

Assessment of Environmentally Safe Conditions of the Urban Environment as a Means to Promote the Economic Development of Urban Planning Systems

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Abstract: The formation of favorable living conditions within the urban environment is one of the strategic objectives of the development of the state. Favorable conditions of the urban environment determine the sustainable development of not only a single territory but also the state as a whole. The creation of favorable and, therefore, high-quality conditions for the life of the urban environment contributes to increasing its attractiveness and further economic development. To create such conditions, it is necessary to analyze the components of the urban environment. To assess the quality of the urban environment, based on the assessment of the criteria that characterize the urban environment, taking into account their significance, it is necessary to calculate the environmental quality indicator. The paper defines threats to environmental safety as criteria that characterize the urban environment and have a negative impact on the development of the urban environment. Thus, the influence of all the criteria that characterize the urban environment is determined as positive and negative, based on the impact on the development of the urban environment. When analyzing all the criteria that characterize the urban environment, taking into account their potential impact on the development of the urban environment, it is possible to develop measures in certain areas to improve the quality of the urban environment and, as a result, achieve sustainable development.


1 INTRODUCTION

The economic efficiency of the state is determined not only by a number of economic indicators that characterize the level of development of the state and its economic activity but also by a number of indicators that determine the quality of the standard of living of the population, as well as the level of technological development. The last two parameters are determined by the level of development of the urban environment, environmental parameters, and the implementation of measures aimed at preserving the environment. All this meets the requirements of the modern concept of sustainable development. Achieving the parameters of sustainable development, defined on a global scale, inevitably

contributes to the formation of the economic image of the state, and, accordingly, economic efficiency. To achieve this, activities at the global level should be used to implement a common policy ensuring a safe and favorable urban environment that contributes to the achievement of sustainable development. In the modern urban environment, a person is exposed to influences that have a negative effect on him, although the urban environment is created for a person, and its improvement is aimed at improving the quality of life in this environment (Marco de Silva, 2017; Rastyapina, 2020). In various studies, about 600 situations associated with risk and extreme living conditions in an urban environment were noted (Vladimirov, 2017; Cortinovis, 2021; Patinom, 2021). All unfavorable situations can be divided into groups (according to Vladimirov): situations of

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technogenic nature, natural origin, and environmental nature. The situations of technogenic nature should include situations related to transport accidents, fires, accidents with emissions of harmful substances (radioactive and biologically dangerous substances), collapse of buildings, accidents in the utility infrastructure of the city (communications, electric power facilities, sewage treatment plants), etc. In total, about 45 situations are allocated. Situations of natural origin include processes that occur as a result of natural factors, such as geophysical, geological, meteorological, agrometeorological, hydrological, natural fires, and infectious diseases. Environmental situations include: changes in the properties and composition of the air, land (soil, subsurface, landscape), and hydrosphere. As a rule, most of the unfavorable natural processes in the urban area develop under the influence of technogenic factors. That is why the issue of not only reducing the technogenic load on the environment but also conducting an assessment of the environmental safety of the surrounding urban environment becomes relevant. Factors that affect the urban environment should be considered threats to the security of the urban environment

2 COMPONENTS OF THE URBAN ENVIRONMENT

Urban planning, urbanized environment is quite diverse and its safety is determined by many factors. In this paper, environmental safety is considered from the point of view of ecology and the degree of favorability of the urban environment. It is not enough to comply with the standards for a variety of environmental parameters. It is necessary to analyze the factors that contribute to the formation of a safe (favorable) urban environment. Sustainable development should not be determined by the stable pace of space development, taking into account modern requirements, but by the ability to restore the natural environment, taking into account its urban (anthropogenic) development (Benites, 2021). Sustainable development of the urban environment should be considered a balanced development of the anthropogenic and natural environment. Factors that have an adverse impact on the ecological state of the city will be considered potential threats to the development of this environment. Accordingly, to achieve favorable conditions for the development of the urban environment, it is necessary to analyze the

factors that affect this environment and are potential threats (Han, 2021; Briones-Hidrovo, 2021).

Given the diversity and complexity of the urban environment, the factors that affect it should be grouped as follows: natural, architectural and landscape, socio-economic, infrastructural, and technogenic. The group of natural factors includes criteria that characterize climatic conditions, hydrogeological conditions of the territory, hydrological, topographic conditions, probability of occurrence of adverse natural processes, under existing conditions (Table 1). These criteria determine the degree of comfort of the urban environment and may be favorable or unfavorable for the development and formation of the urban environment. In the case of unfavorable criteria for development, it is necessary to develop measures aimed at improving the level of improvement of the urban area. Favorable natural and climatic conditions create more attractive conditions for life, and not favorable ones reduce the attractiveness of the territory.

Table 1: Group of natural factors.

Factors/criteria	Assessment (impact)
Temperature range	Favorable (+)/unfavorable (-)
Wind mode	
Radiation mode	
Groundwater quality	
Available groundwater (depth of occurrence)	
Ground conditions	
Available reservoirs	
Terrain	
Adverse natural processes	

The group of architectural and landscape factors consists of criteria that characterize the natural and anthropogenic landscape of the urban environment and the architectural and planning composition formed during the development of the city.

To assess the degree of security of the territory, this group includes the following criteria: architectural (historical, architectural, and cultural values) and assessment of the landscape features of the territory. When analyzing landscape criteria, it is necessary to analyze the value of the landscape, its suitability for the formation of favorable and safe living conditions. The presence of such elements will give a certain color and value to the territory, which will affect the attractiveness of the territory. The absence of such elements does not affect the overall comprehensive assessment of the territory.

Table 2: Architectural and landscape factors.

Factors/criteria	Assessment (impact)
Architectural stylistics	presence (+)/absence
Valuable construction elements	
Landscape value	
Available elements to be preserved	
Historical and architectural value	
Cultural value	

Socio-economic factors (Table 3) of the environmental safety assessment determine the possibility and efficiency of the implementation of environmental measures.

Table 3: Socio-economic factors.

Factors/criteria	Assessment (impact)
Street lighting	Comparison with the number (area of the environment) with regional averages of presence (+)/absence (-)
Pavement quality	
The structure of surface elements of engineering communications	
Quality/availability of pedestrian paths	
Morbidity rate	Increase (-) Decrease (+)

The criteria of this group are included in the analysis of the current state of the urban environment and are compared with previous indicators. It is based on the calculation of the increase rate that it is possible to judge the efficiency of the implemented measures and assess the degree of favorability of the urban environment. No less important is social security, in terms of feeling and perceiving the security of living conditions in the urbanized environment. To assess social security, it is necessary to analyze: street lighting, pavement quality (presence of holes, defects in the pavement, etc.), safety assessment of engineering communication elements (closed sewer manholes), presence of pedestrian paths, sidewalks. To analyze these indicators, it is necessary to compare them with both the total area and the number of inhabitants.

The group of infrastructure factors includes criteria for the analysis of transport, utility, and information infrastructure (Table 4). The analysis of transport infrastructure (Ryriakopoulou, 2021) involves considering the accessibility of transport for the population, coverage of all points of the urban environment, constancy of routes, variety of

transport, and level of motorization. To assess the utility infrastructure, it is necessary to evaluate the following criteria: reliability, safety, energy efficiency, and durability of civil engineering systems. The information infrastructure is evaluated according to the degree of modernity of the information provision to citizens, the speed and accuracy of information provided, as well as the extent and variety of information. The presence of tourist infrastructure also contributes to the economic development of the urban environment.

Table 4: Infrastructure factors.

Factors/criteria	Assessment (impact)
Transport accessibility	Specific indicator (per person or area) of comparison with the regional value, above the level (+)
Variety of transport	
Level of motorization	
Number of parking lots	
Physical wear and tear of municipal structures	More than 50% with negative impact
Compliance with modern requirements (update)	presence (+)/absence(-)
Tourist attractions	
Available information about transport	
Available information about events	

When analyzing this criterion, it is necessary to assess the degree of accessibility (transport and information) of the main tourist attractions.

The factors that make up the technogenic urban environment (Table 5) can be considered from the point of view of evaluating all functional zones of the urban environment for their safe placement and appropriate mutual placement; the quality of development. Construction quality parameters include analysis of the construction material, construction technology, number of floors of buildings, and operating time. Landscaping of the territory has protective functions and contributes to the creation of a favorable visual appearance of the urban environment (Zhu, 2021; Hian, 2021). The analysis of the visual appearance of the buildings is based on the assessment of the aggressiveness and homogeneity of the fields.

Table 5: Technogenic factors.

Factors/criteria	Assessment (impact)
Construction material	safe (+)/dangerous (-)
Tear-and-wear of buildings (more than 50%)	
Number of floors of buildings (proportionality of construction)	favorable (+)/(-)
Visual assessment	
Species diversity of landscaping	presence (+)/absence (-)
Landscaping	Comparison with standards, compliance (+)/ non-compliance (-)
Ambient air quality	
Acoustic pollution of the territory	
Radiation pollution of the territory	

All factors of the technogenic environment can have both positive and negative effects. Therefore, to assess their impact, it is necessary to compare them with the standard values, if exceeded, the impact should be assessed as negative. This refers to the criteria that can be measured (air pollution, water pollution, soil pollution). The landscaping degree of the territory is also compared with the standard values. However, exceeding the standard values of the landscaping parameters has a positive effect, while an insufficient value of this parameter is characterized as a negative effect. The system of green areas should be diverse, which contributes to the efficient protection and improvement of the environment due to the negative impact of anthropogenic impact.

The analysis of the presented criteria in different groups, depending on the significance of the criteria, allows us to determine the quality of the urban environment. The integrated assessment indicator will increase with a positive influence, and it will decrease accordingly with a negative influence. The higher the indicators of a comprehensive assessment of the urban environment, the more favorable conditions are formed for the development and sustainable functioning of the environment.

The main principles of the formation of a modern urbanized environment are as follows (Rastyapina, O.A., Polyakov, V.G., Prokopenko, V.V., Ganzha, O.A., Sabitova T.A., 2020): integrity, harmony, environmental friendliness, and meaning-making. The analysis of the marked directions and criteria will allow determining the compliance of the urban environment with these principles.

3 THREATS TO ENVIRONMENTAL SAFETY THAT DETERMINE THE ECONOMIC EFFICIENCY OF THE URBAN ENVIRONMENT

The presented analysis of the factors influencing the quality of the urban environment confirms the complexity and versatility of the methodology. Accordingly, economic efficiency cannot be determined based on only economic indicators or social indicators that characterize the quality of life of citizens. It is necessary to conduct a multi-factor analysis, based on the assessment of criteria that allow determining the level of development of the urban environment. The formation of favorable living conditions following the modern requirements of the population, introduction of technologies that contribute to the development of a "smart" urban environment, development of tourist infrastructure – all this contributes to the economic development of the urban environment, as well as sustainable development.

All the factors presented can have both positive and negative impacts on the degree of safety of the urban environment. All the factors that shape the urban environment and have a negative impact can be divided into three groups: chemical, physical, and mechanical. The values of the criteria for a group of chemical factors are usually calculated based on a comparison with the standard values. This group includes: volume of pollution (total and summed, reduced to a single measurement indicator), index of atmospheric pollution, area of industrial enterprises (located directly on the border with the residential zone), density of the street and road network (calculated as a specific indicator), area of sanitary protection zones, area of landfills, area of the cemetery, and total indicator of soil pollution. To analyze and determine the favorability of these indicators, it is necessary to determine the ratio of the total area of the urban environment. This specific indicator will be taken into account when determining the overall assessment of the safe environment, given the weight factors of the criteria. Physical factors are included in the analysis of indicators of physical origin. This group includes: proportion of streets with a high acoustic background, area of power lines, and area of heating mains. Certain criteria, such as transport accessibility and level of motorization, do not have standard values, but their presence creates favorable conditions for the development of the urban environment and forms a source of technogenic

impact on the environment. These indicators should be defined as specific, based on the population and the area of the urban environment. The group of mechanical factors includes criteria for the formation of the urban environment that characterize the qualitative characteristics of the buildings. This group includes: coefficient of high-rise buildings, coefficient of visual aggressiveness of buildings, compliance of the construction with the requirements and perception of the urban appearance. Depending on the obtained value determined experimentally, the criteria can have a positive and negative impact.

The analysis of these indicators will allow us to identify potential threats to the development of the urban environment. Taking into account the detail of the factors presented, to improve the efficiency of the urban environment, it is necessary to develop measures aimed at neutralizing the negative impact of groups of factors on the urban environment and achieving sustainable development.

4 CONCLUSIONS

The presented analysis of the components of the urban environment allows us to determine the main directions of assessing the quality of the urban environment. When considering the directions, the criteria for evaluating the urban environment are identified. All the criteria presented can be considered as having a positive or negative impact. The degree of influence should be taken into account when determining the overall/integrated assessment indicator with the appropriate mathematical sign. If the criterion has a positive impact, it increases the integrated assessment indicator; if it is negative, it reduces it. Taking into account the diversity of urban areas and the peculiarities of development, it is necessary to introduce the weight (significance) of this parameter for each criterion. The weight factor should be calculated based on the opinion of experts, as a weighted average of the significance of the factor for a specific urban environment. When assessing the level of safety of the urban environment, taking into account the analysis of the presented criteria, it is possible to determine those criteria and parameters that do not meet the requirements and require the implementation of measures aimed at improving the quality of the urban environment and increasing its economic attractiveness in the future.

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