016]. Moving towards the sustainability of urbanization processes, smart urban planning, as well as the urban planning through innovation and attention to the popular needs can bring the necessary benefits only through courageous and decisive action [Arsovski et al., 2018, p. 32].

Intensive urbanization and the digital environment

Observations show that both intensive urbanization and the technological habits of the digital environment, in some cases, oppose comprehensive intellectual development [Barykin et al., 2020]. In the initial approach, it can be said that in the digital environment, it is "scientific" to constantly follow what is technologically ahead. Such a situation is likely to lead to inertia of technological thinking and increase undesirable technological dependence. In the digital environment, cities are the primary testing ground for that "science". This is because the digital economy is developing in a centralized manner in cities, as shown in the following source. "Digital economies in a concentrated form are developing in cities where pressing problems can be very different: transport, environmental, deterioration of utilities, the need to move industrial production outside the city limits, or the development of an accessible environment for everyone, but they can only be solved in a complex" [Kupriyanovsky et al., 2016, p. 50].

In the near future, the scope of digitalization in urban areas is expected to expand faster. Such an expectation is due to the high rate of concentration of resources in the urban economy. At present, in terms of social criteria, it is difficult to unequivocally assess the economic consequences of the process of concentration of population and capital in large cities. This is due to the fact that the ecological crisis is becoming more and more noticeable in large cities. Therefore, when assessing the possibilities for sustainable development of a large city, environmental indicators come to the fore. However, under certain conditions, it would be wrong to ignore the following opinion. "To the extent that externalities such as pollution and congestion are not assessed in cities, the conurbations will be too large, but not much. Public concerns about the price of congested roads, as well as water and health investments to reduce the

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likelihood of an epidemic, are well founded. From this perspective, concerns about urban slums and substandard housing, which in themselves do not create any externalities, are less important" [Spens et al., 2009, p. 128].

Our research provides sufficient grounds to say that many changes in the geography of economic activity in the environment of intensive urbanization can be assessed in terms of the agglomeration effect [Balayev, 2007, p. 38].

The agglomeration effect as a complex factor of location is expressed in the fact that the coherent and compact placement of objects together is always more efficient than isolated and scattered placement. At the same time, it is believed that "agglomeration effects are considererd to attenuate with distance when a decreasing impact is orbained the further away the rings are from the location" [Behrens & Robert-Nicoud, 2014]. It is not difficult to see that the digital environment provides additional opportunities in terms of assessing the impact of the factor of distance from a large city on the agglomeration effect. The point is that the digital environment, being an environment formed by logical objects used to interpret other environments based on mathematical laws, expands the algorithmic and informational capabilities of quantitative assessment of different manifestations (types) of the agglomeration effect.

In the context of urbanization, it is more realistic to achieve economic benefits without digitalization. Digital technologies are expanding the possibilities for developing and implementing the necessary preventive measures in large cities. Creativity in the realization of these opportunities can provide a transition from the course of persistent imitation of the subject, which is considered advanced, to innovative modernization. Preliminary observations give grounds to say that digitalization has become a leading factor in ensuring harmony and efficiency in a day-to-day urban life and work.

The hypothesis that in the near future people will be mainly engaged in the production of materials and energy, as well as processing information to manage economic processes, does not provide sufficient grounds for optimism about the prospects for sustainable development. Since these are economically active areas, the amount of resources that need to be restored increases as the pace of development of cities and surrounding areas increases. Unfortunately, in many large cities around the world, these resources include the air we breathe.

Baku agglomeration

The urban agglomeration formed around the capital of Azerbaijan, Baku, was chosen as an object of study. Baku is the largest city in the Caucasus and this position is expected to remain unchanged in the near future. About 40% of the population of Azerbaijan and 70% of the available industrial potential are concentrated in the Baku agglomeration (Baku, Sumgait, Khirdalan and their environs), located on the Absheron Peninsula.

Historically, the urbanization process has been controversial in Azerbaijan [Zhongming et al., 2018]. In addition to boosting economic growth, this process has had a negative impact on the balanced regional development. The choice of Baku as a capital city was not because of the natural environment of the Absheron Peninsula, but due to its abundant oil and gas reserves and geographical location [Ashurbeyli, 1992]. Therefore, the urban development in Baku has always faced serious environmental problems. Absheron is an area with a negative balance of water resources.

Absheron is one of the oldest and largest regions in the world for oil production and processing. It was also the first in the world to host the industrial and offshore oil production. There are areas seriously polluted with oil. One billion tons of oil were produced in Absheron from the mid-19th century till the 1990s, when Azerbaijan regained its independence. Even a tenth of profits from the oil production has not been invested in the rehabilitation of oil-contaminated lands [Oil strategy, 2016]. Three state programs have been completed since Azerbaijan's independence to accelerate the socio-economic development of the country's regions, with the fourth one being

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in progress. A significant part of the oil-contaminated areas of the Absheron Peninsula has been cleared. This process is still underway [Guluyeva, 2020].

Attempts to regulate the urbanization processes in Azerbaijan have historically been limited to the monitoring of the situation. The first master plan of Baku developed back in 1897–1899 was aimed to serve this purpose. Baku has continued to expand over the past hundred years. The cities of Sumgayit and Khirdalan, which are part of the Baku agglomeration, were founded and developed in the 20th century. "There is now a master plan of Baku for 2020–2040. Sustainable development of the city is the first priority. Other priorities include the regeneration of the city and environment, the preservation of the city's architectural image and historical heritage, and the introduction of new elements" [General plan of Baku city 2040].

METHOD

Arthur Levis' model of economic development in the context of a labor surplus [Lewis, 1954] is relevant for oil-exporting countries. This issue is also being studied for Azerbaijan [Sadik-Zade, 2020a, pp. 51–98; Sadik-Zade, 2020b].

The object of research and the urbanization processes taking place here were observed to obtain data in the process of organizing the research. The issue of optimizing the structure of suburban agricultural production was considered to determine the role of food security factors in the sustainability of urbanization processes in the digital environment. The model presents a number of constraints based on characteristics resulting from the proximity to the city and the requirements of sustainable development. These conditions were checked in the contingent-regulatory database due to the difficulties in providing information [Balayev, 2007, pp. 262–265; Balayev et al., 2020, pp. 65–83].

The role of food security factors in the sustainability of urbanization processes in the digital environment needs to be reconsidered. In this regard, the issue of optimizing the structure of suburban agricultural production is relevant. Therefore, in the corresponding model, we will consider a number of conditions that take into account the peculiarities of proximity to the city and the requirements of sustainable development:

– on the use of the city's production resources (labor resources, technical means, etc.):

$$\sum_{j\in J_1} a_{ij}\, x_j + \sum_{j\in K_k} a_{ij}\cdot \sum_{k=1}^{3} x_k - x_i + \sum_{j\in J_2} a_{ij}\, x_j \le b_i$$

– on the use of urban food waste as fodder for livestock:

$$c_j x_j - x_j' = 0 \quad j \in J_2$$

$$\sum_{j\in J_2} v_j - x_{\mathrm{i}} - x_{ij} \le 0 \quad i \in I_2$$

$$d_j x_j' - x_{ij} \ge 0 \quad i \in J_3;\ j \in J_2$$

$$e_i x_j' - \sum x_i \le 0 \quad i \in J_2;\ j \in J_2$$

where,

j, J – is the index and abundance of suburban agricultural production, respectively. This set consists of the following non-intersecting subsets: J_1 – crop areas; J_2 – livestock areas;

K – is a set of agricultural products by purpose, consisting of the following non-intersecting subgroups: K_1 – personal consumption and industrial processing; K_2 – used as feed; K_3 – non-productive consumption of seeds and on-farm;

i, I – is the index and abundance of production resources, respectively. This set consists of the following non-intersecting sub-sets: I_1 – is the set of production resources (labor resources, technical means, etc.) involved in the city; I_2 – the majority of feed types; I_3 – the majority of types of food waste in the city.

Variable quantities:

x_j – intensity of development of j field;

x_i – the amount of production resources of the city involved;

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x_j ^' – total food needs of j area of livestock;
x_{ij} – is the quantity of optimal feed supplement of type i for area j of livestock.

Fixed quantities:

a_{ij} – special norms of resource consumption in agriculture. This does not include assembly and initial completion costs;
a_{ij} ^' – are special norms of resource consumption for harvesting and initial completion of agricultural products;
c_j – is the coefficient of feed unit demand per unit of livestock area j;
v_j – is the minimum specific weight of food waste per unit of feed ration per unit area j of livestock;
d_j – the difference between the maximum and minimum specific gravity of food waste in the feed ration per unit area of livestock j;
e_i – the difference between the total demand for feed (taken as a unit) and the sum of the minimum specific gravities of individual types of feed in the ration per unit area of livestock j;
b_i – is the amount of type i resource.

The model for optimizing the structure of suburban agricultural production was implemented in a system consisting of a number of simulation and optimal models of the agri-food sector in urbanization zones, sometimes, due to information difficulties, conditional and normative data were used. In a digital environment, especially in the context of rapid data generation, it is likely that the information issues under consideration will soon be resolved.

The Baku agglomeration has been offered the "average weighted distance of transportation" indicator (L) to monitor changes in the zone of transportation of fresh food products [Balayev, 2007, pp. 163–166]. In order to determine the changes in the zone of transportation of fresh milk to the Baku agglomeration, the indicator "average weight of transportation" was calculated on the basis of sales data for 1965–2019.

FINDINGS AND DISCUSSIONS

Manifestation of digitalization in big cities

Although radical steps are needed for sustainable development aimed at preventing the global environmental crisis, it is more realistic that this type of development can be achieved through evolution. In the modern world, the only way possible is to recommend countries to take many necessary steps to achieve the goals of the concept of sustainable development, including those related to climate change. However, it is already known that if the factor of climate change is ignored, the society will lose its achievements and will not be able to succeed even in the future.

The role of quantitative characteristics in the development of large cities as a condition and result of urbanization processes is growing. In our opinion, the city is, first of all, an economically active area, a landfill for development, a material result of urbanization processes, a promising standard of demographic development and territorial concentration of various forms of activity. For these and other reasons, the exchange of information is accelerating as urbanization intensifies. The information space of a big city is expanding faster than its borders. The level of application of digital technologies in urban infrastructure is usually several times higher than the national average. Therefore, the definition of the conditions and consequences of urbanization processes, the possibility of digitalization, is of methodologically important in terms of economic evaluation of the digitalization processes.

In the digital environment, the gap between the concepts of space and workplace is narrowing. This process is more visible in large cities. Such a situation does not remain unaffected by the competitive environment. In the digital environment, the speed of product distribution in urban areas has the potential to compete with quality (although this is not desirable in terms of food security). Thus, as the impact of a known quality on a manufacturer's market position decreases, the ability of a product to assert its own quality is limited. That is, the pace of realization

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of new production and technological relations is so high compared to areas with low levels of economic activity that the competitiveness of innovation depends on its introduction in the virtual environment, rather than its real presentation in the market.

As information becomes an economic resource and a product of mass consumption in the digital environment, its direct impact on the competitiveness of economic agents becomes stronger in large cities. Under certain conditions (taking into account the Internet of Things and a number of other areas and development technologies), the goal of digital economic activity is to increase the competitiveness of tangible and intangible products, as well as profit-oriented services.

Food security in urban areas in the digital environment

The food problem is one of the most important problems facing humanity. Among the factors aggravating the problem are population growth, environmental crisis and urbanization. Thus, these factors lead to a decrease in the area of arable land per capita on the planet. The link between urbanization and the food problem is derivative and not always obvious. However, new opportunities presented by the digital environment in terms of assessing the impact of food and food security factors on the sustainability of urbanization processes place an emphasis on optimizing the nexus between urbanization and the food problem.

Sustainable consumption and production are among the sustainable development indicators set by the Statistical Office of the European Union (Eurostat). In consumption models: food consumption per capita, in production models, the ratio of the area used for organic farming to the total cultivated area is indicated as indicators characterizing sustainable development [Indicators characterizing sustainable development, 2014, pp. 8–9].

In Azerbaijan, during the events dedicated to the issues identified in the "Transformation of our world: Agenda for Sustainable Development until 2030", there is a regular discussion on food losses, genetic resources of plant and animal origin for agriculture and food production, agricultural lands for sustainable development, food market issues of price anomalies, level of load on water resources, production and exchange of representative information on existing indicators for monitoring and evaluation in the field of sustainable forestry management.

The processes of urbanization and agricultural development are interconnected. However, these relations have not been sufficiently studied, especially in the post-Soviet countries. This situation can be considered as one of the reasons why the role of food security factors in the sustainability of urbanization processes is ignored. Attention should be paid to the role of the product of technical progress and, in a sense, conditional urbanization in the intensification of agricultural production, which is the main direction in solving the food problem. As is known, from the consumer's point of view, the price and quality of food are the main criteria. The cost of food production and the time of its delivery to the final consumer directly affect its price and quality. In other words, the relationship between urbanization and food security is relevant in terms of minimizing displacement. Thus, the centrifugal movement of the population, which is one of the main conditions and consequences of urbanization processes, leads to time savings due to the "squeezing" of the development space.

The role of regulatory actions in realizing the benefits of the digital environment in urbanized zones cannot be overlooked. In this regard, one can agree that "one of the problems of the development of digital technologies in agriculture is the lack of knowledge by users of digital technologies, the lack of funds for access to IT products and services, as well as the absence of government projects to support small businesses" [Kovaleva, 2019, p. 131]. Taking advantage of the digital environment, urbanization zones are likely to achieve significant positive results in solving the problem of food security. In this regard, we can share the optimism that the digitization and platforming of the entire value chain, from agricultural

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products to final consumption, will be more efficient, especially in the agricultural sector [Kenney et al., 2020, p. 38].

Sustainability of urbanization processes and development of the agro-food sector in the digital environment implies the achievement of an optimal level of employment. In this regard, the following position, in our opinion, deserves attention. "Sustainable agro-food systems must provide employment and decent incomes in rural areas and in all parts of the value chain, as well as wholesome and nutritious food, other goods and environmental services for the general population. All aspects of sustainability (economic, social and environmental) must be taken into account in order not to jeopardize the food security and nutrition of future generations" [Sustainable agro-food systems in Europe and Central Asia in the context of climate change, 2018, p. 6].

Fresh food transportation zone to the big city

Food security aspects of the sustainability of urbanization processes provide a solution to the problem of providing the urban population with fresh food products. Large cities, as a rule, can no longer be supplied with fresh food at the expense of their suburban agricultural zones. Modern logistics systems expand the supply of cities with fresh food products at the expense of areas outside the suburbs. As a result, large cities are supplied with perishable fresh food products from suburban areas (sometimes called fresh food transportation zones). Although this situation is not desirable in terms of food security, it is already observed in most capitals.

It is instrumental to determine the zone of delivery of fresh food products to the big city and its degree of compactness in order to determine and regulate the level of supply of the urban population with these products. The current system of indicators characterizing the transportation of distant- and time-sensitive food products prevents the analysis of the actual compactness of the delivery zone.

In order to study the changes in the zone of delivery of fresh food products to the Baku agglomeration, we have proposed the "average weighted distance of transportation" indicator (L).

$$L = \sum_{i=1}^{n} (m_i l_i) \Big/ \sum_{i=1}^{n} (m_i)$$

where,

n – is the number of production points;

m_i – is the mass of products produced at point i and intended for transportation to the city (i = 1, n);

l_i – indicates the distance from the i-point to the city (i = 1, n). The L index allows you to determine the degree of compactness of the transportation zone in the city of perishable foodstuffs that cannot be transported over long distances.

To determine the changes in the transport zone of milk (and a number of fresh agricultural products) to the Baku agglomeration, the indicator "average weight of transportation" was calculated [Balayev, 2007, pp. 233–234; Balayev et al., 2020]. Calculations were made for 1965, 1990, 2005 and 2019, based on sales data.

L_{1965}=163,0 km; L_{1990}=167,0 km;
L_{2005}=165,0; L_{2019} =163,0 km

As you can see, the "average distance of milk transportation" to the Baku agglomeration got its previous value after 54 years, that is, in 2019 and 1965 this figure was 163 km.

CONCLUSIONS

Despite inherent contradictions, urbanization is a cost-effective option for organizing the regional environment. Therefore, changes in urban and regional systems shall be examined collectively. The necessary level of sustainable urbanization is achieved at an acceptable level of human health indicators. Initiatives of the urban population contribute to the introduction of digital technologies in the

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urbanization process. The management by sustainability criteria of urbanization processes, which take place in an uncertain environment and require the development of very complex mechanisms, increases the demand for joint action. A creative approach has become an objective necessity. Advantages of the digital environment expand the prospects for joint efforts and the search for new forms of active participation in order to ensure the sustainability of urbanization processes. The use of the potential of the knowledge economy in cities can make a significant contribution to the sustainability of urbanization processes. To achieve this, smart cities and sustainable urbanization processes must take into account the priorities of knowledge policy and urban planning focused on the needs of the people.

In the agro-food sector, the speed of this process is not satisfactory, although the degree to which digital platforms facilitate exchange, including the replacement of intermediaries, is an important factor in increasing its attractiveness. In order to ensure the active use of these platforms, the formation of a database on the territories should be accelerated, and an appropriate incentive mechanism should be created for small farms.

Attempts by agricultural and food producers to use digital technologies, including in post-Soviet countries, often face financial problems. In our opinion, it is expedient to give priority to innovative development and use the opportunities of public-private partnership in order for these entities to get out of the "middle income trap".

The following should be noted regarding the factors, which contributed to the return of the "weighted average distance of milk transportation" indicator to its previous value after half a century due to the manifold increase in the population of the agglomeration. For more than half a century, a more cautious approach to fresh milk has been formed in the diet of the urban population. The transition from a centralized economy to a market economy led to the formation of new dairy farms, taking into account the proximity of a large city (market), while technology, including information technology and distance factors, came to the fore.

As we approach the Baku agglomeration, the pace of formation and development of the digital environment in the agrarian economy is steadily increasing. This growth is mainly observed in large farms. Thus, in large farms that provide the agglomeration with fresh products, the level of computer literacy of the manager and the degree of openness to digital innovations are higher than in others. Unlike large farms, there are few sustainable business models to enable small farmers to participate in the digital environment. The database for the decision support system using the technological capabilities of the digital environment in the relevant farms should be constantly updated to analyze the situation with the supply of fresh milk to the Baku agglomeration and to assess changes in supplies, climatic risks, productivity, etc.

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