The effectiveness of industrial housing construction enterprises

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Abstract. An industrial housing construction enterprise (IHCE), as a prominent representative of the construction industry enterprises that follow global trends in the field of scientific and technological progress, is a complex organizational and production structure requiring its performance to be evaluated. In general, there are six main effectiveness indicators of industrial housing construction enterprises: innovation, efficiency, productivity, profitability, quality, and environmental compatibility. The enterprise’s profitability reflects the efficiency of its commercial activities and depends on the productivity and profitability indicators. The IHCE’s productivity reflects the volume of construction products that the enterprise is able to produce on time, and is characterized by such an indicator of its production system as output capacity. The efficiency of an industrial housing construction enterprise lies in the ratio of the resources actually consumed by it during the production process to their standard consumption rates. Quality reflects the conformity of the end product with its functioning criteria defined during the design. Innovation involves changing enterprise systems based on the application of best practices. Environmental compatibility characterizes the degree of negative effect on the environment from the production activities of IHCE. The control of these six indicators coupled with strategic planning represent the IHCE productivity.

Keywords: industrial housing construction enterprise, effectiveness indicators, production system performance, potential capacity, strategic management.

1 Introduction

The fundamental function of construction is to form the human environment, therefore it has always been and still remains one of the largest sectors of the world economy. The construction industry consumes a huge amount of human labor and material resources, so efficient management of the processes taking place within it is an important and always relevant problem. Following global trends in the field of scientific and technological progress, construction is moving towards labor saving, accelerated production rate,
automated processes and rationalized use of resources. A striking example of this is industrial housing construction enterprises.

An industrial housing construction enterprise (IHCE) is understood as an economic entity in the real estate market, whose main activity is selling completed construction projects using the large-panel housing construction method. The big advantage of this method is carrying out the entire process, e.g., the manufacture of reinforced concrete elements, within the factory. In turn, this makes it possible to reduce the period of facility construction and achieve high quality, and also allows manufacturing structures from prestressed reinforced concrete, which is usually not possible or impractical at a construction site.

The IHCE business is responsible for all stages of the investment phase of an investment and construction project, from designing a facility to putting it into operation.

When considering IHCE as an organizational and production structure, the main aspect is to evaluate its performance and determine a rational way to achieve the best result. In this area, Grabovyy P.G., Prykin B.V., Danilkin I.A., etc. have professional authority.

2 Methods

The research methodology is based on the activity analysis of the leading industrial housing construction enterprises in the Russian Federation and its evaluation according to the methods developed by leading experts in the field of construction industry enterprises management.

3 Results and discussion

The current level of industrial housing construction enterprises activity allows not only for progressive development of the construction market, but also, with proper organization and effective management, for a rapidly increasing competitiveness and actively developing global sales markets.

The IHCE management should work hard to improve the efficiency of strategic management and the performance of enterprises, while maintaining such a significant competitive advantage as the relatively low cost of a building product for the end user. There are all the necessary prerequisites for industrial housing construction enterprises to become major developers and exporters of breakthrough materials and technologies, unique solutions for construction. At the same time, the enterprise needs to maintain the main focus of work, e.g., the population demand for a favorable human environment and provision of high-quality construction products, which must be taken into account and satisfied.

Before deciding on strategic areas for improving the performance of various types of construction industry enterprises, one should understand how strategy differs from development tactics and how strategic management differs from tactical one (table 1).

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<th>Table 1. Fundamental differences between strategy and tactics.</th>
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<td>Strategy</td>
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<td>The goal of the strategy is to address large-scale and multidimensional issues</td>
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The solution of strategic tasks in connection with the complexity and multidimensionality requires a large time investment at the level of at least several years

Tactical tasks can be implemented within a few weeks or months or within a year in the most difficult cases

Tactical plans are the main tools for adjusting strategic target programs, their approbation to changing external market conditions. These processes can be managed when developing an economic development strategy and using the entire potential of a construction industry company. This strategy, which depends on the economic situation in the country and in the construction industry and their further dynamics, includes the mechanisms and main aspects of managerial decision-making, and also explores patterns and determines the process of formation, development and implementation of that potential.

The economic strategy oriented towards the formation, development and use of the total potential of a construction industry company is a system of theoretical and methodological provisions and relevant managerial decisions of an organizational and economic nature that determine promising long-term area for development and use of potential. The main mechanism for implementing this strategy is a system of interrelated organizational, economic, scientific, methodological and legal ways and means for influencing the organizational structure of a company (enterprise), workforce or individual employees who implement this strategy into reality, forming a single methodological basis for coordinating interests, goals, tasks, and actions.

Strategic management is divided into development, adoption, implementation, control and evaluation of efficiency of management decisions and contains the following steps:

- collection of reliable information about the factors of the internal and external environment (the state of production and labor resources, the economic situation of the enterprise, competitors, other environmental factors);
- formation of a universal concept and key areas for development and use of the entire potential of the construction industry enterprise;
- decision making to choose a general goal (a first-order goal), focused on ensuring the completeness and rationality of using the overall potential of the enterprise;
- forecast of the situation development, analyzing the effects of external and internal environment factors on the possibility of achieving general goals;
- formation of the second and lower-order goals;
- monitoring of results at all stages of strategy implementation and making adjustments to management decisions;
- analysis of the strategy outcomes.

Before setting goals, it is necessary to have a thorough analysis of the key environmental factors that affect to a greater extent the activities of the construction industry enterprise and, as a result, the choice of the strategic management concept and its general goal. A detailed analysis of external factors is contained in the previously considered long-term state programs for the development of the construction complex in sectoral and regional target programs. The development of the strategy, forecasts and plans of the enterprise are based on the decision of the enterprise's management to choose the general goal, and in the future, the outcomes of these decisions are evaluated.

The general goal is schematically represented as a hierarchy of goals and includes a first-order goal, which, in turn, is subdivided into lower-order ones (subgoals) to the required degree of detail. To form a development strategy and use the overall potential of a construction industry enterprise, it is important to correctly set goals, introduce and remove
certain goals from the goals hierarchy, which contributes to the rationalization and increased performance of the enterprise when implementing its strategy.

There is a hierarchy of infrastructural targets in the overall potential strategic management of the construction industry organization, which depend on the company scale (on its organizational structure and size) and competencies of the personnel responsible for strategic management. Infrastructural targets can be considered as the optimal and desired state of the management process structure, qualitative and quantitative indicators of the overall potential, ideally achieved during the strategy implementation, the difference between which and the planned indicators should tend to zero.

IHCE is a commercial organization, the main purpose of which is to profit from economic activities based on material production. In general, there are six main indicators of efficiency of industrial housing construction enterprises: innovation, efficiency, productivity, profitability, quality, and environmental compatibility [3] (fig. 1). These indicators are interconnected and have a direct impact on the formation of each other.

![Fig. 1. Performance indicators of industrial housing construction enterprises.](image)

The profitability (PRB) of an enterprise reflects the efficiency of its commercial activities and is expressed by the following ratio:

$$PRB = \frac{TR - TC}{TC} = \frac{TR}{TC} \cdot \frac{TC}{Q} = \frac{Q}{TC} \cdot \frac{SP - CP}{SP} = \frac{SP}{CP} - 1$$

where:
- $TR$ – the total revenue;
- $TC$ – the total cost;
- $Q$ – the quantity of the sold goods;
- $SP$ – the selling price;
- $CP$ – the cost price.

The profit (PF) of the enterprise will be formed as follows:
The selling price is formed based on the market conditions and directly depends on the consumer qualities of the product, which ensure its competitiveness, and the cost price of its production as the lower limit. The cost price of the end product is directly affected by the efficiency of the IHCE production system and the use of innovations in it. The quantity of the sold goods is limited by the IHCE’s productivity (PR) and product demand (PD). These two indicators must be balanced, otherwise, in the first case (PR < PD), a share of the potential profit will be lost, and in the second, the efficiency of the production system will decline, since some productivity will not be used:

\[ Q = \min(PR, PD) \]

The IHCE’s PR reflects the volume of construction products that the enterprise is able to produce in a timely manner, and is characterized by such an indicator of its production system as output capacity \( P_{out} \). First, the organizational and production potential of the enterprise (PT) – the totality of its organizational and production resources that ensure the achievement of goals in the course of economic activity – goes into the input capacity of its production system \( P_{in} \), called potential capacity. The input capacity determines the maximum possible production volumes of the end product. Then, taking into account the losses of the input capacity \( L_p \) due to the influence of uncertainty factors, as well as the losses associated with organizational and technological decisions, the output capacity \( P_{out} \) is formed:

\[ P_{in} \rightarrow P_{out} + L_p \]

At the same time, the efficiency of using potential capacity is involved in the formation of production efficiency, and has an impact on profitability, and is determined by the efficiency of its transformation into output capacity through the corresponding indicator \( CE \):

\[ CE = \frac{P_{out}}{P_{in}} \]

Hence, the productivity of an industrial housing construction enterprise directly depends on its organizational and production potential and its effective use. The IHCE’s management should actively introduce resource- and energy-saving technologies, as well as modernize production equipment. This activity should be systematic and aimed at increasing the use of modern methods and ways of organizing construction production and labor, as well as economically rational technologies, space-planning solutions, materials and structures. The productivity of an industrial housing construction enterprise is largely determined by the timely modernization of production equipment, respectively, an increase in productivity, as well as the optimal use of the overall potential of construction industry enterprises, largely depends on the timely decision made as to the date of replacement and service life of production equipment, construction machines and mechanisms. The rational use of production capacities and construction equipment is one of the main reserves for increasing productivity, the scope of construction and installation activities of IHCE. It is necessary to carry on measures for the rational use of production and construction equipment. This will create an opportunity for a significant reduction of the construction cost, since the total share of funds used to purchase production facilities and construction equipment is, according to approximate data, at least 35% of the total construction cost. The
rationality of the life cycle of the main production capacities and technical resources in
general terms can be expressed by the ratio of total costs to total outcomes, determined
taking into account discounting. At the same time, different operations require different
investments, and the enterprise’s management must be able to compare these options and
choose the best one, i.e., have a real opportunity to assess the life cycle of machines,
mechanisms and equipment. The main criterion for the optimal life of production
equipment should be to achieve the maximum value of the total cost of capital created with
its help, or to minimize costs.

The profitability of an industrial housing construction enterprise lies in the ratio of the
resources actually consumed by it during the production process to their standard
consumption rates:

\[ E = \frac{R_u}{R_{ac}} \]

The standard consumption rate can be taken from regional or international regulations,
as well as from the company’s own experience or industry researches. The amount of
actually consumed resources can be reduced by optimizing the design parameters of the
finished product, its production processes, as well as improving the material base of
production, which requires a significant amount of innovation to be introduced.

At present, the performance of the construction industry enterprises more and more
depends on the organization of measures to improve the quality of construction production
and output products, as a result, the quality satisfaction of consumer needs. Considering that
the main IHCE’s products are residential buildings, significant attention in the development
of new investment and construction projects and the design of specific houses and
development areas should be given to creating a comfortable and safe living environment
(even within the social housing being built). To do this, it is necessary to understand that
modern consumer demands (having a large selection of housing offered) are quite high,
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comfortable (fig. 2) housing with a long service life.
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![Fig. 2. The structure of the comfortability concept.](image)

Innovation involves changing enterprise systems by applying best practices. These changes can affect both the end product itself and its production process, as well as the organizational, investment and financial systems of the IHCE. The most popular innovations at the moment include: generative design of the end product by using neural networks; the production system optimization of the enterprise through simulation of its functioning; robotization of key stages of technological processes; optimization of management decisions through the analysis of big data. Innovative processes in modern conditions are complex and consist of three parts: the actual innovation itself, the conditions of the organizational environment for its implementation and the conditions of the external environment. The outcome of their interaction is the process of introducing innovations at the plant. Properly implemented innovative principles of the IHCE’s work will allow its management to optimize the system for the formation, implementation and updating of the product range, its management system, as well as mechanisms to support the competitiveness of the product at a given level. In case of no such policy, the product range of the IHCE is formed in an unstable way exposed to random factors, which is accompanied by declining competitiveness and commercial efficiency of goods.
The environmental compatibility of an industrial housing construction enterprise characterizes the impact of its economic activity on the environment. The purpose of estimating the environmental consequences of an investment and construction project implementation, taking into account environmental factors, is to collect, process and present all information about the investment and construction project, which allows the enterprise’s management to estimate the acceptability of its effect on the environment.

4 Conclusions

The performance of an industrial housing construction enterprise is characterized by six main indicators: innovation, efficiency, productivity, profitability, quality and environmental compatibility. These indicators are interconnected and have a direct impact on the formation of each other. IHCE performance management actually means monitoring of these indicators through management decisions based on the enterprise development strategy.

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