UDC 69.003.658.152

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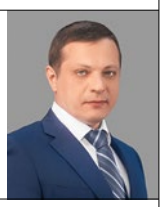
Modeling locally integrated management in the system of spatial territorial development of industrial parks of the “greenfield” type



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The analysis of the industry's development over the last year, as well as over the period of regular collection of statistical information (since 2018), indicates the continued positive dynamics of development of industrial parks in Russia, despite the unfavourable economic situation in recent years. The pace of industrial development has proven the important role of industrial parks as an element of industrial and investment infrastructure, as well as an effective tool for territorial development.
An investment project of an industrial park of the “greenfield” type encompasses justification of economic feasibility, amount and scheduling of capital investments, including the required project documentation, as well as a description of practical steps to make investments in the system of spatial-territorial development. The lifecycle of the investment construction project, starting from the business idea to the commissioning of a facility, has different stages, interrelated with each other. The dates of the project implementation depend on the characteristic features and type of the future facility, conditions of financing, and tentatively make up to 5 years [1–3].
The successful existence and implementation of an investment project throughout its lifecycle is possible, above all, thanks to the professionalism and competence of all project participants, from the customer service, investor and management company to contractors in charge of certain types of work.
Keywords: *greenfield industrial park, investment and construction project, revitalization, sustainable development of urban environment, integrated model, redevelopment*

GENERAL PART

The effective implementation of large investment construction projects is a complex integrated task. Currently, the implementation of projects in Russia successfully adopts a managerial approach: a step-by-step process of project implementation is introduced, comprehensive monitoring and continuous control of the progress of work at all stages of the investment project [4] are performed, taking into account the principle of revitalization of the industrial area of development.

The standard step-by-step process of implementation of a greenfield industrial park project has five key stages: business plan – pre-project stage – design stage – construction – operation.

Each stage consists of a number of pre-set activities. Stages have a standard structure; at each stage, a strictly defined set of results must be delivered; they allow the investor to make key decisions about the further fate of the project, approve of its schedule, budget, and set the priorities.

As the project is implemented, at each subsequent stage, the accuracy of the assessment of the main parameters of the project (the project budget, the net present value) should go up (refer to lines on Fig. 1).

This figure describes an approach to the implementation of three stages of an investment construction project:

- the pre-project stage;
- the design stage;
- the construction stage.

The term “regeneration” is used in the theory of real estate management and is frequently used in the urban development section governing historic development. In the expansive context of a partial or complete change in the functional purpose of real estate, regeneration acquires the properties of the concept of redevelopment. Its functions are identified as follows.

1. Transformation of real estate facilities having any location.

2. All forms of expanded reproduction of real estate in accordance with the model “Construction – Renovation – Liquidation”.

3. Complex nature of restorative and developmental functions of real estate.

4. Functional mobility and adaptability of facilities to the adjacent territory.

Having made the analysis, the hierarchy of existing views on the concepts that reflect the processes that are underway in the established development, are shown in figure 2.

Following the content of the tasks about the main forms of restoration and renewal of the urban environment, we have found that in all cases their implementation is based on method, organizational and managerial mechanisms of redevelopment.

To clarify the content of the concept of revitalization as the notion that most fully reflects the social orientation of rehabilitation and development of industrial property in the territories of cities, let us study their typology.

Revitalization means restoration of the viability of urban industrial spaces through balancing

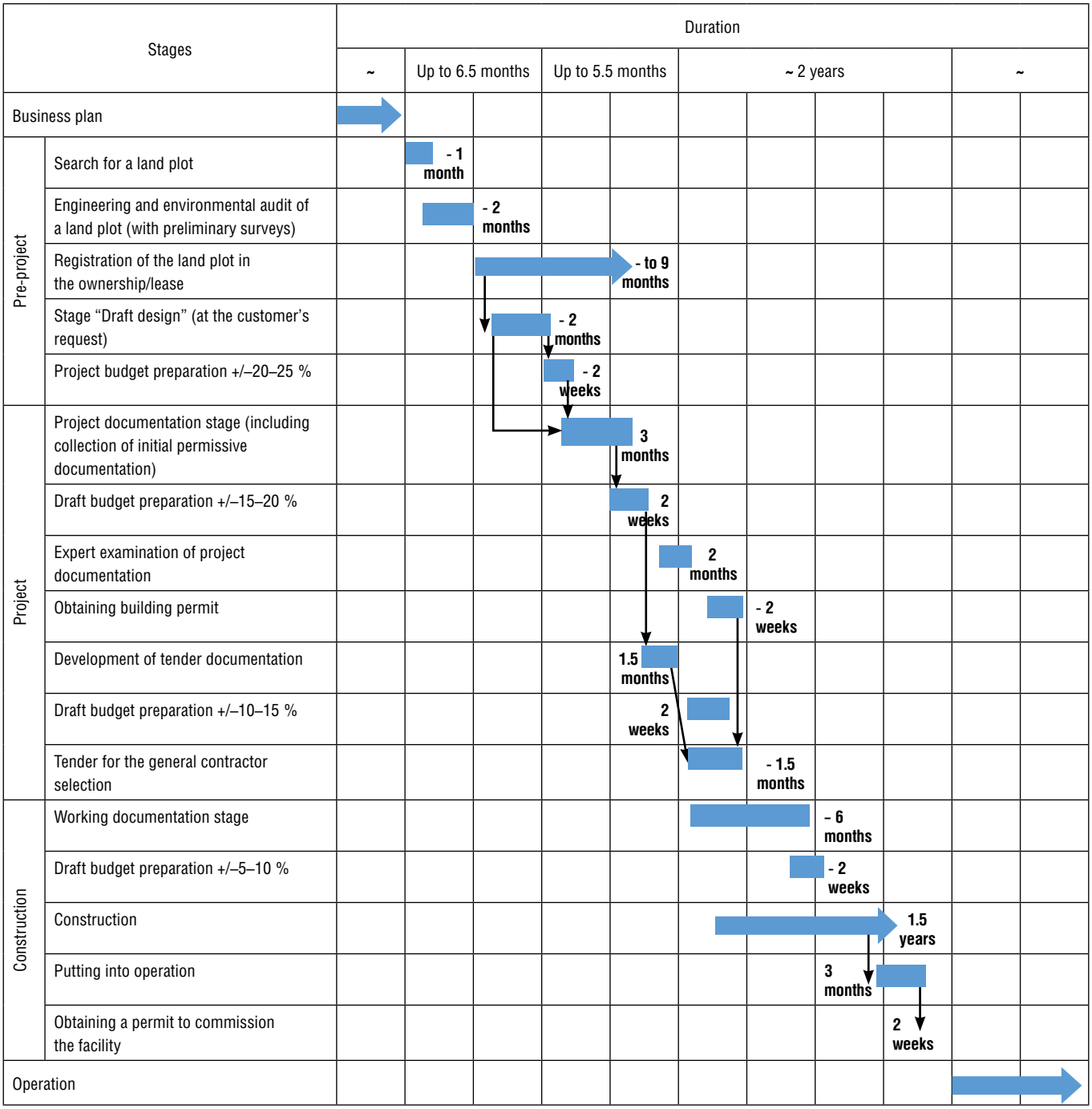

Fig. 1. General schedule for the implementation of the investment project of the Greenfield Industrial Park (IP)

the functional structure of real estate and the biosphere compatibility of urbanized territories with transport facilities and utility infrastructure. Processes of revitalization have functions of urban planning, urban development, and urban regulation in terms of the organization of reproductive processes of renewal (reconstruction, modernization and overhaul) of existing industrial buildings.

The analysis of historically established criteria for attributing cities to the some clearly expressed type allows to systematize them and substantiate the main features that determine the essential differences of urban spaces. Earlier studies have proven that the geographical location of settlements and the nature of their relationship with the outside territories largely predetermines the nature of employment (agriculture — in the case of adjoining fertile land resources; craftsmanship — in the presence of deposits; trade — if the intersection of transit routes is available, etc.). Localization within the country also conditioned the emergence of certain stereotypes of life activities (patriotism – egocentrism; money as the highest of values or justice and service; attitude to natural resources as a common good or private property; the role of the state as the basis of law and order or initiator, protector, judge, etc.). The advantages of location, and, hence, the resource basis for development, attracted residents, multiplying the number of city dwellers.

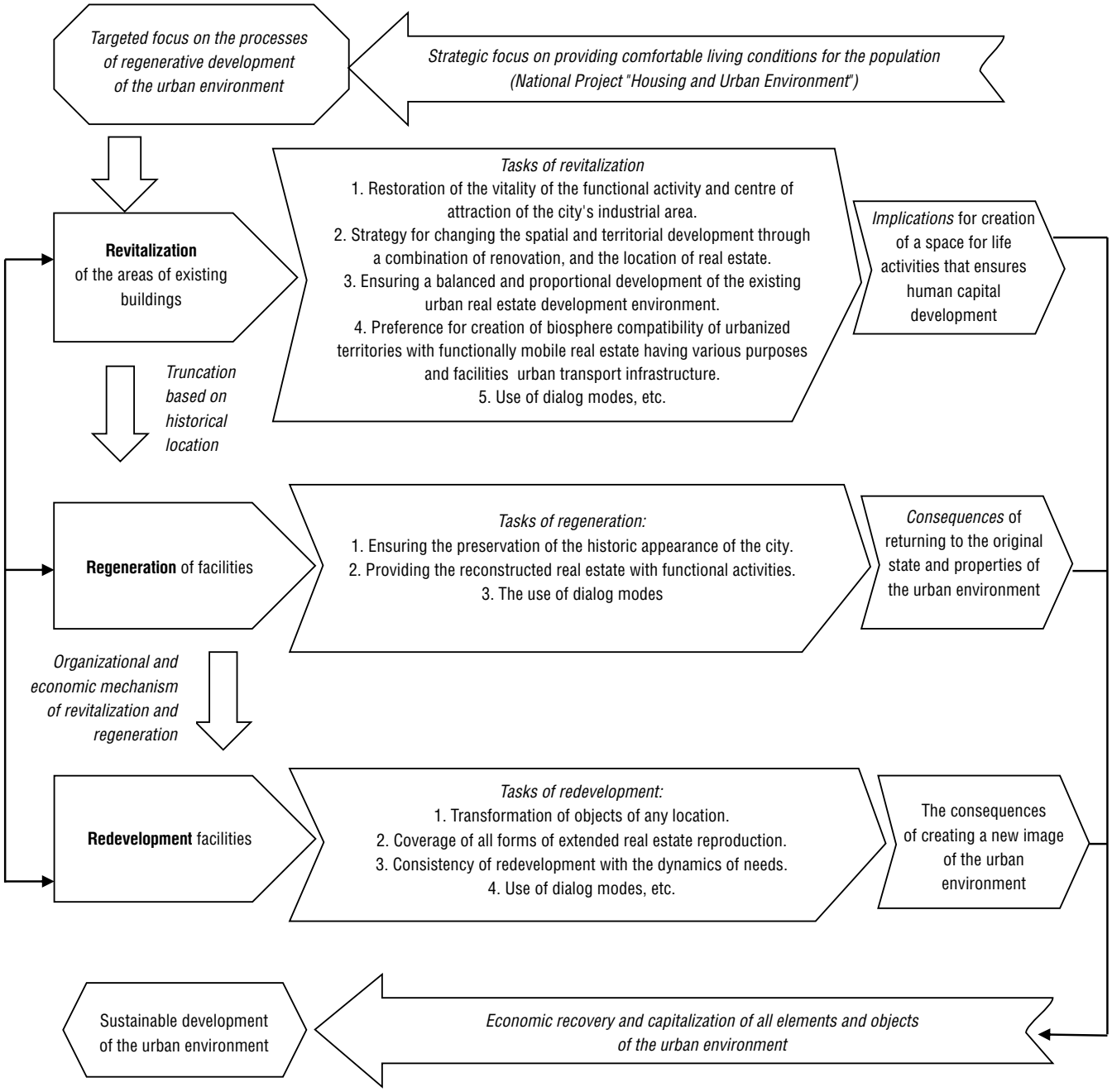

Fig. 2. The main forms of restoration and renewal of industrial areas of the urban environment

The development of the sphere of production, determined by the spheres of resource sufficiency and accessibility, is objective.

RESEARCH SECTION

The implementation of the main tasks of revitalization of the life space in a historically developed city is impossible without taking into account the object-subject relations that develop in the real estate sphere. Their immanent properties are formed, first of all, under the influence of peculiarities of real estate facilities as the material basis for the established structure of real estate. The peculiarities of the real estate sphere should include [5, 6] the profile of characteristics, that is generally accepted nowadays:

- diversity of types of real estate, segmented not only by location, functional purpose, number of storeys, degree of wear and tear etc., but also by the level of capitalization and prospective advantage;
- multiplicity of the facility composition with the internal interconnection and interdependence of constituent facilities. For example, the real estate structure of industrial zones and territories determines the configuration of energy, transport, housing and utilities infrastructure, while natural

or cultural heritage facilities objectively limit, and in some cases expand the views from new construction facilities;

- the functional determinism and relative inertness of real estate facilities, which requires either multi-functionalism or redevelopment, taking into account the dynamics of the structure of needs;
- the possibility of using different economic models of involving real estate in the economic turnover. It can be equity construction or project financing of new construction, purchase of property, lease, trust management, co-working, etc.;
- features of the liquidity of real estate facilities as an investment asset. On the one hand, a reliable asset is always in demand, on the other hand, given the capital intensity and the long payback period, the period of operation of the facility can be long;
- diversity of business entities involved in real estate operations. At the same time, not only legal entities, but also natural persons participate in the management cycle of real estate, taking into account the organizational and legal forms of ownership of a business entity. It is their dynamically changing needs that give impulses to changes in the structure of real estate.

Participants in the processes of cyclic development of real estate conduct their activities in different spheres (Fig. 3). As follows from the figure, a large number of spheres of investment and construction activity, serving all stages of the real estate life cycle, form the work front of participants. This indicates profound specialization of in-house units of large development companies, as well as a fairly wide range of activity segments of small and medium-sized construction companies. In any case, as studies have shown [7–9], the scale of activity is determined by specific volumes and the structure of real estate needs changing in the cyclic dynamics.

All spheres of activity are broken down by the stages in the lifecycle of industrial real estate facilities [10], which, according to the system-wide attributes, are usually subdivided into.

1. Land plots for development that are partially developed. These may be lands of settlements, special purpose lands (designated for industrial enterprises, energy and transport facilities, television, radio broadcasting and informatics, service industry, etc.).
2. Buildings and structures located above and underground.
3. Natural resources that are being developed or are subject to development.
4. Detached water bodies/water areas.
5. Special aerospace facilities, etc.

In turn, buildings and structures are subdivided into aboveground, located on a certain plot of land, and linear types of real estate, which have a length of up to tens of thousands of kilometers (pipelines, power lines, railroad tracks, etc.) All types of facilities are divided into commercial and non-commercial ones. In the generally accepted classification, land plots of noncommercial purpose are subdivided into lands of socio-cultural and research-educational purposes.

Land plots of commercial purpose are subdivided into residential real estate, industrial real estate and multifunctional real estate (retail trade, hotels, etc.).

Linear facilities and roads can also be commercial and noncommercial. For example, pipelines, power lines, railroads, etc. for strategic purposes are non-commercial in nature. At the same time, linear facilities of general business turnover serve commercial projects. Forest lands, water areas, etc., being originally objects of public use, are now also partially commercialized.

It is noteworthy that the structural diversity of real estate is often spontaneous. The development of living spaces is not always comprehensive, systemic and evenly distributed in time. Discontinuity and fragmentation, as a consequence of geopolitical and economic processes, are essentially characteristic of all historical periods of development of modern civilization. Epochs and modes of life left buildings and constructions inherent in their modes of life, which did not always fit into the changed structures of needs. Their dialectics, commensurate with changes in public space, restructured not only the spatial sphere of real estate, but also significantly expanded its functional purpose. The study of the classification criteria used in the research literature [11] shows their infinite variety depending on the purposes of research. Meanwhile, for the implementation of urban planning activities, focused on the provision of sustainable development of territories of historic cities, from the author's point of view, it is important to consider the logical subordination of the criteria of real estate decomposition. This is due primarily to the fact that the target aspect and character of real estate is determined not only by the emerging requirements, but also by its past, objectively predetermined by the spatial localization and various functional projections. In other words, the hierarchical structure of the criteria is based on objective functional properties determined by the spatial localization.

Reproductive processes of complex development of industrial areas include construction, renovation (demolition of obsolete, dilapidated and emergency items of real estate, and their replacement by newly built facilities), urban planning as formation of a multifunctional urban environment. Reproductive processes of renovation of existing industrial development include the whole variety of repair and reconstruction measures throughout the life cycle of the property: reconstruction, modernization, overhaul, restoration, current repairs and arrangement of urban life in accordance with modern safety and comfort requirements [12, 13] (Fig. 4.)

Functional properties of spatial localization, allowing the formation of the target space and setting options for the functional purpose of real estate, influence the nature of the use of real estate facilities, which, in turn, predetermine the type of real estate liquidity. The hierarchical relationship between the criteria of real estate decomposition is presented in Fig. 5.

Organizational principles of revitalization, as well as laws, are divided into general and particular.

Principles of the general structure include: compatibility and conformity of the element; differentiation and integration of functions; update of functions and concentration of functions; mobility (changeability) of functions (in our case — functional mobility of real estate); neutralization of dysfunctions; Le Chatelier principle (any attempts to change properties are caused by resistance, by force equal to influence); proportionality; functional additionality (with required complementarity).

The principle of the update of functions consists in the fact that if necessary, in critical situations it is necessary to implement an important function for its survival (possibly sluggishly implemented earlier), all resources and capabilities of functional elements are mobilized, etc.

The principle of functional mobility (changeability) means that in the same situations critical for an important function, other functions are mobilized, which “unload” and provide whatever is necessary.

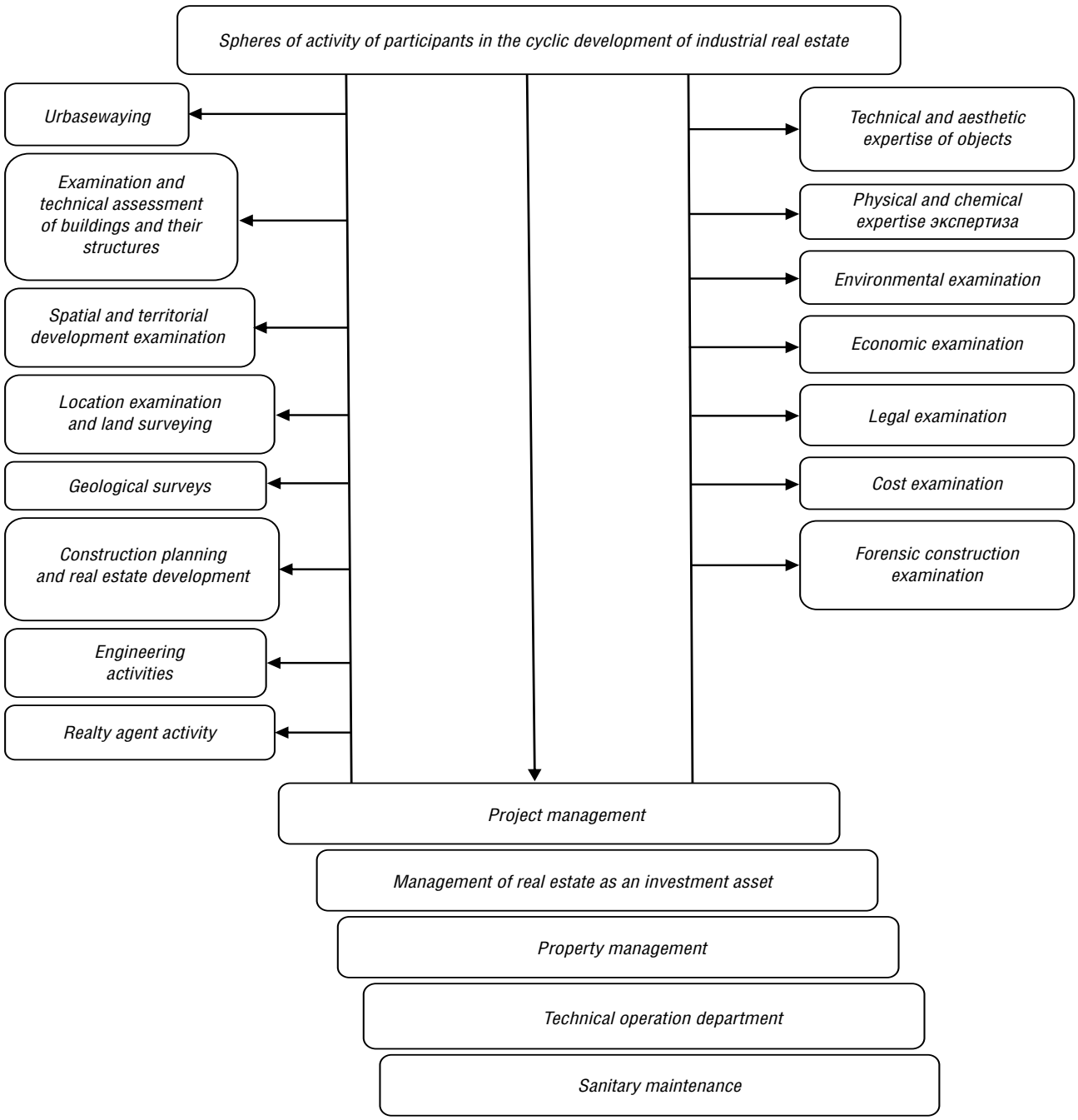

Fig. 3. Spheres of activity of participants in the cyclic development of industrial real estate

The principle of neutralization of dysfunctions consists in the fact that destructive actions of individual elements are blocked, suppressed by others, thereby increasing the viability.

The principle of complementarity consists in the fact that the main element can include elements with different, often mutually exclusive properties, mainly if these differences contribute to the achievement of the system's goals in the best way[1].

Complementarity relationships are assumed to be informational only and are intended to determine the ability to perform the same engineering operations.

Consideration of the theory of functional-statistical modeling, as well as the features and experience of modern construction and operation of real estate in the domestic and foreign practice allows for a fundamental model of functional reliability modeling.

In the most general form, the system-wide conceptual model can be represented graphically (Fig. 6).

Three types of functional relationships can be distinguished: *Z*(I–II), Z(II–III), Z(III–I)/.

This approach is based on a three-dimensional model of the functional system consisting of a set of functions (targets), which should be highly effective due to the combination:

1 System regularities and principles — General theory of systems. URL: istemnye_zakonomernosti_printsipy (rus.).

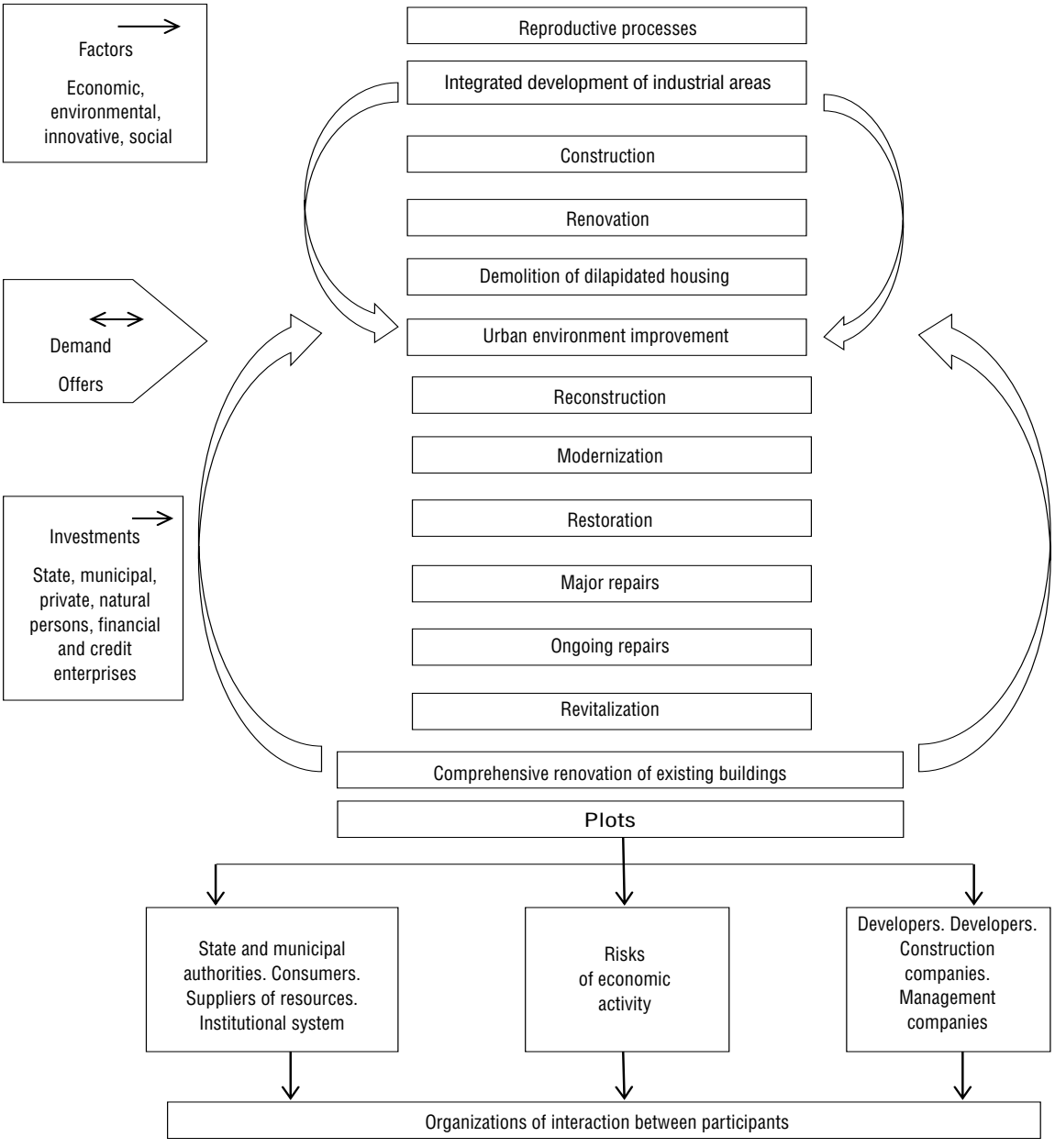

Fig. 4. Reproduction processes underway in the course of managing industrial realty

Level of objective structure	Functional properties of spatial localization — assessment of the potential of land, water, forest, raw material resources, taking into account available buildings and structures
Target level **(Basic module)**	The space of commercial and non-commercial purposes of the available real estate structure – evaluation of the degree of balance
Forecasted level **(Set of calculation methods)**	Scenarios and variants of functional use of real estate facilities – assessment of possible structures and their optimization
Selective level **(Resource and organizational module)**	System characteristics of the real estate facilities and their type of use — evaluation of the lifecycle, serviceability, attribution to the spheres of urban economy, ability to change, etc.
Operational level **(Implementation-operational module)**	Real estate capitalization – evaluation of the advance development potential of the real estate sector
Liquidation level **(Renovation module)**	Identification of damaged capital assets and capital assets in need of replacement and specification of the tasks of imbalance liquidation

Fig. 5. Hierarchical relationship between the decomposition criteria of industrial real estate facilities

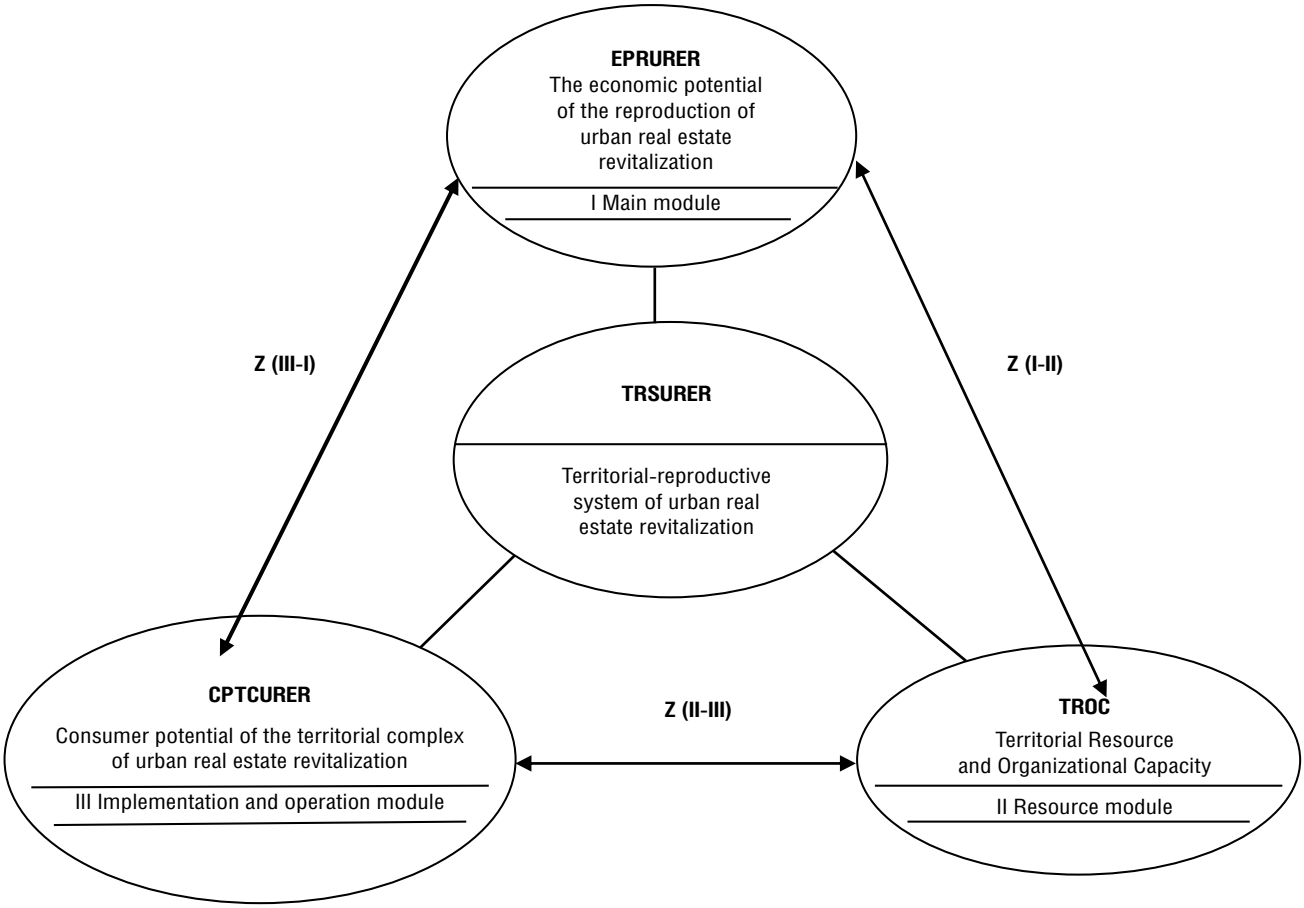

Fig. 6. A system-wide conceptual model applied to the socio-managerial and engineering system of industrial real estate development of an industrial park

Firstly, let's focus on these functions-stages of spatial-territorial development, as the basis for structuring and modeling of management life cycles. The number of (*i-j*) stages by types and spheres of construction here is the subject of forecasting and methodological modeling.

Secondly, the functions-tasks of spatial-territorial development are considered as solutions to private local goals.

Thirdly, these function-objects or types of reproduction and management objects are highly effective.

FINAL PART

The proposed function-based reliable approach to the analysis of the space of integrated development of industrial real estate ensures the analysis of the object of research in the form of a set of functions (target settings) and algorithms, while the research hypothesis and paradigm include: "the hard core" (according to the criterion set by the strategic block of sustainable urban development) and the conceptual part: the "protective shell" or modified (modifiable) part of the paradigm corresponding to the basic principles of real estate revitalization.

The analysis of the research, conducted by the authors in terms of the main methods of industrial construction allows to define conceptual approaches to the development of the strategy of performance management to classify the approaches and stages of assessing the performance of the developer, taking into account the risks, to simulate the management process.

Cycles of a single reproduction process are considered as relatively independent organizational and production subsystems of urban reproduction, the purpose of which is to ensure the integrated development of new land and property complexes and reconsider the existing urban development [14]. The main area of integrated development is the master plan for the development of the city. Renewal of the existing urban development involves the qualitative and quantitative transformation of its structure and composition in accordance with modern urban planning , environmental, and economic requirements.

Industrial construction has a number of features, which are associated with the specific features inherent in the products of construction.

Buildings and constructions differ from most industrial products first of all by their great durability, large dimensions, immovability. They are the most durable items and last for many decades. Buildings of large size require considerable time for their erection, large expenditures of labour time and materials and a large complex of various construction and installation works.

Given the nature of the product of labour in construction, its most important features are the lack of stationarity and the presence of seasonality in the production, long production cycle, and specificity of multifaceted objects constructed for different purposes.

Hence, construction products are created as a result of complex engineering process in which enterprises engaged in different types of activity participate. Such production interaction

allows to unite all these enterprises into a single inter-production construction complex, which is a system of cooperating enterprises and productions, united by stable production, engineering and economic ties.

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Моделирование локально-интегрального управления в системе пространственно-территориального девелопмента индустриальных парков типа «гринфилд»

Анализ развития отрасли за последний год, а также за период регулярного сбора статистической информации (с 2018 г.), свидетельствует о сохранении положительной динамики развития индустриальных парков в России, несмотря на неблагоприятную экономическую конъюнктуру последних лет. Темпы развития отрасли подтверждают важную роль индустриальных парков как элемента промышленной, инвестиционной инфраструктуры, а также действенного инструмента территориального развития.

Инвестиционный проект индустриального промышленного парка типа «гринфилд» (PTNip) — обоснование экономической целесообразности, объема и сроков осуществления капитальных вложений, в том числе необходимая проектная документация, а также описание практических действий по осуществлению инвестиций в системе пространственно-территориального девелопмента.

Жизненный цикл инвестиционного строительного проекта, от бизнес-идеи до ввода объекта в эксплуатацию, включает различные этапы, взаимоувязанные между собой. Сроки реализации проекта напрямую зависят от специфики и типа будущего объекта, условий финансирования и ориентировочно составляют до 5 лет [1–3].

Успешное существование и реализация инвестиционного проекта на протяжении всего его жизненного цикла обеспечивается, прежде всего, профессионализмом и компетентностью всех участников проекта: от службы заказчика, инвестора и управляющей компании до подрядчиков по отдельным видам работ.

Ключевые слова: *индустриальный промышленный парк типа «гринфилд», инвестиционно-строительный проект, ревитализация, устойчивое развитие городской среды, интегрированная модель, редевелопмент*

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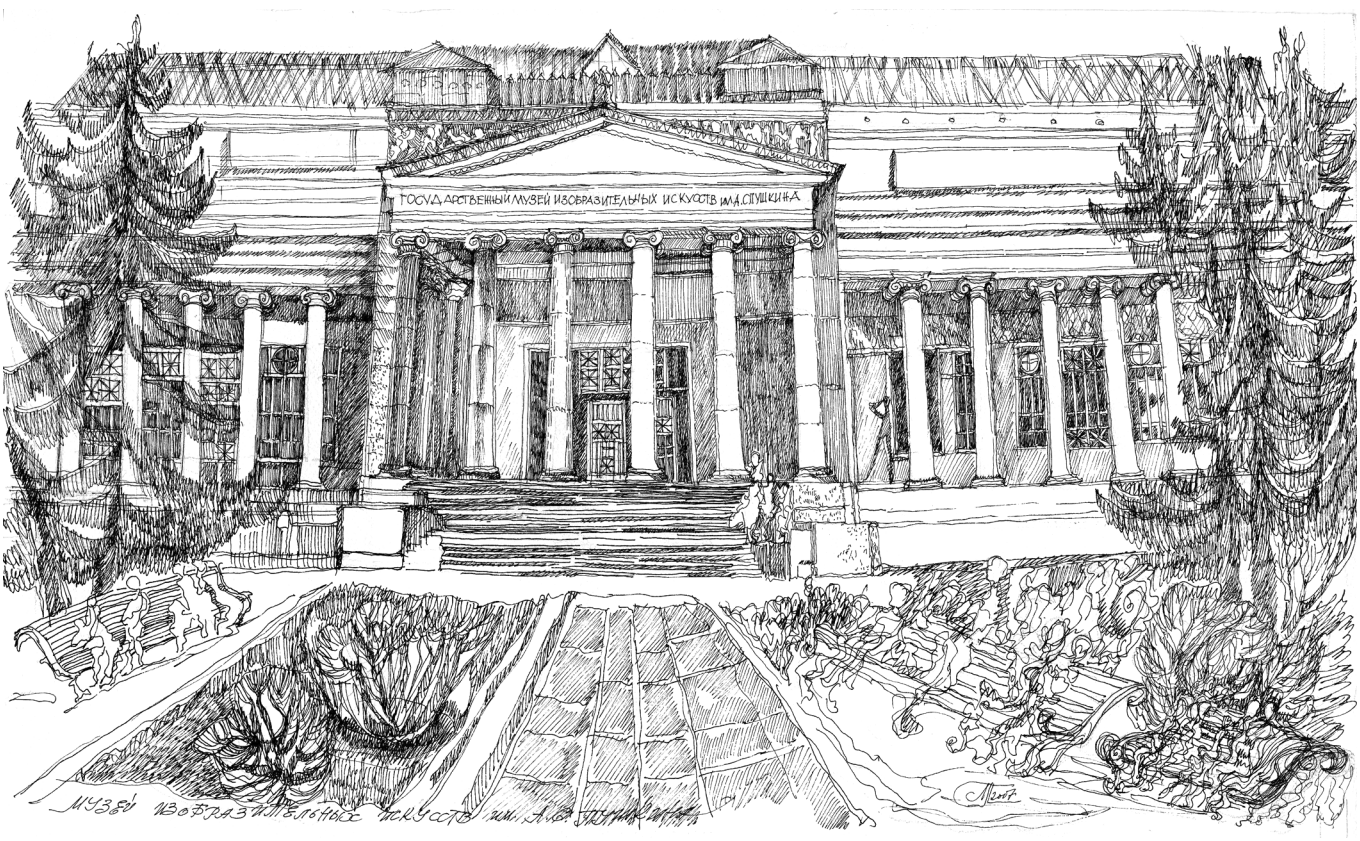
For citation: Volgin V.V. Modeling locally integrated management in the system of spatial territorial development of industrial parks of the “greenfield” type. *Real estate: economics, management*. 2022; 4:18-26.

Для цитирования: *Волгин В.В.* Modeling locally integrated management in the system of spatial territorial development of industrial parks of the “greenfield” type // Недвижимость: экономика, управление. 2022. № 4. С. 18–26.



Л.И. Павлова. Москва. Музей изобразительных искусств им. А.С. Пушкина. Рисунок, тушь, перо