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Algorithm of Effective Development of the Urban Environment

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Abstract. Based on an analysis of modern priorities for real estate development and for the solution of the most acute problems of urban environment, the article presents the universal algorithm of economic justification for building the main elements of the city planning structure. The developed algorithm includes correction of urban planning documents and further creation of the site development concept for the main element of the city planning structure to form a reasonable level of the environment quality in the study area. The main components of the development concept for the city planning structure main element are here presented. As a result of using the algorithm presented, the development of the planning structure main element with a high capitalization potential is carried out. The main criterion of its application for the cost-effective mode of the urban development is the increase of investments in the territory. The use of the study results will allow developers to work out cost-effective projects for the development of urban areas, taking into account the reasonable level of the urban environment quality as a factor of economically reasonable growth of real estate capitalization.

1. Introduction

Directions of the development actualized in the latest program statements of the President and the Government of the Russian Federation [1] are aimed at involving the factors of increasing the competitiveness of the life activity environment that were not used in the past. Previously the country development focused on developing extractive industries. At the same time, despite the achieved pace and scale of major construction, its development was far from corresponding the environment improving, sometimes being even harmful for it. As a result, Russia has become one of the world's largest donors not only of raw materials, but also of intellectual resources. According to World Bank experts, the "brain drain" results from the lack of decent living environment [2,3].

   The cooperative analysis of foreign and domestic specialists in the field of sustainable development has confirmed that the high quality of human capital is impossible without providing decent living conditions and good conditions for activities in business hot spots [4,5,6]. The gap between entire Russia or her particular regions and developed countries (as well as a number of developing ones) in the area of improving the environment that supports the development of human capital is much bigger than the gap in material production, including manufacture, financial, information and other

technologies. The problem of creating "comfortable cities" is now included in the agenda of all the world's discussion platforms [7].

Accelerated adjusting of scientifically based approaches to planning, organizing and restructuring the urban environment enables actualizing Russia's main advantage in the global economy, which lies in the quality of human capital. According to the authors of the Final Report on the results of expert work on topical problems of Russia's social and economic strategy for the period up to 2020 [8], competition for human capital, creating and activating new ideas and technologies, becomes the main direction of intercountry competition in the nearest future. In order to win in this competition, one can only significantly improve the environment, favorable not only for life, but also for human development.

A number of scientists are studying the urban environment and its development. For example, E.A. Gorin and A. Ya. Burdyak use the environmental approach, which in contrast to the system approach focuses on residents, their subjective perception of the urban environment, assessments and opinions [9]. With the development of the environmental approach, an assessment of the quality of the living environment in the city as a factor of its attractiveness to the population and business is becoming one of the most urgent areas of modern research in the spatial economy [10]. Other researchers offer using the bridge funds mechanism as a new tool for urban environment development based on the use of constructive dialogue regime of economic agents of the urban environment with the widest possible subjective connection to the real needs of the city residents [11]. A number of researchers are dealing with the problems of sustainable urban development around the world and their evolution, offering tools for solving modern urban problems [12,13]. Realizing the need to implement the principles of sustainable development promoted the development of construction and information technologies in the field of the efficient use of natural resources, which resulted in a ubiquitous study of the "smart city" concept [14,15] and the active introduction of GIS technologies in the study of cities and their living environments [16] .

The research of the scientific base showed that most researches are focused on studying the problem of the influence of the urban environment at the macro and meso levels, both in determining the strategic priorities of the national economy and in determining the directions for the development of the construction complex and territories. Overcoming the limitations of the available results of the scientific research in terms of realizing the complex potential of the urban environment and its accounting in the process of capitalization of real estate requires the development of an economically efficient algorithm for the urban environment development with an emphasis on basic territorial units of preferable size and configuration.

2. Materials and methods

In the framework of the study, the authors propose to consider basic components of the town planning pattern of the city as basic territorial units.

The Basic Components of the Town Planning Pattern (BCTPP) are residential quarters, micro-districts and other entities, separated from each other by building lines determined in the design of the territory development.

When there are no elaborated designs of territory development, the city areas of 10-60 hectares, but not more than 80 hectares, are considered as BCTPP, if they are not split by the main streets or roads. Within those areas, the institutes and enterprises of daily use should be located in service radius of 500 m or less (within the walking distance). The main thoroughfares or residential streets, pedestrian routes and terrain lines serve as the boundaries of such BCTPP [17].

Before starting the implementation of the project of developing a component of the town planning pattern, it is necessary to make an economic justification for the concept of its construction [5,18]. The economic justification of the developed concept will help to assess the economic nature of the project implementation in terms of costs and taking into account the payback period [19,20].

In general terms, the development concept for BCTPP includes:

a) Analysis of the characteristics of the territory: description and identification of the main technical characteristics and features of the land parcel and buildings located on it.

b) Estimation of the location potential: analysis of the territory, where complex development is intended, its location and surroundings; analysis of the perspective development of the district.

c) Analysis of urban constraints: reasoning the feasibility of implementing objects of different functional targeting on the territory under study.

d) Analysis of the real estate market: marketing research of the real estate market of those segments that can be implemented in legal and practical terms on the given territory.

e) Analysis of the most efficient territory use: working out options for the functional zoning of separate sections of the territory, description of technical and economic indicators for each option and their financial and economic analysis.

f) Description of the general idea of territory developing: the functional zoning of the territory and the positioning of objects; positioning of engineering facilities in the territory; logistics of transport and pedestrian flows; assistant social infrastructure.

g) Demand analysis and description of the most demanded areas: determining the basic requirements of target consumers to planning characteristics, to the infrastructure and the surrounding territory.

h) Financial plan of project implementation: calculation of costs and necessary investments in the project on a larger budget and forecast for their change; priority of implementation and project financing schedule; determination of project profitability factors.

i) Risk analysis of the project: risk analysis in terms of the territory development concept primarily includes a SWOT analysis.

j) Analysis of the current quality level of the urban environment in the territory: assessment of the current quality level in the territory under study is performed in accordance with the principles of factor analysis in the direction of modifying the method of main components. Based on the evaluation results, an integral index of the quality level of the urban environment (QLUE) is constructed.

3. Results and discussion

Based on the results of the study, the authors elaborated a universal algorithm for the economic substantiation of developing BCTPP, which is presented in Figure 1.

The determining factor of the presented algorithm is the presence of a planning and surveying design (PSD) in the developed territory. When there is no PSD, it is primarily necessary to evaluate the functional zoning. Based on the evaluation results, the idea of possible realization of the town planning pattern component under consideration is generated. If the current functional zoning dissatisfies the owner of the land plot, his further actions imply the possibility of making adjustments in the general plan of the city.

If the functional zoning corresponds to the wishes of the owner of the land plot, there is a need to move on to the evaluation of urban zoning. On this stage, if there is a disagreement with the desired development direction, it is necessary to initiate a procedure for introducing adjustments into the Land Use and Development Rules of the city. In case of satisfactory town-planning zoning, the elaboration of the concept of BCTPP development can be proceeded.

After elaborating the concept, it is obligatory to assess the matching of the technical and economic indicators (TEI) of the development concept for BCTPP with the substantiated quality level of urban environment.

By substantiated QLUE, it is meant that the quality level of the environment is not lower than the normative one, which can satisfy the basic needs of the population living or aiming to live within the boundaries of the town-planning pattern component under study and which is economically profitable for the developer implementing the project [21]. Its main criterion is the growth of profitable investments in the territory. Due to different preferences of city residents, the level is formed individually for each specific territory.

The normative level of quality in this case is represented as a minimally necessary list of socio-economic infrastructure, enshrined in town planning regulations and mandatory to perform for the developer. The main criterion is the compliance with the minimum requirements enshrined in the regulatory documentation. This level of quality should be performed throughout the whole city.
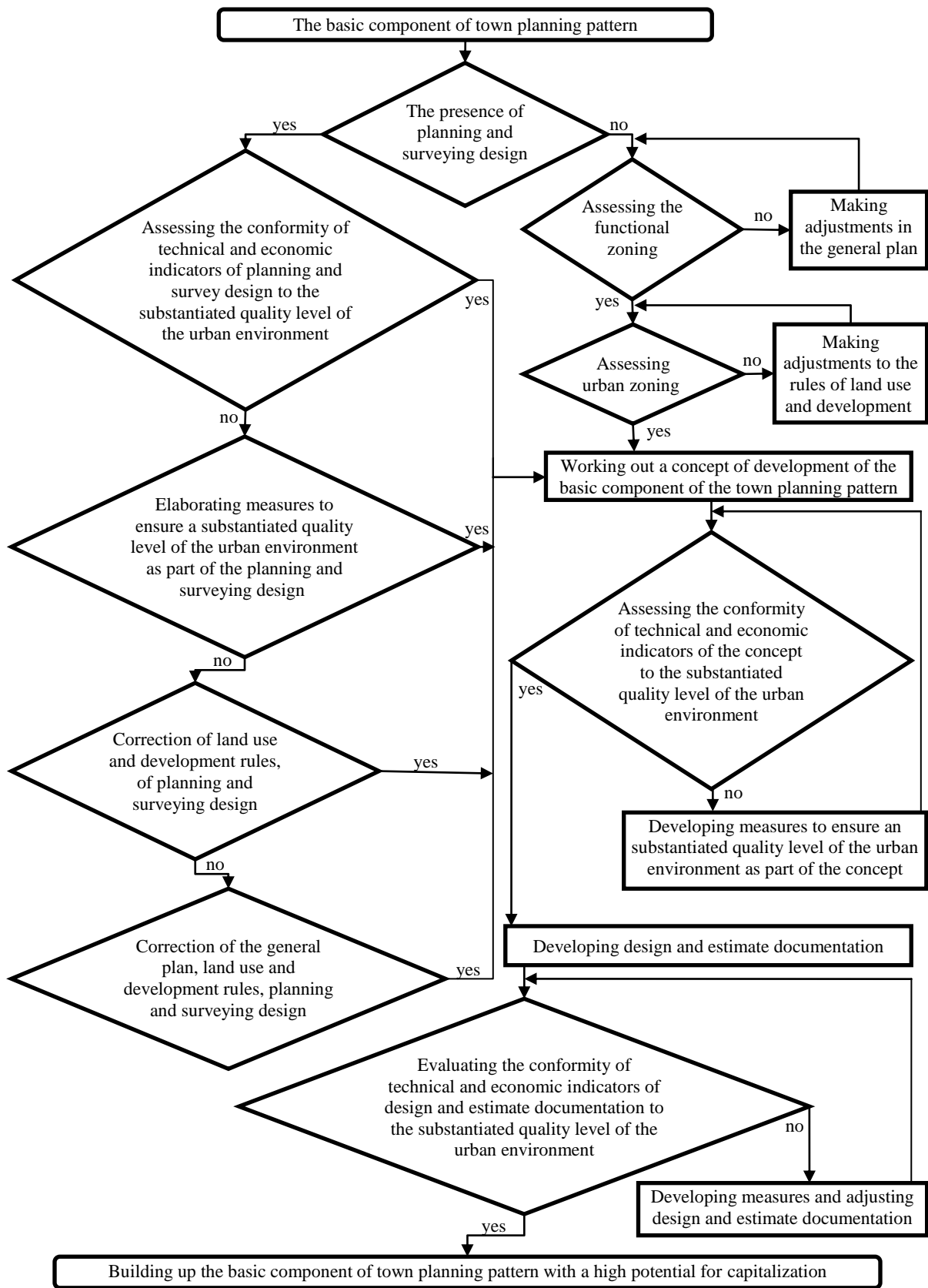
Figure 1. Algorithm for the economic substantiation of developing the basic components of the town planning pattern

The formation of a substantiated quality level contributes to the positive evaluation of the concept, which being implemented in practice leads to the achievement of the maximum real estate capitalization that helps the developer to obtain the greatest combined profit. It is recommended to form the reasonable QLUE on the basis of the following indicators: density of residential development; number of storeys; share of present-day buildings; aesthetic perception of buildings; share of green spaces; area of inarable lands; provision of places in kindergartens; provision of places in schools; the availability of shops in walking distance; number of ground parking lots.

This stage is necessary to reject inherently inefficient projects. In case of negative evaluation of the concept, it is necessary to elaborate measures for the formation of a substantiated QLUE on the territory under development.

When the substantiated QLUE is taken into account, it is possible to proceed the further elaboration of design and estimate documentation (DED), which contains text and graphic materials, defines architectural, functional, technological, structural and engineering solutions for the project assurance. This stage implies assessing the compliance of TEI of DED with the substantiated QLUE.

If they do not comply with the substantiated QLUE, it is necessary to elaborate measures to adjust the DED. The proposed measures should be primarily aimed at reducing the cost of construction, increasing the land-to-building ratio, reducing the cost of the site development, etc. Otherwise stated, there is a need to optimize the structure of planning costs in order to form substantiated QLUE. If TEI of DED correspond to the expected results, one can proceed to the final stage of the algorithm – building up the BCTPP on the basis of the proposed concept.

The algorithm described above is meant for territories that have no planning and surveying design (PSD). If there is one, an assessment of the conformity of the TEI of PSD to the substantiated QLUE is performed.

In case of a positive assessment, one can start elaborating concept of developing BCTPP and follow the stages described above. If the result of assessment of TEI of DED is unsatisfactory, it is necessary develop measures to ensure a substantiated QLUE as part of DED. As a result, if TEI of DED correspond to the substantiated QLUE, then further elaboration of the development concept of BCTPP is performed. Negative results at this stage indicate the transition to the next stage - adjusting the Land Use and Development Rules and DED and reassessing the TEI of the DED to the quality level of the urban environment being configured. If these measures gave a negative result, in addition to adjusting the Land Use and Development Rules and DED, it is also necessary to make adjustments in the general plan of the city.

As a result of these changes, the TEI of the DED will correspond to the substantiated QLUE, therefore it is possible to start elaborating the concept of developing BCTPP adhering the stages described above.

The application of the proposed algorithm for the development of BCTPP within working out the development concept for the residential area "Tikhiye Zori" (the city of Krasnoyarsk) allowed improving the quality of living environment in the project and ensuring the capitalization of residential real estate by 7.75%.

4. Conclusions

The essence of improving the quality level of the urban environment within the boundaries of the territory under study is the raise of consumer performance of real estate, improvement of living conditions, and consequently the growth of investment attractiveness and the value of real estate. More wealthy and solvent citizens purchase housing in a territory with a higher environment quality. They contribute to the prosperity of trade, food, culture and sport spheres and other infrastructure. This leads to an increase in the capitalization of all commercial real estate, including an increase in the cost of square meters of housing. Therefore, the presented algorithm will allow developers to work out projects for the development of urban areas more efficiently, taking into account the substantiated quality level of urban environment.

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