Methodology of planning social infrastructure development to create a comfortable urban environment

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Abstract. The article considers the issues of social infrastructure planning. The purpose of the study is to draw up the list of social infrastructure facilities that provide favorable and secure conditions of living, differentiation of placement of these facilities in the territory and interpretation of priorities in planning sustainable development of the city. The authors have analyzed the researches of global cities development problems, the characteristics of life quality of population and the characteristics of the most demanded facilities of social infrastructure. On the base of a general methodological approach, random decomposition and induction methods, taxonomic analysis and expert evaluation, the authors constructed models for planning the placement of social infrastructure facilities. Comparative analysis of the models allowed describing three levels of social facilities placement that provide favorable living conditions and life quality for population. The authors have systemized the indicators of social infrastructure that is significant for the sustainable urban development, largely ensuring the good quality of the urban environment, secure and favorable living conditions. The results of the research can be used as a methodological basis for studying problems of sustainable development of global cities, good quality of urban environment. The authorities can use the results of the research to develop standards for urban planning.

1 Introduction

The feature of current stage of globalization is an attempt to direct the planning urban development toward the "humanity". The supremacy of market processes, the predominance of the rational over the intuitive, largely alienated urban planning from the principles of comfortable urban environment established during the socialist economy. Trends of returning to the values familiar to people, the desire to create a beautiful, secure and comfortable environment have made possible a new planning model of sustainable city development to appear. In the formation of this model, a special place was given to the standards of urban planning, called the standards of urban planning design. These standards
of urban planning should ideally reflect the social orientation of the strategic processes of urbanization and, at the same time, consider prevailing value system in cities.

Certainly, the idealistic orientation of standards was opposed by objective and subjective factors, such as the availability of a certain amount of resources (financial, territorial, material and other) that have authorities seeking to solve social problems of meeting the needs of population and the need of business communities to reduce costs and increase profitability of investments in construction of dwellings and social facilities.

It is the context in which development of urban planning standards in St. Petersburg were considered.

For theoretical rethinking the content of urban development standards, it became necessary to use a new conceptual approach, which goal was to establish priorities for the life quality and the urban environment quality, which determine the degree of urban sustainability. In this context, it was proposed to consider the most important component of sustainability – creation of a comfortable urban environment, including planning social infrastructure to incorporate into the standards of urban development. The study of life quality indicators and provision of population with social infrastructure facilities is researched by various scientists for different purposes. First of all, these are to catch global trends in development of world cities, to identify new processes of globalization associated with the explosion of interest in assessing the level of human development, the study of the dynamics of indicators of urban environment quality in the rankings of global cities as indicators of sustainability of their development and comfort of urban environment. The works of G. Wolff and J. Friedman, E. Soja, R. Ratcliff, S. Sassen, D. Clark [1, 2, 3] have become the basis for a new era of researchers of world cities and urban planners. The works of Pchelintseva O.S., Lyubovny V.Y, Zubarevich N.V., Safronova S. G. [4, 5] is devoted to the study of global processes of world cities, to the identification of the main social contradictions, including the growth of financial costs of the authorities to level the social polarization of population and to create secure and favorable living conditions.

In the Russian science the works of Akhremenko A. S. [6], Yershova S. A. [7], Nurullina E. I. [8], Safronova S. [9] are devoted to issues of "human" environment creation, integral characteristics of life quality and social infrastructure development in Russian megalopolises and regions. These works allow drawing up the list of significant indicators.

The objectives of this study are to draw up the list of social infrastructure facilities that provide favorable and secure conditions of life and comfort of the urban environment, differentiation of placement of these facilities in the territory and interpretation of priorities in planning sustainable city development.

2 Materials and methods

In the research, the authors assume that the standards of urban design are the basic document for creating a model of urban environment quality as a basis for sustainable city development. The system of indicators of social infrastructure development, as an indicator of life quality, should be formed with the conditions that create the basis to provide favorable and secure conditions of life.

Critical understanding processes of global cities development [10-13], accumulated theoretical knowledge about spatial development [14-17], preparation of standards of urban design for St. Petersburg [8], studying materials of the Master plan of St. Petersburg, strategy of its social and economic development, urban planning projects, published statistical data [18], revealed the expediency of using random decomposition method, induction and taxonomic analysis methods to draw up a list of social infrastructure facilities, incorporated into standards for urban planning design.
A general methodological approach of the research was the method of random decomposition which allowed choosing the most required indicators for a particular city from the total mass of indicators of social infrastructure facilities that provide life quality of population and favorable living conditions.

The next stage of logical analysis was the use of the induction method, which allowed identifying strategic priorities for development of social infrastructure components on the basis of the principle "from private to general".

Further, on the basis of taxonomic analysis the authors research the hierarchical organization of the planning structure of the city, that allowed to define the hierarchical structure of social infrastructure facilities for inclusion in the standards of urban planning design.

According to the results of the expert assessment, the authors drew up a list of priority social infrastructure facilities providing the planned high level of quality and comfort of the urban environment at each hierarchical level of the planning structure for inclusion in the standards of urban planning design.

3 Research results and discussion

Standards of urban planning design are one of the most important components of urban development standards, providing secure and favorable living conditions, creating the basis for sustainable city development. The base of their development was the need to include indicators of social infrastructure characterizing the quality of the urban environment, formed on the statistical and project data; expert opinions on the comfort of the urban environment, the required level of social facilities accessibility; the published results of scientific and practical researches of life quality [7, 15, 18-20].

To concrete population requirement for the environment quality and the living comfort, the authors proposed to compare different models of planning the placement of social infrastructure on the following features (Fig. 1 and Fig. 2):

- type of accessibility to social infrastructure facilities for population (pedestrian, transport);
- accessibility conditions (time to access the social infrastructure facilities);
- frequency of demand (use) of social infrastructure facilities (daily, periodic, episodic);
- proposed location of social infrastructure according to the hierarchy of planning structure elements (block, living area, city).

![Fig. 1. Model of planning the placement of social infrastructure facilities by the accessibility factor for population.](image)

![Fig. 2. Model of planning placement of social infrastructure facilities by factors of demand (use) frequency according to the hierarchy of planning structure elements.](image)
The comparison of these models allows defining three levels of social facilities placement that provide favorable living conditions and life quality for population (table. 1).

**Table 1.** Placement grades of social infrastructure facilities providing favorable living conditions.

| placement grades | signs of differentiation of social infrastructure facilities |   |   |
|------------------|-------------------------------------------------------------|---|---|
|                  | proposed location | demand (use) frequency | type and conditions of accessibility for population, time |
| the first block  | daily             | pedestrian (within 15 minutes) |
| the second living area | periodic | pedestrian and transport (within 30 minutes) |
| the third city | episodic | transport (within 60 minutes) |

The priority social infrastructure facilities that allow assessing the quality of the urban environment at each hierarchical level of the planning structure are below (table. 2).

**Table 2.** Differentiation of social infrastructure according to the hierarchy of placement in the planning structure of the city.

| Industry, social infrastructure facilities | Grades of facility placement | The first | The second | The third |
|------------------------------------------|-----------------------------|----------|-----------|----------|
| Education                                |                             |          |           |          |
| preschool institutions                   |                             | +        |           |          |
| general education institutions           |                             | +        |           |          |
| vocational educational institutions      |                             | +        | +         |          |
| extended educational institutions for children |                       | +        | +         |          |
| Health care                              |                             |          |           |          |
| polyclinics                              |                             | +        | +         |          |
| emergency care                           |                             | +        |           |          |
| hospitals                                |                             |          |           | +        |
| Sport                                    |                             |          |           |          |
| planar sports facilities                 |                             | +        | +         |          |
| sport halls                              |                             | +        | +         |          |
| swimming pools                           |                             |          |           |          |
| outdoor sports facilities for the young extreme sports |             | +        | +         |          |
| sport halls for youth                    |                             |          |           | +        |
| Social services                          |                             |          |           |          |
| complex centers of social service        |                             | +        |           |          |
| центры социальной реабилитации инвалидов и детей-инвалидов; несовершеннолетних |                   |          |           |          |
| centres of social rehabilitation of disabled children and children with disabilities; juvenile |               | +        |           |          |
| institutions of social services for homeless people |                     | +        |           |          |
| residential homes for the elderly and disabled; for children with mental disabilities |             |          |           | +        |
| house of social service for single people |                             | +        |           |          |
| social centers for youth work            |                             |          |           | +        |
| Culture                                  |                             |          |           |          |
| public libraries                         |                             | +        |           |          |
| cultural and leisure institutions        |                             | +        |           |          |
| youth houses                             |                             | +        |           |          |
| theaters                                 |                             | +        |           |          |
| museums                                  |                             | +        |           | +        |
| cinemas                                  |                             | +        |           | +        |
| teenage and youth clubs                  |                             | +        |           |          |
### Grades of facility placement

| Industry, social infrastructure facilities | The first | The second | The third |
|-------------------------------------------|-----------|-----------|-----------|
| Trade and public catering                 |           |           | +         |
| trade enterprises                         | +         | +         | +         |
| public catering enterprises               | +         | +         | +         |

Note: (+) – the object belongs to the given hierarchical level.

First of all, placement hierarchy of social infrastructure facilities is necessary to provide population with social facilities for favorable and secure living conditions.

The first grade social infrastructure facilities are equal to the concepts of «everyday use facilities» or «walking distance facilities» and provide the primary needs of population. These are general education institutions, preschool institutions, trade enterprises. These facilities are the most important indicators of life quality in the modern worldview. For such facilities a fixed radius of accessibility should be set. The radius defines the need to place these facilities near dwellings. The second grade social infrastructure facilities provide periodic needs of population. These are facilities of sport, health care, culture, social service of population, trade. As a rule, these are larger social facilities that provide periodic needs of population in services. The third grade social infrastructure facilities provide episodic needs of population. These are large facilities of trade, sports, health care (hospitals), education (higher education institutions), and social services.

### 4 Discussion

Sustainable urban development is, first of all, the rational use of territorial resources in order to achieve an equilibrium state to provide favorable and secure living conditions, create a comfortable urban environment and neutralize the negative impact of macroeconomic factors. The criteria of urban environment sustainability and comfort are formed in the standards of urban planning and law acts and change as they are amended. Dynamics of system stability and living comfort should be monitored according to the indicators of actual and planned level of the territory development. The higher the separation of the quantitative values of the actual indicators from the normative is, the less stable the system is and the more negative assessment of living comfort and quality.

Stability factor of territory development is counted with the sustainability indexes, which are the ratio of actual and normative values of every environment quality indicator provided to population (indicators stipulated in the standards of urban planning design for each region, city).

Therefore, it is possible to nominally define the following types of urban territories:

- territories which the stability limits are exhausted for;
- territories which the stability limits are not determined for (developing and planned development territories);
- territories which stability factor of development is high for (these are the built-up territories with gaps; the territories built up according to the non-actual standards of urban planning; the built – up territories possessing high urban planning, historical and cultural value which the balance of indicators "territory of residential development – population size – total housing stock – capacity of social infrastructure facilities" is kept in).

### 5 Conclusions

According to the results of the research it is revealed:
social infrastructure facilities largely ensure good quality of urban environment, secure and favorable living conditions;
planning urban development and quality of urban environment, it is necessary to take into account that social infrastructure facilities differ in the levels of demand and accessibility;
social infrastructure indicators relevant to sustainable urban development and provision of comfortable urban environment, proposed for inclusion in the standards of urban planning design, should be systematized by industry and hierarchical levels of planning structure, which allows assessing degree of stability for each type of social facilities.

In general, the research develops the theory of globalization and planning favorable living conditions, the results are universal and their application by the authorities and experts will allow preparing reasonable standards of urban planning design in compliance with specifics of city and region.

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