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The Models of Integrated Area Renovation

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Abstract--- *The article aims at revealing the regularities in the area renovation on the criterion of increasing the level of capitalization of these territories on the basis of modeling changes in their multilayer structure. In turn, the regularities found become an important tool in the revitalization of investors of such territorial reorganization.*

The methods used in the study included infographic modeling and complex engineering of combining the activities of participants in the complex area renovation. Infographic modeling is used to visualize the processes of creating the technological environment of the territory and to distinguish approaches to the formation of the products of the territory demanded by the consumer in the process of functioning of the technological environment.

The complex technology integration of the participants of the area renovation is proposed by the authors as a generalized method of coordination institutional investment and impact on the territory aimed at sustainable functioning. The results of the study are visual representations of the mechanisms of complex area renovation and the assessment of changes in the level of capitalization of the territory in connection with the steps taken to change its functioning. The conclusions of this article are reasonable recommendations for the integrated area renovation.

Keywords--- *Capitalization, Integrated Area Renovation, Complex Objects of Investment, Complex Technology, Modeling, Assessment of Optimal Distribution of Investment Resources, Technological Environment*.

I. INTRODUCTION

It is recommended to understand under the integrated development of the areas [1] "...activities for the preparation and approval of planning documents of the area for the location of capital construction of residential, industrial, social and business and other purposes and necessary for the functioning of such facilities and ensuring the life of citizens of communal, transport, social infrastructure".

The concept of "sustainable development", referring to the country, region, includes the use of environmental technologies. Sustainable development is: "... a long-term continuous process of meeting social needs based on the

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level and pace of economic development, which do not entail irreversible environmental consequences"[2]. And this is development without infringement of the rights of future generations, based on the application of science-based strategy of interaction with the environment.

According to the work [1], integrated and sustainable development of territories includes four forms:

- Development of built-up area;
- Integrated area development;
- Integrated area development on the initiative of the land owners;
- Integrated area development on the initiative of local government. In addition, such activities involve work on architectural and construction design, construction, reconstruction of these facilities.

Since the end of the last century, the solution to the multifaceted problem of urban development (in particular, residential areas and neighborhoods) has attracted a significant number of Russian and foreign researchers. The authors of [2-9] on the basis of involving the model of the "man-technique-environment" system have significantly transformed the activities for the development of territories, expanding the direction of integrated and sustainable development through the introduction of the term "area renovation". The applied approach allowed forming and investigating new directions of complex area renovation, which can be attributed to:

- Refocusing of urban areas with full or partial demolition, completion and superstructure of buildings and structures erected on them:
- Changing the legal status and ownership of urban areas and their buildings and structures;
- Returning of the original functional purpose of urban areas, complexes of buildings, structures [4].

The model of the "man-technique-environment" system was formed as an object of study in the conditions of the systematic approach, which determined the type of graphical representation of this model, shown in figure 1. The arrows in the figure show the interaction of the elements of the "man-technique-environment" system in the process of their interaction.

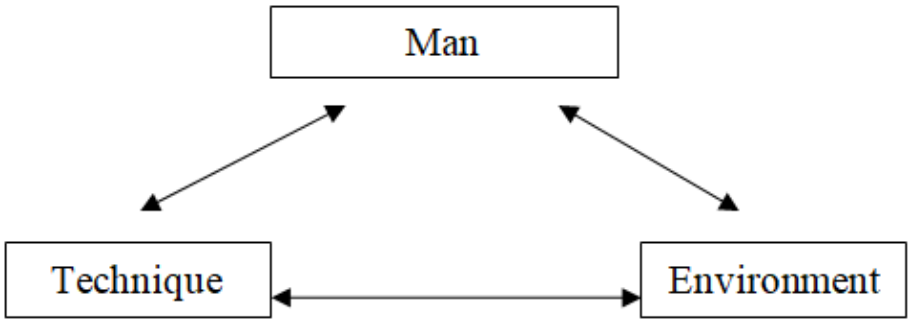

Figure 1: The model of the "man-technique-environment" system [4]

[2]The definition was given in the report of the World Commission on Environment and Development of the UN "Our common future" under the chairmanship of the Prime Minister of Norway Gro Harlem Brundtland (1987), for the UN conference on environment and development in Rio de Janeiro (1992)

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The mentioned aspects allowed the authors to formulate the research tasks as a model description of the complex area renovation with typical and developed types for the activity of such renovation, previously referred to the construction of buildings, structures in the territories [10].

The use of the broader concept of “renovation” in relation to territories will make it possible to transfer the requirements of “sustainability” from construction projects built on the territory for which such a requirement has become the norm at the international level. This confirms the properties of complexity in the formed models of renovation. The concept of “sustainable construction” has appeared relatively recently. At the first international conference “Construction and environment” (USA, 1994) the introduced concept was formulated as follows: “sustainable construction means the creation and responsible maintenance of a healthy artificial habitat based on the efficient use of natural resources and environmental principles”. Today two concepts are used and distributed: “ecological construction” and “green building”.

These concepts are identical and are understood primarily as a reduction in the level of consumption of both energy and material resources throughout the life cycle of the building. Green building, as well as environmental construction, is aimed at the introduction of environmental technologies in order to reduce the environmental intensity (the value characterizing the efficiency of natural resources). This orientation, of course, affects the economy, because: “the lower the value of the index of environmental capacity, the more effective the economy of the country (at the macro level) and the industry (at the industry level) [11]." The introduction of “green” technologies leads to an increase in the ecological capacity of the territory with minimal material and energy consumption at all stages of the production cycle and with the least impact on humans and natural ecosystems.

The analysis of approaches to the object of study, which is the integrated area renovation, should include in the consideration of the target orientation of the area renovation for all participants in the implementation of this process. To determine the purpose of the integrated area renovation, the theory of the noosphere introduced by V.I. Vernadsky is used. From the theory of V.I. Vernadsky it follows that the biosphere of the planet is constantly being rebuilt and goes into the state of the noosphere, corresponding to the dominance of the Mind. Among the conditions necessary for the formation and existence of the noosphere, V.I. Vernadsky called the development of all-planetary communication systems, the creation of a single information system for humanity [12]. Speaking about the worldview sense of the concept of the noosphere, it should be noted that, unlike the biosphere, the noosphere is formed not spontaneously, but only as a result of reasonable human activity, in continuation of the logic of the biosphere development at a qualitatively new level. The methodological meaning of the concept of “noosphere” includes the implementation of the complex interaction model of systems of “nature” and “society”, ensuring their harmonious development. Moreover, as it has been previously shown [12], this direction of development is focused on improving the suitability of the natural environment for the existence of society. According to the theory of I.V. Vernadsky, the reorganization of the biosphere and its transition to the state of the noosphere will be accompanied by the development of new principles of coordination of actions and new behavior of people in society; it will require a change of life norms and values. The sphere of interaction between society and nature, within which reasonable human activity becomes a determining factor of development, participates in the restructuring of organizational and technical systems, respectively. And the means that humanity uses in the implementation of such

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reconstruction are determined by the achieved levels of scientific and technological progress and socio-economic development.

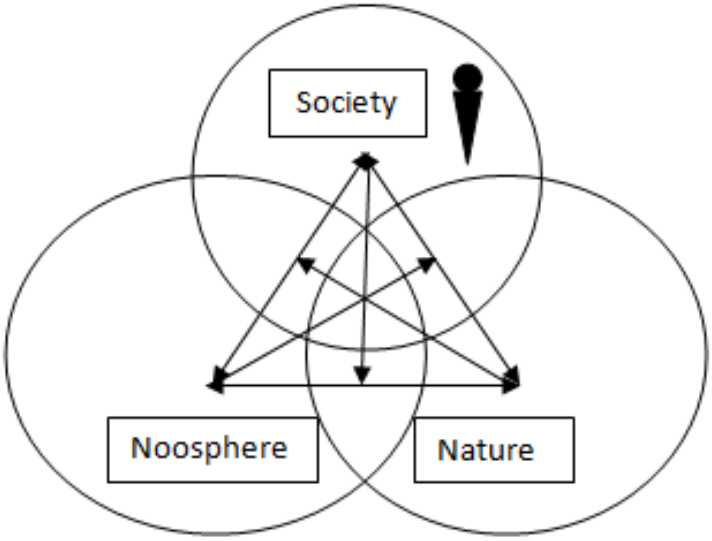

Figure 2: An integrated model of the noosphere formation of Vernadsky in terms of interaction between human society and natureso

It should be noted that, in contrast to the "man-technique-environment" system, the integrated model presented in figure 2 is composed using an integrated approach and contains, in addition to the arrows of mutual influence of systems (bilateral arrows), also the arrows of control of mutual influence of systems (one-sided arrows). In addition, the figure shown in it indicates the content in the system of social (organizational-activity) content, which refers to the infographic model. The transition from a systematic to an integrated approach, and to the complex technology, implementing this approach [13, 14], becomes the basis for an alternative consideration of the possibility of implementing an integrated area renovation.

II. Materials and Methods

The use of the complex technology allowed us to present the noosphere formed by a multilayer model of an integrated object of area renovation [6], shown in figure 3.

1. Consumer goods sector
2. Products of the area (traditional and innovative)
3. Equipment of buildings, structures of the area
4. Technology platform of the area
5. Buildings and structures of the area
6. Engineering and transport networks and communication systems of buildings and constructions in the area
7. Area (geographical location, natural resources, climate, human resources, etc.)

Figure 3: Infographic model of the integrated object of area renovation (IOAR) [6]

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The model updates the territory and its multi-layer infrastructure, each system layer of which is now becoming a separate object of renovation. The buildings have their own local area and are connected to utilities, supplying the building with a resource for operation and selecting the used resource. On the other hand, the building is equipped with engineering facilities that converts the resource received into maintenance services. The quality of resource transformation, as well as the formation of both traditional and alternative services, depends significantly on the technological platform used. In this case, the resulting area renovation consists of the reconstruction of each layer of the IOAR model. Accordingly, investment projects of the integrated area renovation consist of investment projects of reconstruction of its layers.

Considering the model from the bottom up (ascent from the abstract to the concrete) – from the broad abstract functional capabilities of the territory to the specifics of personal consumer services, the descriptions of the system layers of IOAR are obtained [6, 16]. It should be noted that the reconstruction of IOAR layers determine the possibility of converting the biosphere into the noosphere. The territory is a system element of IOAR, considered in the context of a broader in relation to the accepted as an infrastructure resource of the natural environment, on the "consumer quality" of which depends the operational quality of the building, facilities, as well as the quality of services. The natural environment supplies resources to the building, and it is assumed that the building should not disturb the ecological balance, i.e. should become part of the environment. Thus, each upper layer of IOAR organizes the functioning of the lower layer, forming the conditions necessary for the consumer of services of the territory for the activities and viability. Changes arising in each of the layers and formalized by appropriate organizational and technological solutions can be presented as the processes of formation of the quality of services in the area renovation.

In developed countries, the area renovation has more than a century-long history [2, 4]. A significant number of stakeholders are involved in the integrated area renovation, contributing resources of different types to the functioning of the model layers. In addition to the "consumer goods sector", which include the residents, the administration, etc. the participants with organizational, material, financial resources of its functioning in the territory, the separate group of participants of complex reorganization defined as the "system of investors of the territory" (SIT) is developed. A SIT is an investment pool consisting of investors in each layer of the IOAR. In figure 4, fixing the Association of investors and investment objects, the SIT is represented by a column in the continuation of the table form of the IOAR. Moreover, each investor is represented by the contour of the figure (not painted) with a figure corresponding to the sequence of reference from the layer "area" of IOAR.

Attracting investments to solve the problems of development of territories has been involved into a sufficiently effective mechanism, and the proportion of investments in the area renovation made by the public-private partnership has been worked out abroad. In Russia, the proportion of investment components in the integrated area renovation has not yet developed. This is primarily due to the uncertainty for the investment of the components as an integrated object of renovation [6]. And this, in turn, does not allow planning the arrangement of territories with the production and consumption of products that provide return on investment, and introduces uncertainty in the actions of investors [9].

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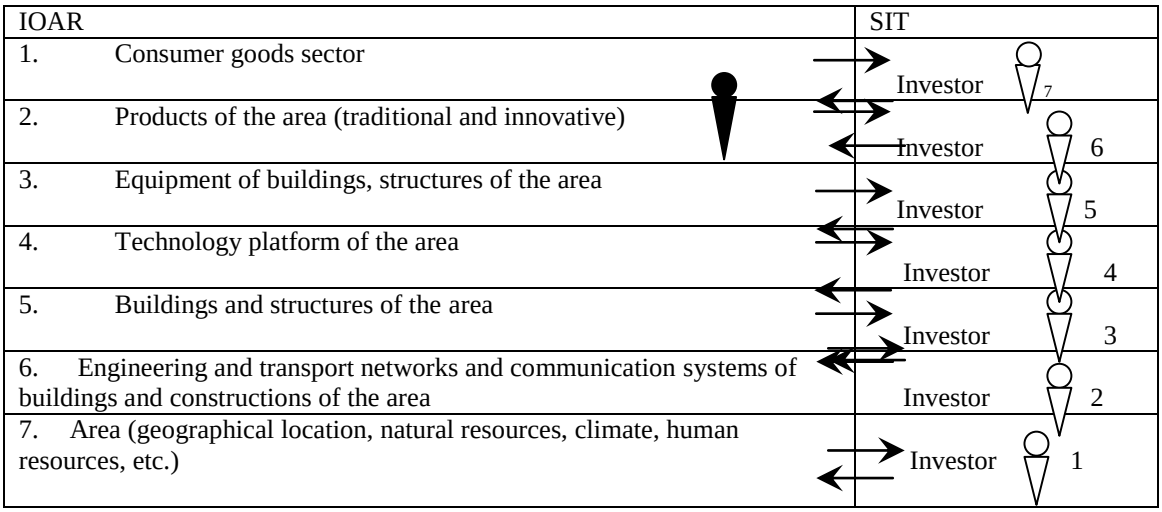

Figure 4: Infographic model for the integration of IOAR and SIT

Further study of the integrated area renovation showed that the development of the territory can be represented by a model of the complex development cycle of the territory (CBC), shown in Figure 5. This model allows determining the economic parameters that regulate the relationship of the project participants with the adopted technical and economic indicators that provide a strategy for the development of the area, thereby combining three platforms into a single cycle:

- Social and consumer, creating marketplace needs;
- Technical and technological, which are the basis of the real estate market;
- Land and resource, providing the implementation of the complex of buildings and structures.

Land and resource platform determines the class of real property, using the physical characteristics of the land and its location, which is advisable to build in the selected area. This class of real property is reflected in the model of social and consumer platform, which reflects the interests of different consumers (1,2,..(N) by a full set of services (1.2,..(N). A set of services for a particular level of the consumer in general will vary, thus it is not excluded that range of services will handle the needs of different classes of consumers (U1P1; U1P2; ...U1PN, etc.). Providing a set of services will require buildings or premises with different functionality and as a result – different levels of technical and technological equipment (F1T1, F1T2... F1TN, etc.), which forms the quantitative and qualitative composition of the real property in the built-up area.

Each of the platforms has its own representation in the city administration and the federal administration. For the successful implementation of the investment project, a common vision of the goal of an integrated area renovation should be formed. To this end, it seems necessary to work on the formation of an agreement between the project participants.

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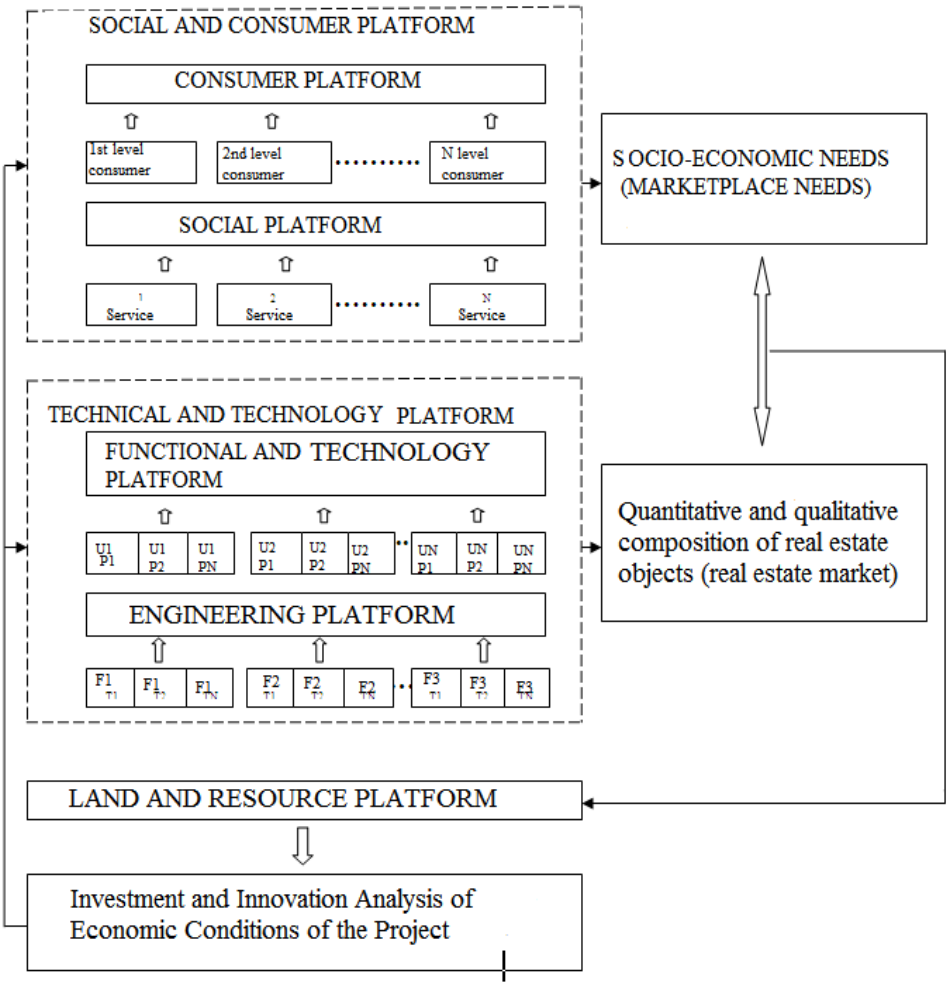

Figure 5: Model of CDC of the area [17]

Such an agreement is fixed by infographic models of the area development process taking into account the state (and/or municipal), public interests, as well as the interests of investors, shown in figures 6 and 7.

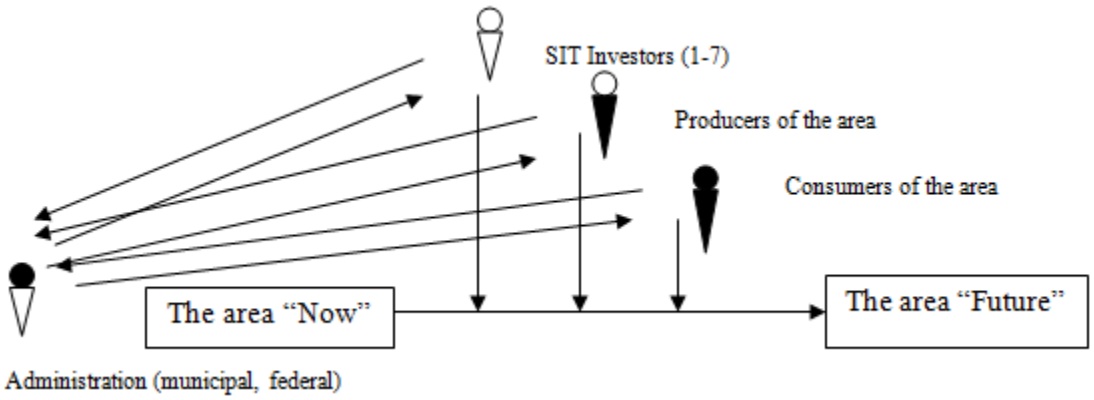

Figure 6: Infographic model of area renovation process from the perspective of the interests of participants in the integrated area renovation

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According to the model, municipal and federal, represented by legislative bodies (municipal, federal) and relevant ministries (municipal services), develop, coordinate, approve the project of the integrated area renovation (the developed, available) and plans activity on its reorganization in the future renovated area. The state (and/or municipality) represented by the administration negotiates (shown by double arrows) with investors, directing resources in the area development, with consumers of the area (residents, visitors, etc.), as well as producers etc.

Investors can be businessmen attracted from outside and local businessmen interested in the implementation of the development strategy of the area. Investors include their financial resources in the area renovation, which can be prepared and implemented in the form of medium - and long-term plans of resourcing for the area renovation.

Let us consider how the infographic model of the development process changes for the case of public-state-private partnership [18] in the implementation of the goals (projects) of each of the participants. The interaction of the partnership members fixes the model shown in figure 7.

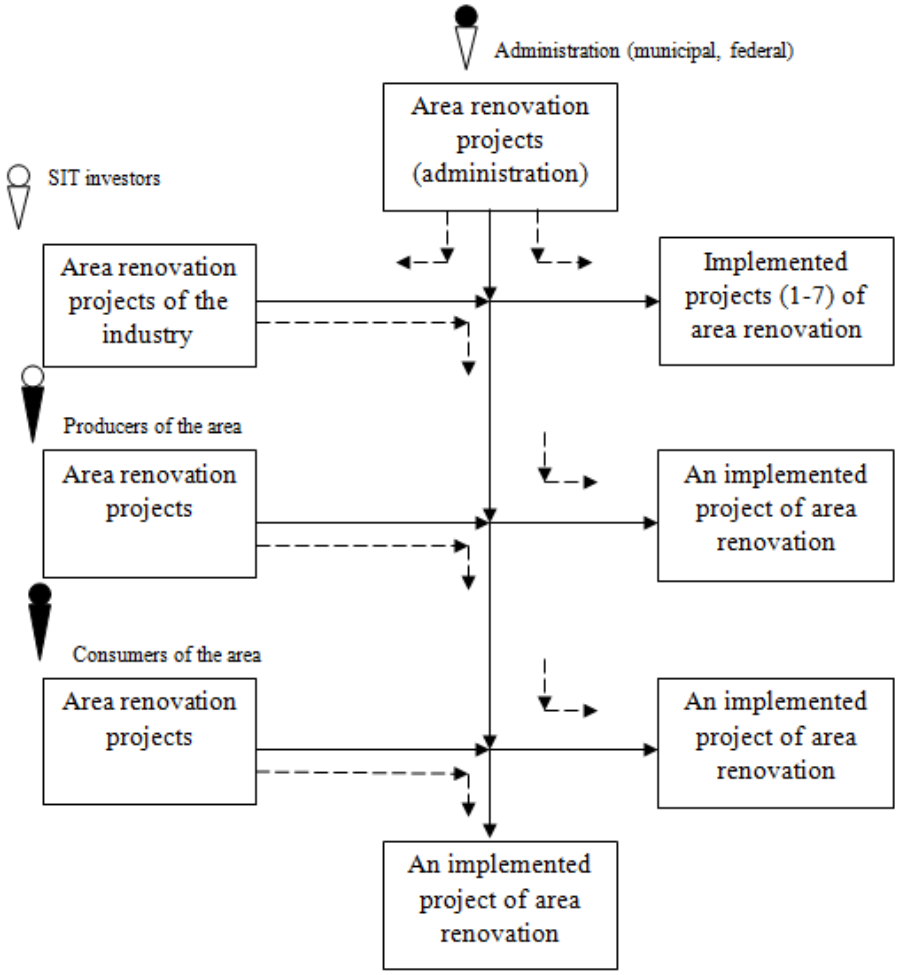

Figure 7: Infographic model of the process of area renovation in the framework of public-private-state partnership

Each of the partnership members has its own project(s) for the area renovation. Thus, in relation to the

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renovation projects, each of the participants can be in three positions in relation to the projects of other participants:

- Support (invest) a someone's project;
- To be indifferent and not to participate in the implementation of someone's project;
- To oppose the someone's project.

It is logical to assume that for the investment support of someone's project, the participant of the area renovation can obtain support for "his" project. This allows you to integrate resources to achieve each participant's own goals, as shown by the arrows. Partnership is achieved by building a common strategy of strategies to achieve the goals of each of the participants. The resource to achieve the goals of investors consists of their own resources and budget resources. These resources are shown in figure 7 by the arrows based on the dotted line. By combining the objectives of each partner, it is necessary to solve the problem of practical definition of investment conditions for the implementation of the project for each participant.

In addition to the "consumer goods sector", which includes residents, manufacturers and other participants in the territory of providing organizational, material, financial resources for its functioning, there is a separate group of participants of the integrated renovation, defined as a system of project organizers of the integrated area development (IAD). This system traditionally includes the administration (municipal, federal), in which there is an organizational pool of employees responsible for the functioning of each layer of IOAR and SIT. In figure 8, fixing the Association of investors and investment objects, the IAD is represented by the IAD column on the left side of the table form IOAR +SIT.

The organizers are presented by figures 

, where the Roman numerals indicate the management of socio-consumer platform of the area, management technological platform areas and on land management and resource platform areas, respectively. The resulting generalized model of the complex object of capitalization of the area fixes the structure of interaction of all participants of the integrated area renovation. The target function of the integrated area renovation is to extract maximum profit from the implementation of the investment and innovation project of the integrated area renovation for all its participants (designers, builders, services and utilities on the territory and users of construction products) while improving the status and comfort of use of the renovated territory. This formulation becomes decisive for the choice of directions in the integrated area development.

Solving the problem of socio-economic area development, economists, designers and builders will be powerless until they are not armed with a special scientific "instrument, the indicator", assessing and describing the condition and dynamics of area development and allows you to make the right direction of this development. The choice of the area for the investor, as well as the choice of the investor for the area, will be carried out by analyzing the proposed project of its integrated development in terms of increasing the level of capitalization of the area. This integral indicator will include not only the result of innovative and technological development of individual elements of the area, as a consequence of scientific and technological progress, but also the result of socio-economic development, as a consequence of organizational and activity development of consumers of the area's products.

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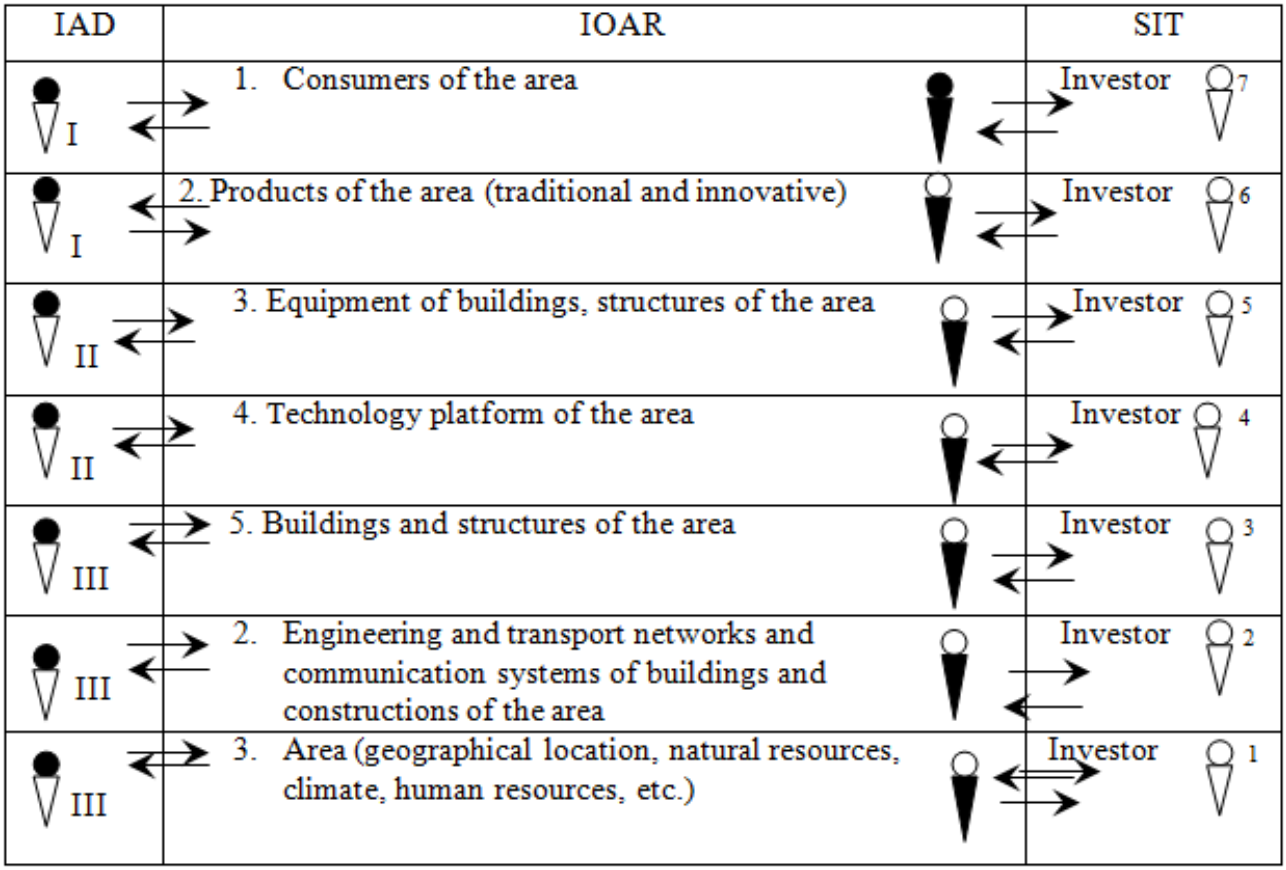

Figure 8: Generalized infographic model of an integrated object of the area capitalization

III. RESULTS

The use of the above materials and methods in the study of the integrated area renovation allows obtaining a number of results that provide a clear, reasonable and quantified representation of changes in the organizational, technical and socio-economic elements of the area.

Thus, based on the IOAR model shown in figure 3, a structural representation of the Vernadsky noosphere model shown in figure 2 was obtained. This structural representation of the model shown in figure 9 becomes important for understanding the direction of development of modern technologies that transform the biosphere into the noosphere. The system "society" is represented in the figure by all participants of the integrated area renovation. The noosphere system is represented by technological platforms that can be combined through the "cross-cutting" application of digital modeling technologies. An example of such an association can rightly be considered BIM – technologies used at all stages of the project presentation of objects: buildings and territories, etc. [19]. Arrows (unidirectional or

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bidirectional), a link system based on the coordination modes of operation and form of their interaction, their mutual links and relations, typical for the unification of systems into the complex.

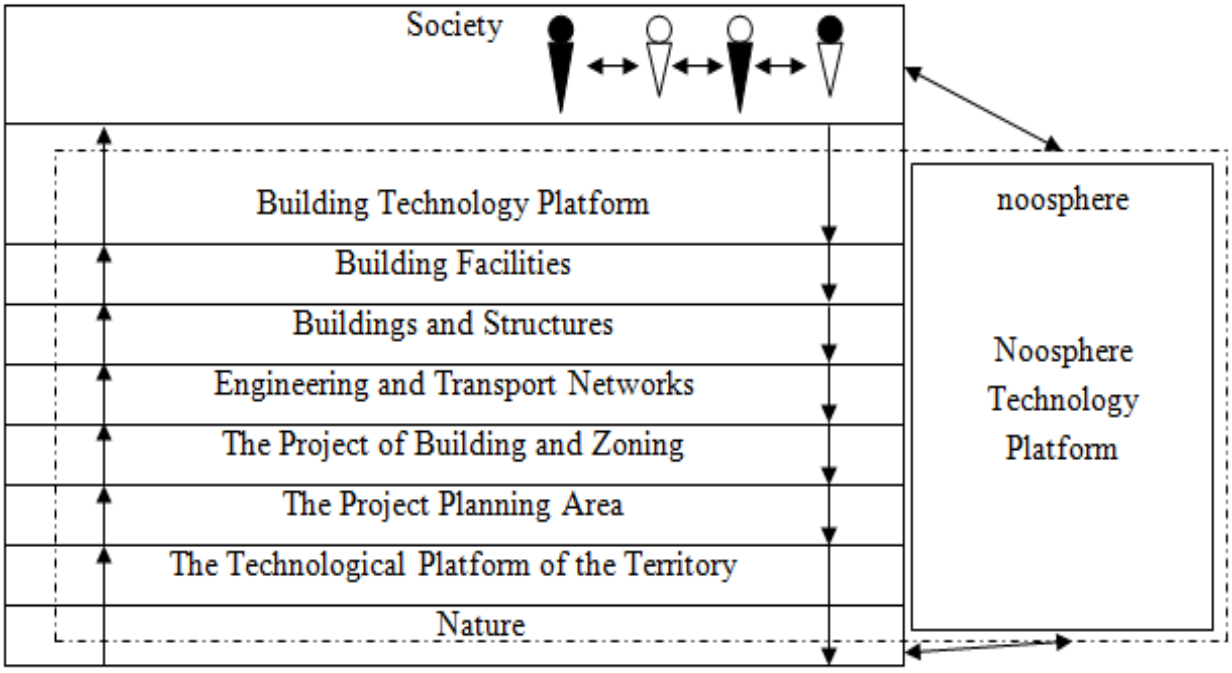

Figure 9: Complex model of the noosphere formation (by Vernadsky) as a system of technology platforms

The given model at its further filling with specific investment and innovative projects becomes the complex facility of land management, the model of which is shown in figure 10. This model is required to form a methodology for assessing the level of capitalization of the territory, which allows us to quantify changes in its development during the implementation of the integrated renovation project.

The initial element in the model of the complex facility of land management is the "earth" – a system layer that has its own life cycle, laid down by the Creator, restored in the process of functioning and implementing the function of support and preservation of the biosphere.

The second component of this model – the land management works performed by the person (the project of planning, the project of building) and a set of technologies used at investment design in the territory beginning from the design of buildings before management of execution of the investment project (the technological platform of the territory), the third component is engineering networks and directly elements of the building together with the consumer who in the course of operation of the building "adjusts" it under requirements of environment.

This model will be considered from the bottom up. Each layer of the model contains a certain amount of resources, which is reflected in the market value of real property. It should be noted that all the layers of the presented model have a relationship between them, i.e. they are a recurrent sequence leading to the Fibonacci sequence, described by a spiral and within the corresponding "Golden" ratio, which determines the harmonious state of the system.

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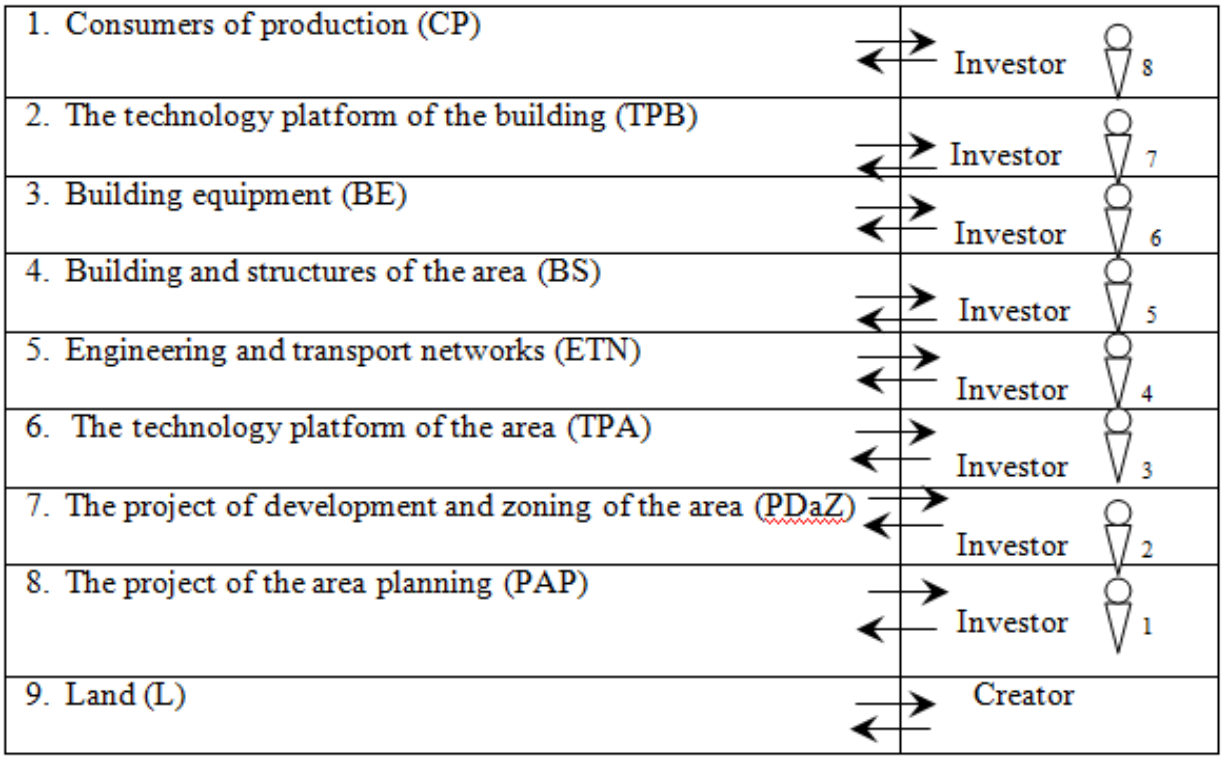

Figure 10: The tripartite model of the area

Land (L) initially has no value, since it is not the result of socially necessary labor and cannot be reproduced by labor and the land planning and development projects are the first step to the creation of infrastructure and the subsequent construction of the property. This activity is a subject of the enclosed socially necessary work for the existing area and it is not separable from factors of production and together with the land act as spatial operational basis.

The project of the area planning (PAP) is a subsystem of the area considered in the context of the "natural" environment for allocation of elements of planning structure, establishment of parameters of the planned development of elements of planning structure, zones of the planned placement of objects of federal, regional and local value and including the project of the land demarcation. The PAP provides an "infrastructure" resource through transport networks and built-up areas that define the functionality and class of future buildings and structures.

The project of development and zoning of the area (PDaZ) is a subsystem of the area considered in the context of "natural" environment fully fixes necessary town-planning requirements and restrictions on use of the specific site and the capital construction object built on it or planned for construction. The development project provides "infrastructure" resource of buildings and structures through the provision of engineering systems.

The technology platform of the area (TPA) is a subsystem of the area including a set of technologies used at investment design of the concrete object, beginning from design of buildings before management of execution of the investment project.

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Engineering and transport networks (ETN) are the subsystems of the area, supplying resources for the implementation of the functional support of real estate objects of the study area.

Building and structures of the area (BS) are the subsystems of the area; realization and providing necessary functions of ensuring activity of the population depend on them.

Building equipment (BE) is a subsystem of the area, providing the implementation of functions to create the necessary comfort and functionality of the internal environment of the building.

The technology platform of the building (TPB) is a subsystem of the area reflecting the quality of technology and human resources used to create real property.

Consumers of production (CP) are the subsystems of the area with participants of the operational stage of the life cycle of real property to ensure the delivery of share to the property in accordance with the state of supply and demand in the property market and in accordance with their requirements and desired specification of the assignment.

Thus, each of the upper layers of this model organizes the functioning of the lower layer, thus forming the conditions necessary for the consumer to ensure his economic activity and life. Changes arising in each of the system layers in their reconstruction and structured with appropriate organizational and technological solutions can be presented as the processes of formation of real property and capitalization of the area. The top layer is the consumer of production organizes all layers of the territory beginning from the first layer according to the project of planning of the area and finishing with a technology platform of the building. It should be noted that the positive changes occurring in each of the system layers of the area, increase the capitalization of the land – the main part of the spatial operational basis for investment processes for the area development.

The layers presented in the model were grouped in pairs in accordance with four components of the system, on the principle of "creative elements" and elements "determining development". As a result, we obtain a model that repeats the model of the Universe [20, 21] consisting of four components, including two elements. Each component of the system has a fixed resource, which is equal to the sum of the resources of its elements. The model, using the principle of such grouping, is shown in figure 11.

Creative elements	Elements, determining development
Land (L)	
The project of the area planning (PAP)	Consumers of production (CP)
The technology platform of the area (TPA)	The project of development and zoning of the area (PDaZ)
Engineering and transport networks (ETN)	Building equipment (BE)
Building and structures of the area (BS)	The technology platform of the building (TPB)

Figure 11: The fractal model of area development

The calculation of the weight coefficients of each element of the presented model, based on the energy model of the Universe and the six initial numbers of the Fibonacci sequence, provided the full synergy of spiritual energy with the human organizer and the equitable distribution of resources between the elements of the model, is presented in table 1.

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Table 1:

Layer	(L)	Spiritual Energy	Person's Energy	PAP	CP	TPA	PDaZ	ETN	BE	BS	TPB	Total
Value without spir. en.	0.18802	0.0599		0.18802		0.18802		0.18802		0.18802		1.00
		0.0087	0.0512	0.094	0.094	0.1253	0.06267	0.1128	0.0752	0.1175	0.0705	1.00
Value with spir. en.	0.2			0.1	0.1	0.1333	0.0666	0.12	0.8	0.125	0.75	1.00

The total weight coefficients of the elements of the triple model of the area are proportional to the values of the beginning of the Fibonacci sequence (2, 3, 5 ...).

Since scientific and technological progress does not stand still (there is an evolutionary development of society), the weights of the elements of each component of the triple model of the area, except for the component "land", will change without violating the total resource of each component – a pair of the model. If we assume that table 1 shows the state of the system at the initial stage, then at the next turns of the spiral of development the ratio of the elements of each component will approach the "Golden ratio", and the harmony of the weight coefficients of the layers of the triple model of the area is violated. In this case, in order to preserve the harmony of the system, the organizer should redistribute its energy resource not evenly, but based on the conditions of the harmonious state of the entire system. To ensure the balance of the system, the rule of mutual compensation of the resource of one element of the pair by the resource of the opposite element should be fulfilled, which most likely occurs due to the desire for harmony of the weight coefficients of the layers of the triple model of the area by changing the socio-economic state of society or due to the uneven distribution of resources by the organizer. Quantitatively, this process is presented in the matrix in table 2, the arrows indicate an increase or decrease in the resource (starting from the fifth level, changes are observed in the seventh and more decimal places).

Table 2: Matrix of quantitative change of elements resource

VIII	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197
VII	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197
VI	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197
V	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197	0.618034	0.38197
IV	0.618033	0.38197	0.618034	0.38197	0.61834	0.38197	0.618034	0.38197
III	0.61797	0.3820	0.61805	0.38194	0.618025	0.381974	0.618037	0.38196
II	0.61538	0.3846	0.61904	0.38095	0.61764	0.3823	0.61818	0.3818
I	0.5	0.5	0.666	0.334	0.6	0.4	0.625	0.375
Level / Element	↑ **(PAP)**	↓ **(CP)**	↓ **(TPA)**	↑ **(PDaZ)**	↑ **(ETN)**	↓ **(BE)**	↓ **(BS)**	↑ **(TPB)**

It should be noted that the calculated quantitative ratio of weights of the elements in the triple model corresponds to the empirical Paschen's law 20 : 80 for social systems, confirming and somewhat expanding it, determining the quantitative weight of such an element as the infrastructure of the area, reflecting the social nature of the state of the area.

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In the calculation 25% for intellectual property found empirical confirmation of the law, which represents the sum of the weighting factors for the land and an organizer 0,18802 + 0,0599 = 0,2479. This coincidence of the calculated weights with the generally accepted empirical laws of social systems confirms the correctness of the models.

The obtained values of the weight coefficients of different layers of the model allow us to calculate the capitalization coefficients for each component according to the methodological approach of evaluation [22, 23].

As a result of the calculation of the proposed approach, the values of capitalization ratios are obtained in accordance with the real values of the resources invested in each element of the system, during the construction of the property. Due to the fact that of all the components of the system, only the land can be accepted as an invariant, the capitalization ratios for infrastructure, buildings and the total capitalization ratios are determined by the calculated capitalization ratio for the land, applying the "Golden ratio" rule. The closer the proportion of real capitalization ratios to the "Golden ratio" rule, more accurately the conditions of harmony corresponding to sustainable development are fulfilled. Thus, the indicator of socio-economic development of the area can be the value of the capitalization ratio for the land and the proportion of the actually obtained capitalization ratios of individual elements of the area to the "Golden ratio" rule.

The model of the indicator of socio-economic development of the area according to the methodological approach presented in this article is illustrated in table 3.

Table 3: Model of indicators of socio-economic development of the area

Indicators \ Elements	Land	Site preparation	Buildings and Structures	Object as a whole
Market cost (C)	C_L = 20% C_O	C_{LP} =30% C_O	C_B = 50% C_O	C_O = 100%
Capitalization Ratio (R)	$R_L = 0.38\ R_O$ →	$R_{LP}=1.38R_L$ →	$R_B = 1.62R_L$ →	$R_O = 0.62R_B$
	←			
Development Expenditure (E)	$E_L = C_L * R_L$	$E_{LP} = C_{LP} * R_{LP}$	$E_B = C_B * R_B$	$PE=R_L+ R_{LP}+ R_B + R_{KR}$

IV. DISCUSSION

Solving the problem of socio-economic area development, economists, designers and builders will be powerless until they are not armed with a special scientific "instrument, the indicator", assessing and describing the condition and dynamics of area development and allows you to make the right direction of this development. A tool that helps to think globally, act locally and determine the possibility of reasonable decision-making in the management of development and arrangement of the area has not yet been developed. Considering the management of territorial

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systems as an object of land management, it should be borne in mind that the regulation of land relations, in its essence, is not only the regulation of relations of people on the ownership and use of land and other real property. But, mainly, the management of territorial systems is the regulation of human impact on the land and the definition of the land's response to these effects.

Each element of integrated development of the area has been considered separately and a methodology for assessing the required investment contributions to each layer of the IOAR model has been offered.

In the proposed model, this land resource, as a factor of production, is reflected in the form of a separate land resource platform, which physical characteristics of the land and its location determines the class of real property, which is advisable to build in the selected area. This class of real property is reflected in the model of social and consumer platform, which reflects the interests of different consumers (1,2,..(N) set of services (1.2,..(N). This platform forms the socio-economic needs of future owners of buildings and structures, that is, forms the market needs.

A range of services for a particular level of the consumer will vary, thus it is not excluded that range of services will handle the needs of different classes of consumers (U1P1; U1P2; ...U1PN, etc.). To provide a range of services require the building or premises with different functionality and, as a consequence, different level of technical and technological equipment (F1T1; F1T2...F1TN, etc.), that forms the quantitative and qualitative composition of objects of real property on the territory – the real estate market.

The concept of the market value of real property is based on the premise of the fundamental importance of the distribution of the market value of the land and the object as a whole. The cost of land is from 25% to 50% of the total value of the property, depending on the efficiency of use of this site [22]. Depending on the success of a project, this figure is 25-30%. This provision defines the essence of the property of the market value of the land; the land is not subject to deterioration with proper use. In other words, those improvements that are made on the land, in the form of buildings, structures, communications, forest areas, etc. increase the cost of the object as a whole, depending on how these improvements are perceived in the real estate market. In this regard, the best and most effective use of the real estate object of the land can exist for any real property as a free and use of land with located on it improvements, and in general, these options may not coincide. If the existing improvements do not comply with the best and most effective use of the real estate object, the value of the land is a large part of the market value of the object as a whole. In this case, the potential of the land is not fully used and the analysis of use should consider the feasibility of the construction of buildings in accordance with the optimal functional purpose of the land.

Indicators of the real estate market, in turn, reflect the existing demand and the social status of potential buyers, as a basis for further development of the development area.

In other words, the best and most effective use of the real estate object is a reasonable option of using the land and existing buildings on it, which is legally competent, physically possible, financially secured with the maximum economic effect on the valuation date (i.e. giving the maximum value from the use of the estimated land determined by the residual method).

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Thus, when determining the best and most effective use of the real estate object of the territory, it is necessary to have reliable data on the following parameters:

- distribution of shares of land value and improvements in the created object (L, B);
- capitalization ratio of the object (RO);
- capitalization ratio for investment or building (RB);
- the capitalization rate for land (RL);
- the value of the entrepreneur's profit (EP);

Based on the economic nature of these parameters, it follows that they reflect the investment attractiveness in the area renovation.

The distribution of shares of land value and improvements reflects the effectiveness of the use of the territory on the basis of a well-known law of diminishing marginal productivity. The size of the land for construction is determined by regulations and construction norms and rules. The land is a part of one of the factors of production – the built-up area. And the second factor of production – the building block, is regulated by the subject of investment by the rules of renovation. Thus, the subject of investment can regulate the effectiveness of area development by the proportion of the land value in the constructed real estate object.

Capitalization ratios by their nature reflect on the one hand the macroeconomic state of the region (the values of the risk-free rate and country risk are the basis for their calculation), on the other hand they include risks of liquidity and profitability of finished real property in a certain segment. This dependence is usually presented in the following form: $R_O = R_{rf} + R_m + R_p$, as the amount of risk – risk-free rate, market risk premium and risk premium associated with the real estate market. At the same time, the risks of profitability and liquidity depend not only on the functionality of the objects, but also on their class.

Having a common basis, the capitalization ratios of the object as a whole, the land and the building are interrelated according to the well-known in the theory of real estate valuation rule of the investment group, i.e. the equality $R_O = R_B \cdot B + R_L \cdot L.$ is performed.

In the analysis of investments in real property, the entrepreneur's profit margin is used as a discount rate (equalization of profitability) and its essence, as an internal rate of return on investments [23].

According to the existing practice, the definition of the best and most effective use of the real estate object is carried out either by the expert way or by one method of calculating several options for the use of land on the basis of the average indicators of the real estate market of the studied area. In this case, the most commonly used method of intended use, which is subsequently used to assess the land. This leads to the uncertainty of the results and their subjectivity due to the uncertainty of the economic parameters included in the calculation. In order to determine the techniques to reduce uncertainty and subjectivity consider the economic essence of methods for calculating the residual value of the land.

The following methods are used to evaluate the land plot as a residual in the real estate valuation theory:

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- in the comparative approach – the distribution method;
- in the income approach – the balance method for land;
- in the cost approach – the method of selection and method of intended use.

Each of the three assessment approaches uses the information basis for calculation. For a comparative approach, this is market information on sales prices and rental rates, for income – economic indicators of the market of a certain segment of real property; the basis for the cost approach is the value of land and construction cost of a certain class of building. The correction coefficients to each of the approaches can be calculated with the use of information indicators other approaches.

The basis for all approaches is the macroeconomic framework, which is expressed:

- in the comparative approach in the form of a sale price trend for objects of comparison;
- in the income approach as a basis for calculating capitalization ratios;
- in the cost approach as a basis for calculating the value of the entrepreneur's profit and
- prices for building materials.

However, this or that approach may be limited by the lack of information. At the same time, determining the cost separately by each method involves a lot of uncertainty and subjective vision of the appraiser [22].

The method of distribution is based on determining the share of land value in the total value of the property and is expressed by the following formulas:

$V_L = L * V_O$ – the cost of land;

$V_B = B * V_O$ – improvement value.

Where:

L – the share of land value in the total property value;

B – the share of improvement value in the total property value;

VO – the value of the real estate object.

Determination of the share of land value in the value of the object as a whole is associated with the methods of statistical analysis, and since the real estate market is essentially imperfect, this value varies in a fairly large range and we can talk about an acceptable spread of 5% only if the principle of the best and most effective use of the real estate object. Therefore, this method is not used in practice [23].

An area balance method uses economic indicators that reflect the profitability of the property as a whole, the economic potential of the land plot, and the profitability of the constructed building in the process of future operation. This method is expressed by the following formulas:

$$V_L = \frac{NOI_L}{R_L};$$

Where:

$NOI_L = R_O \cdot V_O - R_B \cdot V_B$ – net operating income from the land;

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RL – capitalization ratio for the land plot;

RO – capitalization ratio of the object;

VO – the value of the property;

RB – capitalization ratio for the building;

VB – the value of the building;

Determining the values of capitalization ratios is associated with a large amount of uncertainty, especially to assess the distribution of the capitalization ratio for the object as a whole on the coefficient of land and building. Therefore, a single residue method is difficult for practical application.

Methods of allocation and intended use, in general, allow determining the value of the land by the difference between the value of the object as a whole and the cost of construction of an existing or proposed for the construction of the building, taking into account the profit of the entrepreneur and the amount of deterioration. These methods are expressed by the formula:

$$V_L = Vo - V_B;$$

Where:

VL – the value of the land;

VO – the value of an object;

VB = (DC+ IC + PE) – the cost of an existing (or under construction) building;

Where: DC – direct costs;

IC – indirect costs;

PE – profit of the entrepreneur.

In this method, the greatest uncertainty has the value of the entrepreneur's profit, which is used in assessing the value of the building (improvement), because it depends not only on the macroeconomic parameters, but also on the correspondence of the functional purpose of the building location, and the state of this segment of the real estate market. The size of the profit of the entrepreneur with the most effective use should cover all the risks of the real estate market and financial risks of the region. In general, this dependence can be represented as follows:

PE = RL+ RB+RREF+RMB+R$

Where:

PE – profit of the entrepreneur;

RL – capitalization ratio for the land plot;

RB – capitalization ratio for the building;

RPEF – the refinancing rate of the Central Bank;

RMB – interbank rate;

R$ is the magnitude of the change in foreign exchange rates;

The three methods under consideration determine the same value – the cost of the land plot, while all three methods use the cost of the estimated object. Based on the principle of independence of the calculated value of the applied method, the calculation formulas can be equated to each other.

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The result is a system of three equations. The parameters included in these equations are interconnected by the rule of the investment group, forming the fourth equation of the system. The dependence of the entrepreneur's profit on macroeconomic factors and capitalization ratios gives the fifth equation of the system. The system of five equations can be solved by iteration. The variable values are: revenue flow in the range defined by the market for a particular location and development object; as well as the flow of construction costs of a certain class of real estate and the period of time of the project. With the current level of macroeconomic parameters at the date of evaluation, the conditions for determining the economic parameters of the investment project are achieved. Changes in the process of iterative action, the proportional distribution of the land value and buildings and the values of coefficients of capitalization for land and buildings, and hence the profit margin of the entrepreneur, in the range corresponding to the state of the property market, will lead to equality of results in the calculation of the first three equations of the system. The values of the economic parameters corresponding to this state of the system and reflect the state of the investment climate for the project in the selected location.

The proposed approach to the calculation of economic indicators in the area construction reduces the uncertainty of determining the parameters included in the calculation. Setting the ranges of construction costs, the share of land value will allow the organizer to set the development strategy by establishing the initial price of the contract for each participant, and to regulate the uniform distribution of resources.

V. CONCLUSION

The article analyzes the regularities of the formation of projects of the integrated area renovation and modeling of objects included in the life cycle of the rebuilt territory.

The problem solved in the article is to determine the optimal allocation of resources for maximum profit from the implementation of investment and innovation project of the integrated area renovation for all its participants (designers, builders, services and organizations of public utilities in the territory and users of construction products) while improving the status of the renovated territory.

A scientific hypothesis has been put forward that the modeling of the integrated area renovation will effectively apply the models to assess the increase in the level of capitalization of the area. Methods and means of infographic modeling and complex engineering were used to simulate the changes made by the integrated area renovation.

In conclusion, it should be noted that the increase in the level of capitalization of the territory today is the most promising assessment of the implementation of projects of integrated area development: this is an important element of the digital economy based on innovative activity of scientific, technical and socio-economic development.

The main result of the study is the formation of a model of integrated area development, which, together with the method of assessing the level of capitalization forms the methodology of technologization of the area.

VI. RECOMMENDATION

Recommendations for possible use of the results of the studies include the following items:

1. Determination of the capitalization ratio of certain socio-economic elements of the area;

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2. Implementation of the objective calculation of the land cost for construction;
3. Calculation of economic efficiency of elements of the area for a certain building;
4. Establishment of economically reasonable relationship between the participants of construction of an integrated object in his contribution to a particular element of the area;
5. Calculation of the cost efficiency of the construction project at various stages;
6. Determination of proportionality of costs for individual elements of the area with the state of the real estate market.

These results are of interest for the following categories of consumers:

1. For experts involved in the evaluation of investment projects in the field of land management, urban planning, construction.
2. For investors implementing investment projects on the integrated area renovation.
3. For the managers of federal and municipal services forming projects of the integrated area renovation.

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