

"Green Building" as a Driver of Sustainable Innovative Development of the Industry

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Abstract. Authors justified the role of cognitive technologies in the sustainable development process, including investment-construction complex. Role of the human resource management subsystem in the emerging knowledge economy is shown. Criteria of sustainable economic development, with the focus on the innovative aspect are developed. Scheme of the methodology of application of the cognitive technologies on the example of the eco-housing construction, which represents the systemically important direction for the investment-construction complex. Realization of the offered methods allows to develop recommendations on stimulation of the “green” building, that will promote the growth of innovation activity in the construction industry and its institutional subsystem.

1 Introduction

Modern dynamics of socio-economic development is characterized by a number of trends, among which crucially there is techno-economic paradigms supersession, the imperative of which are cognitive technologies. Let's agree, that currently, in conditions of existing techno-economic paradigm, knowledge and human capabilities have almost great significance, particularly in economics and management. All existing software and computer technologies, methods and models were designed for decision support, while the result is subjective and depends on the decision-maker. That's why on the cutting edge of the development process there are cognitive technologies, which create the basis of the knowledge economy, the overarching factor of production of which is the human capital assets.

2 Methods

Knowledge production process is advisable to subdivide into the production of cognitive knowledge (reproduction of knowledge) and product knowledge (inventions and innovations) [1]. Cognitive process is the self-organizing process, especially in terms of

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knowledge reproduction. Postulates of the M. Eigen theory are obvious in this process: necessity of existence in the system of function of the retrieval of the proper information, the carrier of which in cognitive economy are knowledge. Therefore, the ability "to build and structure itself; only desirable for human trends of the self-development of this system must be initiated in the proper way" is present in the development of the cognitive economy. Simultaneously, recognizing the actual denial of the role of internal fluctuations in its system dynamics as disadvantage of the theory of self-organization, there must be considered the methodology, which develops this direction of the theories, namely, catastrophe theory, which postulates the paramount importance of the internal fluctuations of the self-organization process [2]. Critics of the synergetic approach aptly note, that "synergetic economy" not very clearly reflects the economic fluctuations inside the system, particularly, the influence and role of the institutional changes and other economic parameters on the different time durations. Status and dynamics of the social sphere should be also considered in the projection of the cognitive economy as a reflection of the results of realization of human resource management methodic [3].

Representing a new paradigm of development of society, innovative economy, in our opinion, is characterized by the scaling invariance: from macro level to the Nano economies level (according to B. V. Salikhov). By emphasizing of sectoral and cross-sectoral forms of reproduction on the meso-and micro-level of the knowledge economy, it's important to throw the key postulates to the development of the investment-construction complex.

Elements of institutional subsystem of the investment-construction complex, as a method of objectification and expertise of knowledge [4], have social genesis. Conclusions of sociogenetics come, that human is the source of changes in society, as well as of heredity and socio-economic system. Human is the carrier of the explicit and implicit knowledge as the basis for both of the institutional subsystem, transaction within the system, and within its interactions with the environment, as well as of the knowledge of the project, which creates the vector of inventions and innovations, respectively. Based on the above, thesis about presence and, moreover, the dominant role (in terms of cognitive economy) of the social subsystem in the management system of investment-construction complex is confirmed. Subsystem is presented as organizational ability, which is presented by the set of cognitive knowledge (both explicit and implicit), providing the strategic vision of the result of sustainable development and ongoing training, as the road to it, in the knowledge formalization process, and coherence of direction and boundaries of joint activity of the labour collectives with the purpose to develop organizations of the investment-construction complex [5]. Social subsystem provides the creation of environment, which forms the organizational culture (as the expression of the implicit organizational knowledge) and institutional bases of interaction of subjects of the investment-construction activity, thereby ensuring the institutional inheritance system, which, in its turn, generates the micro economic environment of the business-operational activity; processes of production and consumption of the complex production structure and change the organizational ability of the participants of the investment-construction activity.

Realization of the self-development principle, which is around necessity of continuous development and training for employees of the investment-construction complex should be ensured at the level of social subsystem with the purpose of knowledge formalization and ensuring of their reproduction. Moreover, on the one hand, knowledge is a stimulus for development and training, on the other hand, reception of the new knowledge by employees is a stimulus for the institutional changes performing (spontaneous and directed institutional changes), ensuring the reproduction of knowledge [6].

Recognition of the principle of self-development is the postulate for ground of the leading role of self-organization in socio-economic processes, based on the cognitive

decision-making technologies, the learning process. Therefore, there is necessity of planning and organization of appropriate changes, which are based on the identification of the basic rank parameters, decision rules, strategies.

Dynamic change, which represents the development of investment-construction complex, consisting of the urge to the continuous development and renewal on the cognitive basis of all elements of the subsystems. Its confirmed by comparison of self-movement stages of each subsystem. Principle of innovation is realized in accordance with this integrative characteristic: one of the main driving forces and causes of the system development and the changes of its organizational-economic structure is technical and technological innovations, generated by the implicit cognitive knowledge [7].

Selection and identification of the rank parameters, which consider innovativeness of the development, should be aimed at integrity maintenance, homeostatic sustainability of the investment-construction complex, that is the main parameter of all systems.

With this regard appears necessity of definition of the criteria of the sustainable development of the system. According to the synergistic conclusions, condition of stability of the system last not for a long time and are rare, but the purpose of operation of the system is determined by the urge to the achievement of these conditions. Achievement of the desirable condition of the control system has an explicit social genesis, being the producer of the formalization and application of the cognitive knowledge.

Regarding the content of the sustainability concept in the scientific environment, nowadays there is wide range of judgments, which demonstrates, firstly, about the volume of the concept, complexity of its structure, big number of subdominant concepts and secondly, about the absence of consensus regarding theoretical methodical basis of the sustainability.

Currently, the concept of sustainability is interpreted as a stationary stability (balance) (the viewpoints of R. Solow, V. I. Roshchin and others), sustainable development (V. B. Oleynik and others), sustainable growth (possibility of the further development production) (S. G. Ezerskaya and others) within the concept of sustainable development.

In terms of balance, sustainability is such balanced condition, in which economic and managerial decisions are able to regulate main factors of the sustainable position of the system. On the example of the micro level of the system of management by the investment-construction complex (company) such presentation of sustainability should be displayed:

$$\begin{aligned}
 PR &= f(S, D, \sum_{i=1}^n F_{vne_i}, \sum_{j=1}^m F_{vnu_j}) \rightarrow \max \\
 D &= S \\
 P(F_{vne_i}) &\leq P_{pr}(F_{vne_i})
 \end{aligned}
 \tag{1}$$

Where S - value of the offer of goods (services); D - value of demand for products (services); The F_{vnt} - environmental factors; The F_{vnu} - internal environment factors; P (F) - probability of action of the factor; $P_{pr}(F)$ - predictive probability of action of the factor.

In general, achievement of the development of the system by the path during particular time of the gal set of the conditions is accepted as the criteria of sustainability. Such interpretation of the concept of sustainability, reflecting the fundamentals of economic theory, doesn't provide necessary condition for the development of the system of the condition of continuous dynamic changes.

Essence of the sustainability as security of the system involves the provision of condition of the rational use of its resources for the prevention of threats. Threat of stable functioning and development of the system is treated as any conflict of the purposes of the functioning and development of the management of the system with internal or external environment and with coincidence of the purposes as inconsistency of the way of its achievement or as any, external or internal, indignation, which moves object out from the stable position:

$$\begin{aligned}
 U &= f\left(\sum_{k=1}^K R_k, \sum_{i=1}^n F_{vne_i}, \sum_{j=1}^m F_{vnu_j}\right) \rightarrow M \\
 A_k &\leq R_k \leq B_k \\
 P(F_{vne_i}) &\leq P_{pr}(F_{vne_i})
 \end{aligned}
 \tag{2}$$

Where R - resources, A, B - resource constraints; M - mission of the company; U - economic stability (in this case, company).

In general, due to this approach, absence of the trajectory deviation of the system development during predicted time duration from the definite set of the security conditions is the criteria of sustainability. This interpretation also doesn't consider necessary dynamics of complex non-balanced systems.

Understanding of sustainability as sustainable economic growth presupposes necessity of the almost monotone increase of function of the key indicators of the system development on the predicted time line with further presence of function values in the particular valid range as criteria. Characteristic of sustainability, which exactly reflects non-equilibrium of the complex system is the "ability of economic system to return to its previous condition":

$$\begin{aligned}
 CV &= \frac{\sigma(U)}{M(U)} \rightarrow \min \\
 U &= f\left(\sum_{i=1}^n F_{vne_i}, \sum_{j=1}^m F_{vnu_j}\right)
 \end{aligned}
 \tag{3}$$

Where M (U) - mathematical expectation of sustainability; σ - standard deviation.

In this context, criteria of sustainability can be accepted as asymptotical stability of the path dependency of the system along with its structural stability.

In this case economic sustainability represents to adapt to the changing parameters of external economic environment with minimal losses and adequate reaction on its impact and internal disturbances (fluctuations). In this case, sustainable development of the investment-construction company is development, which allows to ensure the long-term steady growth of qualitative and quantitative indicators of the activity of the structural components of the complex, that doesn't lead to degradation changes of the external environment.

Today sustainable development is a priority not only of the investment-building complex, but of the system in general. So, within the existing concept of sustainable development implies nonnegative dynamics of all kinds of resources in complex, namely, natural resources, people, social and physical capital [8], which allows to ensure the well-being of the future generations.

In economic projection sustainable development presupposes the quality, given to the future generations of the physical capital (buildings, equipment and technologies), people (knowledge and science), institutional development of the environment [9]. Thus, the defining systemic elements of sustainable development are the investment-construction complex, which forms qualitative physical capital, and social subsystem, which forms people and institutional environment.

3 Results

So, the key aspect in the process of creation of physical capital for sustainable development is ensuring of the quality of the construction products on all stages of its creation, particularly on the stage of exploitation, which has the most impact on the well-being of future generations. That's why problem about energy intensity and efficiency, environmental friendliness of the construction products is the much concerned today. Unity

of the all listed requirements is achieved by implementation of the concept of "green" construction [4]. Concept of the "green" construction considers a real estate unit not only as construction product, but as human environment, i.e. totality of the factors of the building and its infrastructure, that determine the conditions of life. Besides, significant feature of the "green" building concept should be recognized its innovativeness, as without implementation of the mainly productive and process innovations, correspondence to the "green" building criteria is almost impossible [6]. Innovative character of the "green" building leads to the understanding of its cognitive basis. In this case, following the typology of B. V. Salihov, objectification of the several interrelated types of the cognitive knowledge to the end product is realized (fig. 1). Consequently, the process of management of the development of the "green" building should be directed not fragmented on some elements of the structure of cognitive knowledge, but on the whole described above range of knowledge, taking into consideration the differentiation of the degree of types of knowledge management, level of formalizability and input intensities.

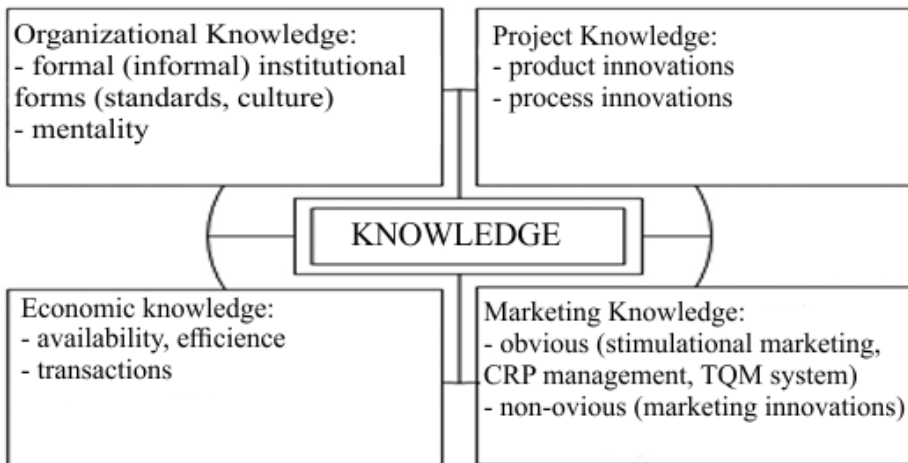


Fig. 1. The structure of the cognitive basis of the "green" building

In this context reproduction and formalization of cognitive knowledge is connected with range of problems, including institutional genesis. Analysis of statistical data, as well as the results of expert studies on this problematics [6] indicates a quite low innovation activity of the companies of construction industry, not only in Russia, but in the world.

Regarding conservatism of the construction industry in terms of innovation, its aggregate character should be noted. In construction industry, the results of the production of different sectors of the economy, including, characterized as innovative are often used as resources.

Nevertheless, on the way of acceleration of the innovative development of construction industry appears range of problems, most of which has institutional nature.

Complexity of the structure of participants of the work contract, duration and length of actualization of normative-technical documentation in the field of construction and design, duration of the life cycle of construction products, imperfection of the builders liability system for the future functionality and quality of the unit, presence of non-price and unfair competition on the construction market, large amounts and long period of the investment-construction projects financing and low policy-making activity can be highlighted as problem factors.

4 Discussion

In view of the foregoing it can be concluded that the problem field of activation of the "green" building also has a cognitive nature, taking into account, that institutions and knowledge are closely interrelated. Besides, realization of the "green" building principles by its innovatization is related with the growth expenses [7]. That's why, taking into account not enough high level of the solvent demand in Russia and high level of competition with conventional construction projects, the demand of adequate assessment of the economic viability of the final and intermediate production of the "green" building is revealed with consideration of demands of sustainable development and ecological criterion observation. This raises the problem of quantitative accounting of ecological effect for user of the unit and environment.

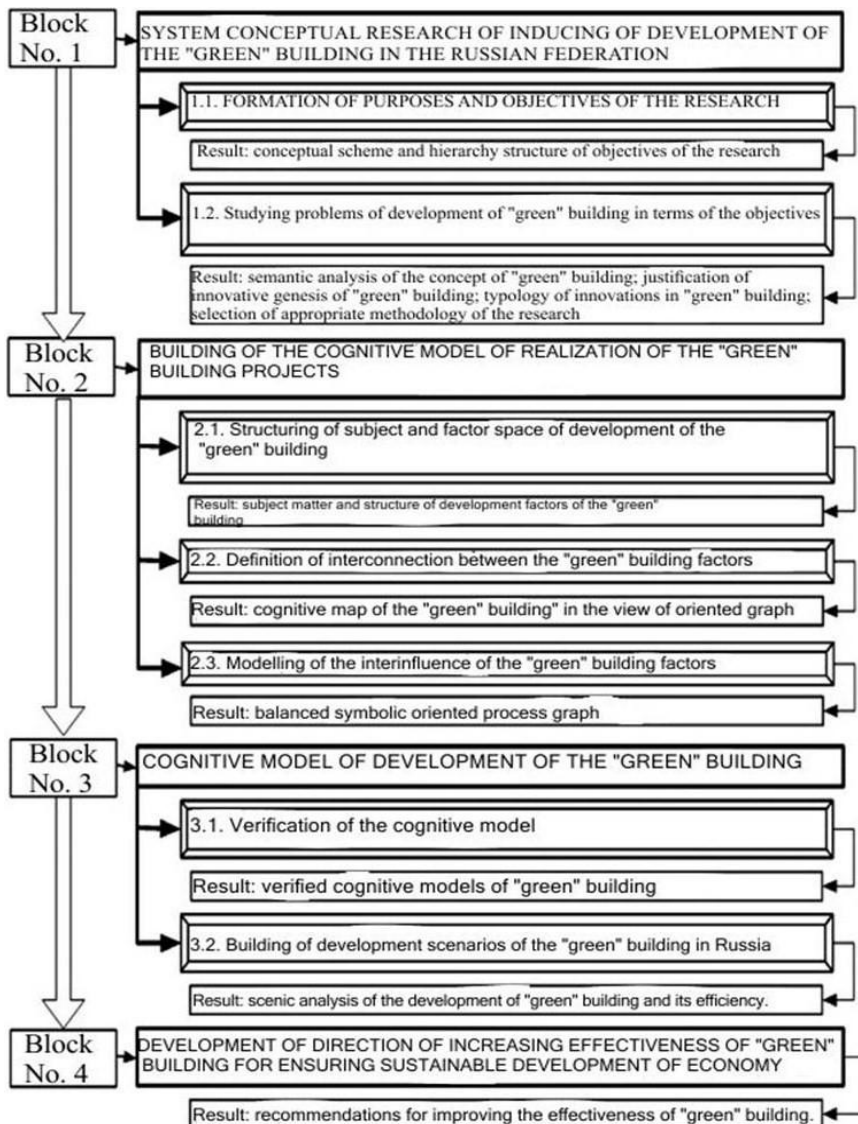


Fig. 2. Principle diagram of the development of the cognitive analysis of the "green" building

Today assignment of units to the "green" building is only possible as a result of comparison with existing standards, which often have significant "imbalance" in the system of requirements toward the energy efficiency and not always consider the economic effect, that significantly decreases possibilities of dynamic development of this segment.

Accordingly, the problem of activation of the "green" building as the most important condition for sustainable development on the basis of cognitive technologies differs by the multidimensionality, absence of the representative static information about realized projects, intense volatility and dependence on the external environment [8]. Cognitive nature of the "green" building and problems, bound with its development should be especially emphasized. That's why for development of directions for activation of the "green" building in our country, it's reasonable to apply methodology of the cognitive analysis and modeling. It should be noted that the means of cognitive modeling are oriented for the specific situation, for consideration of specifics of political and economic conditions, condition of the information environment, peculiarities of the institutional sphere, etc. [9]. These features along with application of the expert knowledge and competencies allow to use this methodology for solution of the problem of activation of one of the key directions of innovatization in construction. Principle diagram of the methodology of the cognitive analysis of the "green" building development is presented in the picture 2.

5 Conclusion

Realization of proposed method allows reasonably develop the recommendations for promotion of the "green" building, which, in turn, will contribute to the growth of innovative activity in the industry of building materials, innovativeness of the standard operating procedures and institutional subsystem of the investment-construction complex. Simultaneously processes of objectification and reproduction of knowledge and competencies will accelerate considering the increasing of the marginal utility of the process of learning. Accordingly, process of self-organization of the investment-construction complex will comply with criterion for stability of the non-equilibrium systems following the principles of self-development and innovation and that will ensure its effective sustainable development.

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