Economic model of the construction subjects’ intellectual potential transformation

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Abstract. The human potential is of great importance in modern economy during the period of technological structure change and the transition to the knowledge economy, the imperative of which is the cognitive technology. Human abilities aimed at making managerial decisions strategically important for the progressive development of economic entities are expressed in the process of transforming potential into “new resources”. In this regard, the direction and power of the transformation processes form the basis of the economy. The basic factor in the production of the transformation is human (intellectual) potential. The economic effect obtained as a result of transformation processes is directly dependent on the knowledge of the person, taking the decision. In order to improve the effectiveness of the resources use a methodology for assessing the transformational costs of enhancing the intellectual potential of business entities was developed. The analysis of the products cost structure produced by business entities will make it possible to identify the priority areas for the revitalization of resources necessary for the finished goods production and the conditions for transforming the potential into “new resources”.

Introduction
Transformational processes expressed in the knowledge reproduction are self-organizing processes capable of self-building, self-structuring and self-development [1]. However, studying the self-organization processes the intellectual development potential of both business entities and industries and territories is necessary to be taken into account. This development is a consequence of institutional changes in the process of dynamic development of socio-economic systems [2].

The dynamic development, being a characteristic for the investment and construction complex subjects, implies continuous improvement, updating all its elements and subsystems based on the cognitive technologies’ development [3].

The formation of intellectual capital, material and technical capital and the institutional environment for the investment and construction complex development are observed in the process of potential transformation [4, 5].

The peculiarities of the potential transformation processes are mediated by the coordination of the conflicting interests of market participants. In the process of coordinating interests, the collisions conventionally located in three areas: property, income distribution and management occur.

The regulator of the contradictions’ elimination in the coordination of economic interests is the market. As a result of the contradictions’ elimination the needs of all participants are ranked [6]. The
hierarchy structure of objectives determining the investment and construction complex development vector is formed depending on the priority needs of a participant [7].

The vector of development of the investment and construction complex in the knowledge economy is due to the transformation processes of organizational (institutional norms), project (product, process innovations), economic (efficiency) and marketing (stimulating marketing, CRP marketing, TQM system) knowledge [4, p. 95].

The economic effect obtained as a result of transformation processes is directly dependent on the knowledge of the subject taking the decision. Therefore, the development of a methodology for assessing transformational costs while enhancing the intellectual potential of business entities increases the resource use effectiveness. The analysis of the cost structure of goods produced by business entities makes it possible to identify the priority areas for the revitalization of the resources necessary for the production of finished output and the conditions for transforming the potential into “new resources”.

The scientific novelty consists in modeling the transformation processes of the socio-economic system potential (using the example of the investment and construction complex) by transferring resources to a new qualitative and quantitative state by enhancing the intellectual potential of business entities involved in the production of finished construction output.

The purpose of the study is to develop a methodology for calculating transformational costs in the process of activating the resources of the business entities by their transition to a new qualitative and quantitative state by the reproduction of the cognitive knowledge to ensure the investment and construction activities economic performance.

**Methodology and methods of research**

*Methods of the cost items valuation in the structure of the construction products estimated cost.*

The all types of resources involved in the investment and construction process and used in the process of creating a finished construction product is understood as “new resources”. The content, composition or nature relationship occur due to the cognitive processes. That is, the new innovative, intellectual, informational resources inherent in the knowledge economy, as well as traditional resources in the new interaction forms, within which the growth in the performance indicators of investment and construction activity is observed, can be new.

The features of the potential transformation into “new resources” in construction, are primarily due to the limiting use of the estimated regulatory framework of pricing and represent the integration of labor, material, technical, operational and other resources in the enlarged form [8], characterizing the construction products estimated cost:

\[
C_{ex}^i = \sum_{i=1}^{n} (S_{gen} + C_{oper} + O_{vhc}) \cdot C_{W} + \sum_{j=1}^{m} M_{j} + \sum_{k=1}^{l} E_{Eq}
\]  

where \(i, j, k\) – are the certain types of work, materials, equipment; \(n, m, l\) – define the required number of works, materials, equipment; \(S_{gen}\) – defines the main workers labor cost; \(C_{oper}\) - the maintenance and operation costs of construction machinery and mechanisms, including depreciation for their renovation; \(O_{vhc}\) – is overhead during the construction; \(C_{W}\) – is the coefficient reflecting the weather conditions in which the work is carried out; \(M_{j}\) - is the cost used in the performance of construction materials, building structures, parts, fuel, electricity, etc.; \(E_{Eq}\) - the cost of the equipment installed at the construction site.
Overhead costs are normalized indirectly (as a percentage of the estimated labor costs for the construction workers and machine operators). The amount of the overhead for each work performed is calculated as: 
\[ Ovh_i = C_{ovh} \cdot S_{gen}, \]
where \( Ovh_i \) is the overhead rate [9].

The costs for materials, labor and machine operation are directly normalized. These cost items characterize the processes of transforming potential into “new resources” during the construction of the facility accordingly. They depend on the consumption rate, consumption cost, consumption volumes and, accordingly, can be presented in the following form [10]:

\[ S_{gen} = \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{C_{gen}} \cdot V_{x_{gen}} \cdot C_{Sgen}), \]  
\[ C_{oper} = \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{C_{oper}} \cdot V_{x_{oper}} \cdot C_{Coper}), \]  
\[ M = \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{di} \cdot V_{M_j} \cdot P_{E_j}), \]

where \( Ovh_i \) is the rate of the consumption for the \( i \)-th resource type for the \( j \)-th work type (natural units);
\( V \) - is the \( j \)-th work type volume, (natural units);
\( P_{E_j} \) - is the resource \( i \)-th type estimated price rub. / natural units;

The method of calculating the transformation costs, which makes it possible to increase the economic effect of using the resources involved in building construction output by activating the intellectual potential of business entities and by transferring them to a new qualitative and quantitative state.

The processes of the potential transformation in conjunction with market forces are often associated with additional costs, with the transformation of environmental conditions, characterizing the change in the resources value. In other words, it makes sense to consider the transformation processes from the angle of the costs comparison and the profit obtained from the exclusive rights to resources, taking into account the market institutional parameters.

Transformational costs (\( Ctf \)) represent the costs of the potential transition into a “new resource”, that is, the process of building capacity into the existing system, leading to the emergence of new properties and characteristics in this system as an economy feature of a new technological order. They may include the cost of acquiring intellectual property, technical production re-equipment, staff development on the basis of the latest achievements of science and technology, the cost of introducing organizational and managerial innovations, etc. [11].

The alternative, the transformation costs of which are lower is to be implemented in the transformation process. Using the relative values, the choice of alternative can be determined as follows:

\[ Ctf \cdot (X_i + \sum_{r=1}^{n} X_r) \rightarrow \min \]  
\( X_i \) - is the proportion of resources that have the potential to transform into “new resources”;
\( X_r \) - is the cumulative amount of attracting all types of resources to the construction

\( Ctf \cdot (X_r + \sum_{r=1}^{n} X_r) \) - defines the unit costs of this resource type when transforming potential into a “new resource”.

Effective potential transformation into “new resources” will allow to reduce the rate, volume and the expenditure costs, that is:
\[ 0 \leq Ct^f \cdot \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{gen} \cdot V_{gen} \cdot P_{ES_gen}) \leq \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{gen} \cdot V_{gen} \cdot P_{ES_gen}), \]  

\[ 0 \leq Ct^f \cdot \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{opri} \cdot V_{opri} \cdot P_{EC_{opri}}) \leq \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{opri} \cdot V_{opri} \cdot P_{EC_{opri}}), \]  

\[ 0 \leq Ct^f \cdot \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{l_i} \cdot V_{M_j} \cdot P_{EM_j}) \leq \sum_{i=1}^{n} \sum_{j=1}^{m} (Ovh_{l_i} \cdot V_{M_j} \cdot P_{EM_j}) \]  

The implementation of inequalities 6-8 will accordingly lead to a decrease in actual cost in relation to the planned and estimated cost: \( C^f_{eq} \leq C^est_{eq} \leq C^{df}_{eq} \) and, accordingly, to the increase in the potential transformation effectiveness into “new resources”.

The efficiency of transformation can be represented in the form of the profit growth.

The profit from savings on resources is formed as a result of rationally aligned business processes, competent policy of purchasing materials and equipment, optimal implementation of organizational and management processes, logistics chains, reducing transaction costs as a result of making economically sound management decisions.

Profit growth \( (P_{gr}) \) as a result of changes in the value of the key items of direct costs will take the form:

\[ P_{gr} = P_{est} + \sum_{i=1}^{n} C_{Wi} \cdot (S^est_{gen_i} - Ct^f \cdot S^m_{gen_i}) + \sum_{j=1}^{m} C_{LC_j} \cdot (M_{st_j} - Ct^f \cdot M_{m_j}) + \]

\[ + \sum_{k=1}^{l} C_{LC_k} \cdot (Eq_{ext_k} - Ct^f \cdot Eq_{m_k}) \]  

As can be seen from the formula 9, the increase in profit is due to the action of both intensive and extensive factors. In relation to the construction industry, the multiplicative effect, formed by the coordinated process of extensive and intensive use of resources, can be expressed as a combination of the following factors:

1. The coefficient reflecting the new costs of labor:

\[ C_{Si} = \frac{Ct^f \cdot S^m_{gen_i}}{S^est_{gen_i}}, \]  

2. The coefficient characterizing the new cost of purchasing materials:

\[ C_{Mi} = \frac{Ct^f \cdot M^m_{j}}{M^est_{j}}, \]  

3. The coefficient reflecting the new costs for the purchase of machinery and equipment:

\[ L_{Eq} = \frac{Ct^f \cdot Eq^m_{c}}{Eq^est_{c}}. \]  

The multiplicative factor is determined by multiplying the three factors:

\[ C_{mul} = C_{Si} \cdot C_{Mi} \cdot K_{Eq_i}. \]  

**Summary**

The transformation processes effectiveness is directly dependent on the totality of organizational, project and marketing knowledge of the subject taking a decision regarding the investment and construction projects management and the resources use involved in the construction process. The key factor in the business entities success is the use of cognitive technologies as the most important
resource of enterprises and organizations. The reproduction of knowledge as well as the transformational costs associated with it, are carried out by the extensive and intensive processes implementation and are aimed at improving the efficiency of the resource use, profit growth and, consequently, increasing the competitiveness of business entities, industries, territories. The proposed methodology for calculating the transformational costs might allow the business entities to increase the efficiency of using all the resources involved in the production of finished construction output by transferring them into a new qualitative and quantitative state by activating their intellectual potential.

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