Green building technology resources on the technological platform of a complex facility for environmental reconstruction of the territory

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Abstract. Territory reorganization modeling is one of the leading areas in the analysis of integrated development. The subsystem “technological platform” is part of a complex object of ecological reorganization of the territory, its functions and role in ensuring sustainability of territorial development. Reconstruction of this layer of the complex model requires changes in the equipment used in buildings and facilities, affects the construction of engineering and transport networks and communication systems and determines the possibility of obtaining innovative products. Organizational reconstruction of enterprises as innovative changes based on green technologies requires the economic mechanism of innovative development of enterprises. Areas of restructuring the technological platform of the territory by improving the level of capitalization of the territory due to its resource development were identified.

1. Introduction

Today, the main tool used to study complex systems and their interactions is modeling whose methods are being developed and have a wide scope [1, 2]. Modeling is replacing an object (system) with another object (model) in order to obtain data about the first object based on the study of the model.

The task of complex modeling is to build a model of systems adequate to the original object. The results are used to predict the development of the object under study [3]. In accordance with the principle of adequacy, modeling involves the construction of a new object and its experimental study, and the reverse transition from the model to the original. Moreover, the model must comply with the principles of:
- functionality (i.e., the model should meet the goal),
- causality (a causal, substantiated chain of relationships should be traced),
- completeness of parts and complementarity (the model should contain workable components that complement each other when they are combined).

2. Literature review

Comprehensive modeling, unlike system modeling, entails the presence of component systems whose goals are opposite (for example, “production - consumption), i.e. the goal is harmonious correspondence...
of the producing system to the consumption one. The system “territory” as a producer and the system “consumer of territory products” consuming products are interacted in this way.

In [4], the model represents a complex object of reconstruction (COR). Suggesting equal changes in all layers of the model, its properties were studied, research directions were identified.

Consistent expansion of the scope of use of the model made it possible to specify conditions for its use depending on the content of its layers. In [5], an analysis of the complex object of territorial reconstruction (COTR) was carried out. A model that fixes the immutability of the “carrier” of changes is shown in Figure 1.

| Consumer products |
|-------------------|
| Territory Products |
| Equipment of buildings, facilities |
| Technological platform |
| Buildings and facilities |
| Engineering and transport networks and communication system of buildings and facilities |
| Territory (geographical location, natural resources, climate, human resources, etc.) |

**Figure 1.** The COTR model [5]

The COTR model was considered from from abstract to concrete - from the broad abstract functional capabilities of the territory to the specifics of its personally oriented products (traditional and innovative). Brief descriptions of the systemic layers of the COTR model were presented. An important conclusion of [4] was the definition of integrated development of territories as a process of their capitalization. It was noted that the positive changes in each system layer increase the capitalization of the territory, which is important for including such a territory in investment processes. It was also noted that the structure of each layer depends on the projection of neighboring layers onto this layer5. The projection of layer 6 onto layer 7 forms a layer called “territory planning project”5. The projection of layer 5 onto layer 7 forms the layer “territory development project”6.

3. Results

The study aims to consider the influence of the layer (subsystem) “technological platform of the territory” on other layers of the complex object of territory reconstruction.

The technological platform of the territory is a set of technologies that are used in producing and selling products of the territory. Thus, the subsystem “technological platform” is part of the COTR model. The function of the “technological platform” is to provide and support the process of capitalization of territories. Its role is a resource integrator of organizational and technological innovations in the resource development of territories.

5 The territory planning project is a subsystem of COTR considered in the context of the “natural” environment, for identifying elements of the planning structure, establishing parameters for a planned development of elements of the planning structure, zones of planned location of federal objects, regional objects, and local objects. [4]

6 The territory development project is a subsystem of COTR considered in the context of the “natural” environment; it fully captures the necessary urban planning requirements and restrictions on the use of a particular site and a capital construction project built on it or planned for construction and is an “infrastructure” resource. [4]
Since the technological platform was not fully described in the above works, let us consider the contents of this layer of the COTR model. We proceed from the assumption that reconstruction of each layer should “work” in order to increase capitalization.

The reconstruction of this layer requires changes in the equipment used in buildings and structures of the territory, affects the construction of engineering and transport networks and communication systems and determines the possibility of obtaining innovative products of the territory. Organizational reconstruction of enterprises was studied in [6, 7], the economic mechanism of innovative development of enterprises was identified. As a result of the modeling, direct projections of the “technological platform” layer on all layers of the COTR model were obtained. The resulting model of the integrated facility is shown in Figure 2. The arrows show the directions of innovative technologies from the the layer “technological platform” to other layers of the model.

The technological platform can include all organizational and technological solutions that determine the management and development of the territory. First of all, these are production norms expressed in the standards for activities of enterprises. Modern management standards integrated into complex management systems have been successfully applied both in foreign and domestic practice to improve consumer characteristics of the products. The ISO 9000 series, ISO 14000, ISO 5000, OHSAS 18000 and other industry standards are superimposed on the production process and create sufficient conditions for purchase, operation and disposal of products demanded by the consumer.

Organizational reconstruction of enterprises as innovative changes was studied in [6, 7] related to the economic mechanism of innovative development of enterprises. As a result of the application of modeling, direct projections of the “technological platform” layer onto the “territory” layer were obtained. In [5], it was noted that such companies as Siemens and Bosch develop organizational and technological solutions based on common technological principles and focused on supporting all possible functions of buildings and structures of the territory. This technological platform includes full equipment of building’s premises, their cable infrastructure, determines the location and size of niches in the building, as well as the content of office premises.

| Consumer products                                                                 |
|--------------------------------------------------------------------------------|
| Traditional and innovative products                                            |
| Traditional and innovative equipment of buildings, facilities                   |
| Technological platform of traditional and innovative solutions to the problems |
| Traditional and innovative buildings and structures                             |
| Traditional and innovative engineering and transportation networks and system communications of buildings |
| Territory (geographical location, natural resources, climate, human resources, etc.) |

**Figure 2. COTR Model**

The technological platform is the basis for the management of the buildings of the territory. It creates “amenities” that characterize quantitative aspects of the operational quality of a building. The subsystem implements an integrated approach to the design of all engineering systems of the building at the initial stage of the project, which will ensure their integration, consistency and stable operation. The verification of compliance of the technological platform with modern requirements is the basis of competitive capital construction procedures.
The “technological platform” subsystem includes “technical” and social technologies. According to [5]: “... technological platforms are a new communication platform for discussing the most important technological development projects, developing and implementing long-term priorities within the national economy by modernizing existing and forming new sectors of the economy, using tools influencing the speed of distribution of promising technologies in all areas of society.” Technological platforms combine capabilities of science and business used throughout the cycle of development and production of innovative products. Technological platforms become the basis for thematic areas, within which the government determines priorities for various research projects whose results should be implemented in production [8].

The aforesaid allows us to consider the technological platform as a means of territorial development using cross-disciplinary approaches to the development of reconstruction technologies. When projecting the “technological platform” layer onto the “territory” layer, the latter acquires the focus of innovative development. Moreover, the direction of modern zoning of the territories (accelerated development zones, sustainable development zones, support zones) involves the integrated development of the territories of regions where these zones are created, will be created or are being created.

If the technological platform of the territory is focused on solving the environmental problems, the COTR model is a complex object of ecological reconstruction of territories (CEPT) shown in Figure 3.

![Infographic COTR model](image)

**Figure 3.** Infographic COTR model

The model is characterized by the restructuring of target settings of activities of specialists involved in the conversion of COTR layers, compliance with environmental standards in the process of reconstruction of the territory. To ensure the sustainability of complex development of territories, the requirements of standards should be taken into account even when designing products. At the same time,
for the layer “buildings and structures of the territory”, standards should be based on “green standards”.

The basic factor for developing green building projects is strict adherence to the requirements of the relevant international standards and the building certification system: BREEAM, LEED or DGNB [8].

The implementation of recommendations of the green standard used for the certification can be the basis for environmental safety of production using equipment in the buildings of the territory, and environmental safety of transportation by transport networks of these buildings. Social technologies and high humanitarian technologies involved in the implementation of green building standards are used by social movements and organizations consisting of socially and environmentally responsible companies. The main goal of this promotion is introduction of the concept of sustainable development in the activities and encouraging partner companies to use green building technologies.

The partners of public movements and organizations promoting green building standards are a wide range of enterprises that apply the environmental approach. Such directions were tabulated in [10]. In contrast to this table, Table 1 specifies the readiness of these directions to develop green building technologies.

| Organizational mechanisms                  | Security | Improving Energy Efficiency and Energy Saving | Rational water consumption | Comfort and quality of the interior | Eco Purchasing |
|------------------------------------------|----------|----------------------------------------------|----------------------------|------------------------------------|---------------|
| Stimulation of investors of construction projects | +        | +                                            | +                          | -                                 | -             |
| Preparation of consumers of the results of construction activities | +        | +                                            | +                          | +                                 | +             |
| Training of the members of the expert construction community | -        | -                                            | -                          | +                                 | +             |
| Training of specialists in specialized educational construction institutions | +        | +                                            | +                          | +                                 | +             |

The “pluses” denote available resources. "Minuses” denote the lack of mastery of the activity and the low level of an organizational mechanism.

The directions are safety, energy efficiency and energy saving, rational water consumption, comfort and quality of the internal environment of buildings, eco-purchases. The above directions cover the main stages of the consumer's life cycle: training and education. The continuity of the impact on the vision of the subject of construction activities ensures stability of approaches to the implementation of environmental activities.

4. Conclusion

The models allow us to consider the influence of the layer (subsystem) “technological platform of the territory” on other layers of the complex object of territory reconstruction. The model can be used to determine the impact of "green" construction on the level of capitalization of the territory.

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