Information Technologies of Administrative Synthesis in Building Industry as the Factor of Boosting Labor Efficiency

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Abstract. In the article the authors study the need to study the impact of information technology on the effectiveness of management and construction organizations. The article proposes a new algorithm for the introduction of information technology management in construction, which will provide changes in the content, quality, nature, conditions of managerial work. Today, more and more importance is attached to the information sector of the economy, because the dominant position in the activities of modern organizations occupy the processes of exchange, processing and storage of information. Successful management of the economy at the organizational, regional and Federal levels is directly dependent on the effectiveness of the use of modern information technologies in management work. The use of the Internet, computer programs, information technologies radically changes the organization and technique of administrative work in construction. They allow to receive information and make decisions quickly, force to reconsider traditional views on a role and the mechanism of relationship of the organizations, open opportunities for participation of the organizations in the national and world financial markets and investment projects in construction.

1. Introduction

The referentiality of the contemporary economics suggests a search of new organizational - technological and organizational - economical solutions in the global experience of production. Economic efficiency is the result of optimizing accumulated experience [1, p. 168]

The up-to-date resource-saving technologies offer the building industry a new higher level and minimization of the dependence of construction on its traditional thirst of unprofitability.

We suggest that success lies in the sphere of application of modern additive technologies. "Additive technologies" is the term that generalizes some technologies of making products by means of the digital model data (or CAD models) by adding material [4].

Additive technologies are generally treated as a 3D-printing method exclusively, although functionally it is the construction of a project by realizing all its stages via a specific information model. In other words, submittals are constructed in virtual space to implement every design and maintenance stage from concept to complete dissolution and realization of the virtual model in objective reality resulting from the multifactor information administration.

The technologies of the layer-by-layer administration of construction may serve as a breakthrough into the building production of the future. If at the end of the 20th century the introduction of wide automatization to the building industry was blocked by the constructive approach, substantially fewer ready-made products as compared to other industries, and the economic negative appeal of expensive
equipment and limited materials [1] that can be produced automatically, the contemporary building industry keeps stumbling upon serious barriers including low labor efficiency, high statistics of accidents at construction sites, complexities of building operational administration, lack of qualified staff [2], insufficient control over building operations, engineering staff being overloaded with irrelevant challenges.

Currently, there are a limited number of works devoted to the modern digital economy. Fundamental research in this area is absent altogether. The authors suppose that the scientific community will have to go a long way in the field of research of this new trend in the world economy. At the first stage, the following works can be identified: A.P. Dobrynin "The digital economy - are different ways to the effective use of technology (BIM, PLM, CAD, IOT, SMART CITY, BIG DATA, and others),"[2] which tells about the relationship of key areas of technology, in particular, constructive, industries with modern digital technologies and their role in the economic development of civilization. V.P. Kupriyanovskiy and others “Smart Cities as the “Capitals” of the Digital Economy” [3]- the study provides an overview of the possibilities of integrating modern urban building technologies and informational and intellectual systems. Kupriyanovskiy V.P. and others “Reasonable Water”: Integrated Water Resources Management Based on Smart Technologies and Models for the Smart "[4] is one of the few works that includes not only theoretical research in the field of practical application and prospects for informatization of the objective world, but and contains specific calculations of cost planning and prospective development of costs and profits.

Actual problems of modern training of personnel in view of information technology are researched in studies of M.A. Barzayeva "Actual problems of the development of modern education in Russia" [5], V.P. Sveczharev, “Convergent Education: Social Aspect” [6].

The concept of "digital economy" in modern Russian science is quite vague and eclectic. Some (for example V. Balts) define the digital economy as “economic activity based on the digital technologies [7], connected with electronic business and electronic commerce, and produced by and selling by them electronic goods and services. Payments for services and goods of the e-economy are often made by electronic money. ” This definition cannot be taken as a decisive one, since it ignores the actual real sector of economic development, reducing the digital economy to organizing information exchange in a narrow sector of trade relations.

It seems to us that the definition given by A.P. Dobrynin is more reasonable: "Digital Economy (EU) is the result of the transformational effects of new general purpose technologies in the field of information and communication. It has an impact on all sectors of economic and social activities, such as retail, transportation, financial services, manufacturing, education, healthcare, media and so on. This has implications far beyond the information and communication technologies "[2].

2. Materials and methods
We offer a new methodological approach to boost building production by means of a synthesis of information technologies in the administration of building operations.

To help solve the problems of stimulating building production we should identify its reserves and then develop and implement the procedures of putting them to good use. Approaching this problem starts with identifying and selecting some most efficient steps towards stimulating building production [8]. This can be explained by the multitude of directions and factors to make up the background of building industry stimulation. The system analysis and choice of the optimal solution in view of such criteria lies in the field of the multifactor analysis and managerial synthesis by applying the information technological modeling. In return, these criteria are grouped in dozens of directions. The implementation of measures per each factor and direction is regarded as a separate way of stimulating production. With the great number of ways there comes an issue of picking out some most vital and cost-saving ones. The need in finding most efficient ways is justified by the fact that the contractor will be unable, say, during one year, to realize all their resources of boosting production, because it would distract lots of labor and means, which always tend to be limited this way or other[9-11].
Analyzing the factors that affect changes in the stimulation of building production points at the need in dividing them along the levels of administration. Some may be utilized (apprehended and realized) at the level of the building authority, others at the level of such authority's top management, the rest on a few managerial levels at once. For example, the introduction of the team pool payment system is done by contractors, while the economic effect via introducing new prices of building production is implemented through the joint efforts of the Ministry of Construction, Ministry of Economic Development, clientele, and realistic market conditions. Moreover, the key part here is played by the level of market demand, regional component, volumes, and production stock [12,13].

Stimulation of construction should be regarded from the angle of boosting the effectiveness of capital assets and investments in the process of construction proper. The first direction spans the issues of the rationale of capital investments and boosting of commissioning already completed objects. The second one includes every question relating to using the direct reserves of construction. These issues might also include the introduction of new machinery and progressive technologies of information modeling and administration, new materials and structures, more efficient building and transportation machinery, improved labor efficiency of builders thanks to better management of labor and production etc[14,15].

After the analysis of all the possible ways of stimulating construction has been made, they can be divided into two groups. The first group includes the ways and factors that cannot be directly influenced by the builders, while the second one covers those within the competence of the builders. The first group includes the creation and supply of new highly productive machinery, new materials and structures, capital investments etc. to construction. The second group also includes every aspect of stimulating the direct and materialized types of labor. Evidently, the second group, i.e. using all the available resources in building production, will seem more vital for builders.

3. **Results and discussions**

While choosing the ways of stimulating building production, the effects of each way is estimated in terms of the gain in marketable output and rates of its realization, sometimes also building and assembly operations or formally clean building products that can be obtained from operating with limited resources.

The volume gain of the building marketable output, where a single factor of stimulating building production is realized, can be determined using this formula:

\[
C_{\text{smr}}(\text{fcp}) = P_h \cdot U_{\text{ph}} \cdot 100\%
\]

where \(C_{\text{smr}}(\text{fcp})\) is gain in marketable building products or formally clean products (fcp) received in a planned (estimated) year by means of realizing this given way (factor in % to the volume of marketable products (fcp) in the reference year;

\(P_h\) - standard of the growth of marketable building products (mbp) when realizing the way under study in unit fractions to the reference year;

\(U_{\text{ph}}\) - volume of realization of a given factor for an appraisally potential period determined in relative unit fractions by dividing the volume of marketable building products (mbp) of the contractor in the reference year[16-18].

Actual calculations on the information model that uses the above formula show that the definition \(U_{\text{ph}}\) yields no obstacles, which was the case with defining certain factors of the stimulation standard (Si). This could be explained by such standards being different for different managerial systems. Most of them are defined depending on the experience of construction and design companies[18-20].

By comparing the operational results achieved by ten contractors with the total volume of 700,000 sq.m of floor space produced in 2015, the value of marketable product gain (fcp) at realizing stimulation reserves per a single factor under study lies within the limits spanned by this formula. This means that the application of the information systems of accounting and administration based on this particular algorithm of calculating stimulation enables to estimate the gain, hence make the
conclusion on the feasibility of the measures taken for their introduction. However, when calculating it is recommended, in every case, to bear in mind that the effect of stimulation should be due to saving direct and materialized labor, i.e. resource savings.

The managerial programs based on the information technologies of administrative synthesis (e.g. ROST) give boost to the choice on effective approaches (based on the sum of certain factors) to stimulating building production.

Obviously, the products obtained by means of such programs give an impact on the actual gain in labor efficiency. Moreover, the thematic scope of their operation should be controlled by targeting this system at boosting labor efficiency, introduction of the systems of intellectual management in building production. We believe the number of stimulation approaches being developed within the framework of the administrative information complex may only be limited by the power and performance of the equipment, and the proficiency of managerial personnel, capable of operating this technology.

4. Conclusions
On the other hand, the analysis of the introduction of the complex technologies of managerial synthesis shows that a certain part of results is never implemented in practice. Presently, the number of workers per building and assembly works, priced at one million RF Roubles, amounts to 0.1 - 2.03. We feel that this way of establishing the number of workers never stimulates any growth in labor efficiency. The factor under study should be in direct dependence on the actually achieved level of labor efficiency. In such case, concrete contractors and their divisions will be materially accountable for the factual gain in efficiency. The factor of personnel size should be revised depending on the actual impact of complex managerial measures on the key indicator - gain in labor efficiency. Still, there are instances where there are also taken into consideration those efficiency indicators that lack any documentary support. Errors, writeups, abuse of the means plus unqualified work force - they all distort the key indicators of the efficiency of building production.

We should also keep in mind that such calculations should include the actual formally documented effect.

Today, the gain in labor efficiency due to smart technologies, managerial synthesis in particular, makes up to 0.5 - 3.5%, despite its great potential.

In order to boost labor efficiency and productivity, the following should be done:
• job assessment of the design and technological stages should be made according to the actually achieved level of labor efficiency in the form of final products; this should be performed independently, by means of information management software and modeling;
• develop and approve of the unified standards and norms of contractor's operations based on available potential - model personnel, functional services, standards and prices of services, operations planning procedure, unified accounting and reporting, system of material and moral motivation etc;
• factor of personnel size should be established in direct dependence on the actual labor efficiency plus relevant adjustments in view of results achieved;
• exclusion of the costs of non-introduced plans from the approved schedule of objects, complexes, and sites.

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