

UDC 658.5

The productivity of an industrial housing construction enterprise as the main indicator of the potential intensity growth of the production and construction system

The heterogeneity of products and consumed resources can make it impossible to measure the productivity of construction enterprises and the construction industry as a whole. Man-hours cannot be added to cubic meters used as a measure of placed concrete mix or to rubles used as a measure of durable equipment, kilowatt-hours, etc. to obtain the total value of resources. Kazan DSK PJSC or Samolet construction group cannot use the method of continuous concreting to add two square meters of exterior panels to two square meters of constructed frames of residential and commercial real estate to find the final product. Since gains and losses, related to productivity, are distributed by a housing construction company between consumers through price systems, it seems appropriate to use money as the measure of this system to analyze this distribution. The ruble serves as a convenient common denominator in Russia. However, the ruble is a variable value, especially in the current economic environment. These fluctuations must be minimized when the ruble, a monetary unit, is used as an aggregation tool. One of the main features of the proposed approach is the availability of an appropriate corrective (revaluation) mechanism. This method allows:

- measuring the impact of productivity changes on profits;
- learning how acceptable and reasonable productivity changes are in relation to the integral indicator of potential intensity of an enterprise;
- identifying the impact of productivity on the competitive position in terms of the location of residential and commercial real estate.

The article assesses the main criteria of potential intensity (performance) and their impact on profitability and productivity.

Keywords: potential intensity, productivity, profitability measures, total income, total expenses, cost, return on assets

Grabovyy P.G.
Zhikharev D.F.



Grabovyy Petr Grigorievich,

Doctor of Economics, Professor, Head of the Department of Organization of Construction and Real Estate Management; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; ID RISC: 302471, Scopus: 57164862700; GrabovyyPG@gic.mgsu.ru



Zhikharev Dmitry Fedorovich,

Candidate of the Department of Organization of Construction and Real Estate Management; Moscow State University of Civil Engineering (National Research University) (MGSU); 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; Zhikharev.77@mail.ru

GENERAL PROBLEM STATEMENT

In the production and construction system of an industrial housing construction enterprise (hereinafter — DSK), labour productivity growth (PI) can be boosted if:

- cost prices go down, while the amount of finished construction products (hereinafter, FCP) goes up (Fig. 1, a);
- the volume of finished construction products grows faster than the cost prices;
- the volume of finished products do not change for a long time, and their cost goes down (for example, as a result of regional innovation programmes (Fig. 1, b));
- the volume of finished construction products grows at a constant cost;
- the volume of finished construction products decreases slightly, while the cost price grows at a slow pace.

It is known that innovations and investments are the main drivers of reproduction of capital and labour productivity growth at DSK enterprises [1, 2]. Capex as an investment in the development of the production

and engineering potential of an industrial housing construction enterprise can be allocated by reducing the cost of production during the construction of new and reconstruction of existing production facilities [3].

As is known, for industrial housing construction enterprises, the main form of production is a combination, which means a technological combination of interrelated heterogeneous productions and their technical and economic unity with construction [4].

For the effective use of capex, it is important to have options for a rational combination of production, technical potential, technological potentials (means of production, such as tools, working conditions, labour items and labor resources) with the financial and economic potential (financial resources and intangible assets), which represent the total potential of the production and construction system (Fig. 2) [5].

In general, the total production and technical potential is determined by the integral criterion of effectiveness (potential intensity), which includes a set of indicators [6]: resource concentration — RC , efficiency — E , product quality — Q , productivity — PI , the level of activity of labor resources — W , innovations — I , profitability — P (Fig. 2).

$$V(t) = U_{i,j,k}^N = \{[RC], [E], [Q], [PI], [W], [I], [P], [RC]\} V(t) \rightarrow \max, \quad (1)$$

where R is the aggregate risk level of an investment project (programme); C is the indicator of sufficiency of the total resources.

The potential intensity of the production and construction system of an industrial housing construction enterprise is understood as the effectiveness of

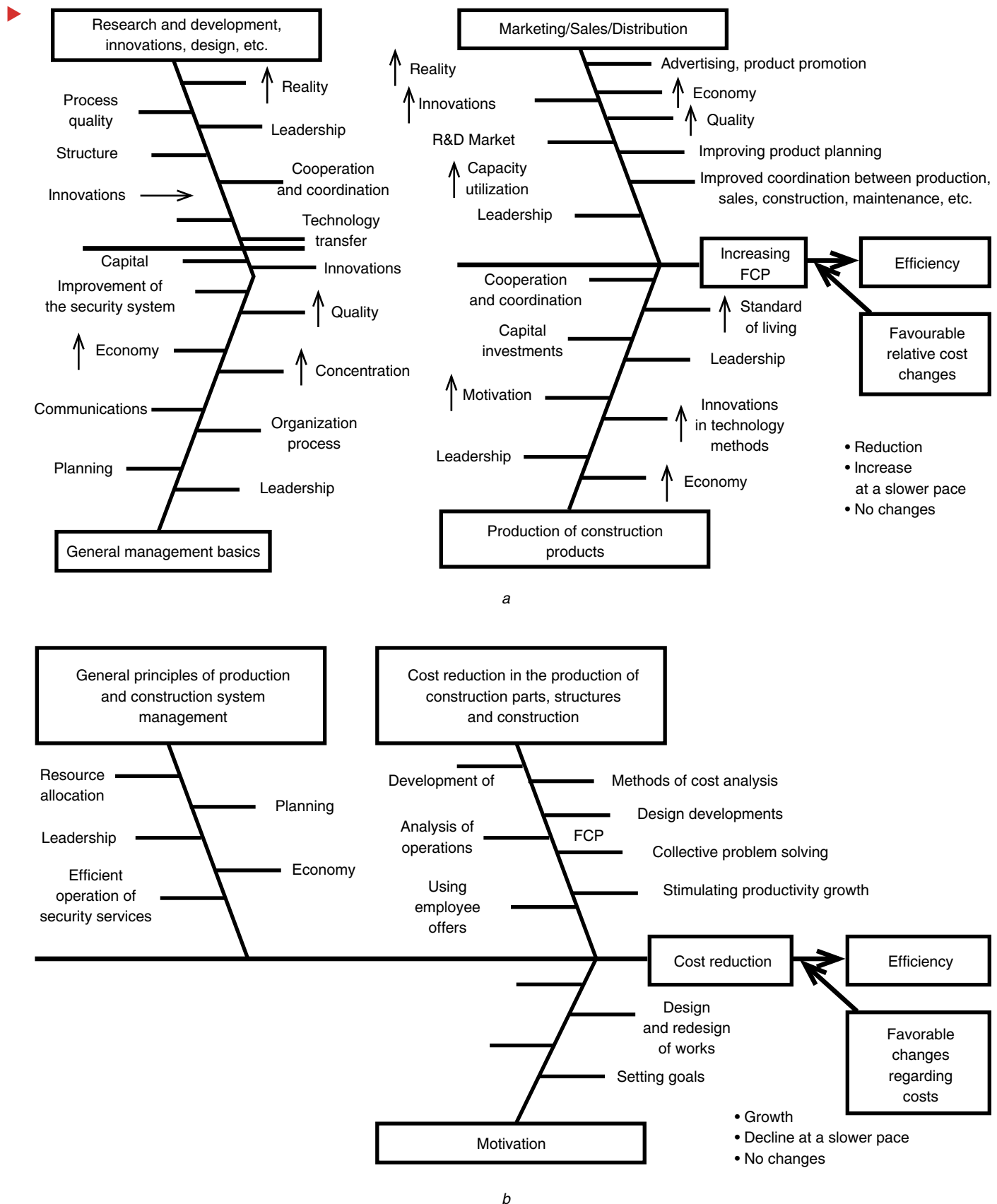


Fig. 1. Options a) and b) are to increase the labour productivity (PI) of industrial housing construction enterprises: a — by increasing the volume of FCP; b — by reducing the cost

productivity of its activities, when the ratio between what the system produces and the available resources of the “proper” type spent on the production of finished construction products allows for its high performance in the long term from the perspective of income and expenses of the system.

THE PROPOSED METHOD OF PERFORMANCE MANAGEMENT

Capital construction needs production and circulating assets to perform its activities [7]. The working capital of enterprises is in continuous motion. It is known that a change in the value of working capital is expressed in the following form:

$$M - P \dots FCP \dots P' - M', \quad (2)$$

where M is a change in the monetary form (value), P is a product (service), FCP means finished construction products.

This is a classical pattern. Industry-specific engineering and economic features of industrial housing construction enterprises determine the features of the turnover of funds in capital construction due to the fact that construction is characterized by a relatively long duration of production and technological cycles, and this is its first feature [8]. Suffice it to say that the renovation of existing buildings may take several years. Prerequisites for reducing the duration of construction in progress are the management of the duration of production, technological and construction cycles. It can reduce the term of construction and eliminate the “spraying” of funds due to the simultaneous concentration of production, technical, technological, financial and economic potentials at the start-up facilities of the urban renewal programme.

Secondly, construction production is not stationary. Unlike industrial enterprises, where means of labour and labour force are geographically connected to a certain place, and the product of labour leaves the place of production, in construction it is not the product of labour (finished products and non-production fixed assets) that moves, but the means of labour and labour force. The need to move means of production from one construction site to another disrupts the continuity of the production process.

Thirdly, construction means unique work. This implies various functions of developers and contractors.

Fourth, not one, but several specialized construction organizations, including transport and logistics firms, are usually engaged in the industrial production of structures on the construction site.

Due to the further specialization of contractors, the composition and structure of the working capital of individual corporate contractors may differ significantly from the average industry composition and structure of the working capital [9].

Stages of circulation of funds in construction differ depending on whether calculations are made for the stages of work or fully completed facilities.

A customer or a management company (depending on the chosen organizational form of management and the type of contract) wires money to pay for the equipment and certain types of materials transferred to the contractor. The contractor transforms the monetary form of value into the commodity one [10].

Next, the production maintenance process takes place. Inventory (products, materials, structures) and equipment arrive at the construction site, where their value is transferred to the newly created product as a result of the application of labour to them. The volume of construction and installation work is accounted for on the contractor's balance sheet as work in progress, while the equipment commissioned for installation continues to be accounted for on the developer's balance sheet.

For a contractor, the completion and delivery of a stage of work means the completion of the circulation of funds, although for the whole construction project it is nothing more than continued circulation of working capital in the process of production.

If we proceed from the fact that unfinished construction accounted for on the developer's balance sheet is not a current asset (which is not a fixed asset yet), but as it is moved to the contractor's balance sheet, it acquires the function of working capital, but the economic nature of unfinished construction listed by developers remains unclear.

A fundamental solution to the problem of unity of working capital is especially important, since in the future settlements between developers and contractors will be made only for fully operational facilities and enterprises according to formula 3.

$$M - P \dots FCP \dots P' - M' - M - Ce \dots FCP \dots P' - M', \quad (3)$$

where Ce is the cost of equipment purchased and installed by the developer.

In contrast to the pattern of circulation of funds in the calculations made for the stages of work, the scope of work, performed by developers, has no unfinished construction.

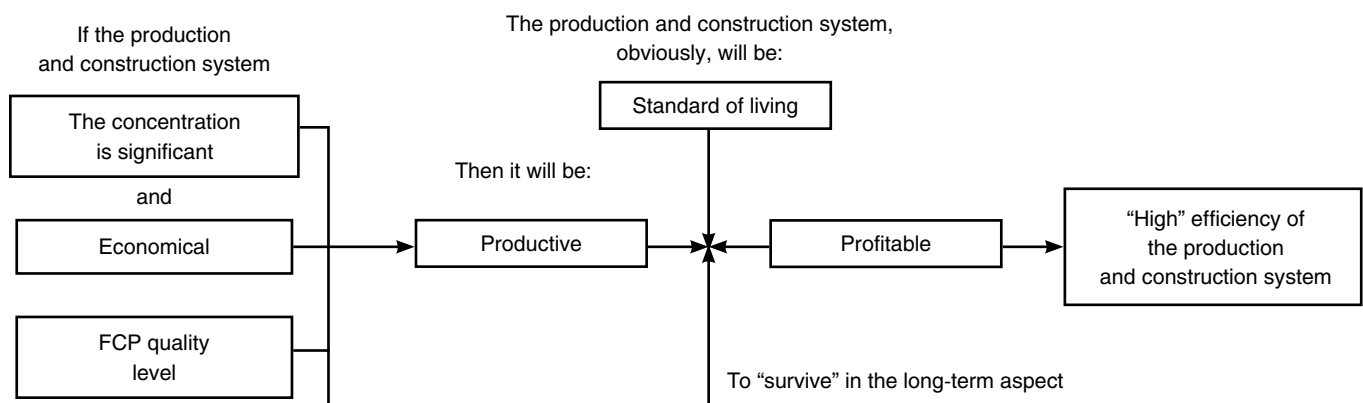


Fig. 2. Hypothetical cause-and-effect relationships between the meters (criteria) of effectiveness of the potential intensity of the production and construction system

► Constructed structures and various products are listed as part of the production stock of contractors: reinforced concrete, concrete, metal, wood, as well as electrical and sanitary units, blanks, etc. Basic building materials, structures and products, such as cement and concrete mixtures, metal and metal products, timber, sanitary and electrical materials, roofing, etc. rank high among the production stock. The share of basic building materials accounts for more than 50 % of the production stock held by the contractor. Other auxiliary materials are necessary for the maintenance of construction operations (cleaning, lubricating, etc.); spare parts of machines and equipment, non-inventory containers are not treated as fixed assets (barrels, bags, etc.) needed for temporary buildings and household premises [11].

At the same time, the following four options can boost the aggregate potential of industrial housing construction enterprises and improve the labour productivity in the future (Fig. 4).

For each of the four options (see Fig. 3) actual t_r and standard t_n of the duration of production and construction processes are determined [12]. After identifying the optimal duration of the process, only those options that meet the conditions are accepted $t_{t,opt} \leq t_n$.

EVALUATION OF POTENTIAL INTENSITY CRITERIA

The ratio between productivity, cost recovery and profitability is presented in formula (4).

$$\left. \begin{array}{l}
 \Delta \text{ production volume} \times \Delta \text{ production price} = \Delta \text{ income} \\
 \begin{array}{ccc}
 \parallel & \parallel & \parallel \\
 \Sigma[(Q_i^o) \text{ period2} \times (p_i^o) \text{ period2}] = CI \text{ period2} \\
 \Sigma[(Q_i^o) \text{ period1} \times (p_i^o) \text{ period1}] = CI \text{ period1} \\
 \Sigma[(Q_i^i) \text{ period2} \times (p_i^i) \text{ period2}] = CP \text{ period2} \\
 \Sigma[(Q_i^i) \text{ period1} \times (p_i^i) \text{ period1}] = CP \text{ period1}
 \end{array} \\
 \parallel & \parallel & \parallel \\
 \Delta \text{ amount of resources} \times \Delta \text{ price of resources} = \Delta \text{ cost} \\
 \text{Column1} \times \text{Column2} = \text{Column3} \\
 \text{"performance"} \times \text{"cost recovery"} = \text{"profitability"}
 \end{array} \right\} (4)$$

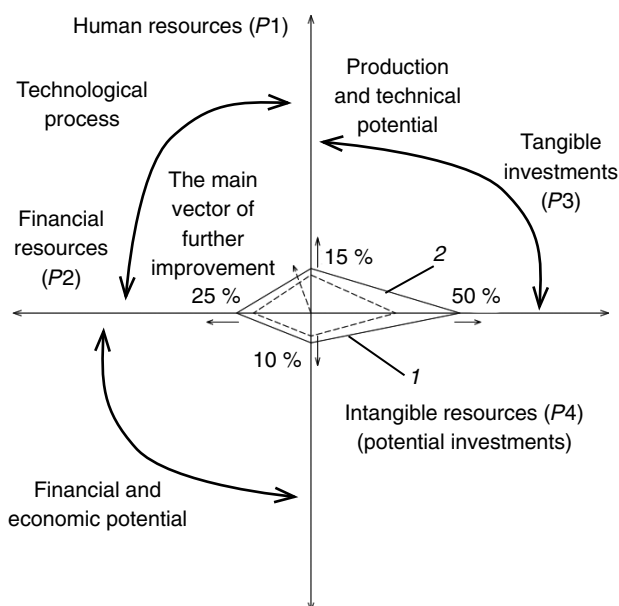
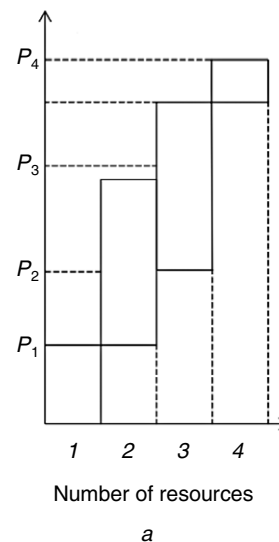


Fig. 3. The total potential of the production and construction system (the case of Kazan DSK PJSC): 1 — planned value; 2 — actual value

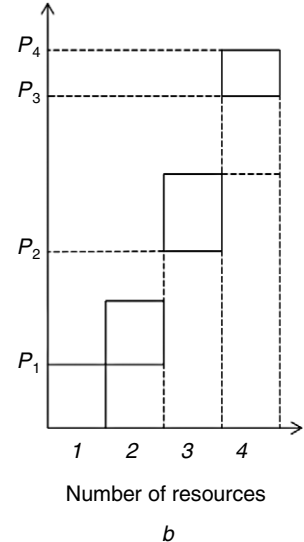
The potential of the resource and the DSK

The potential of the resource and the company

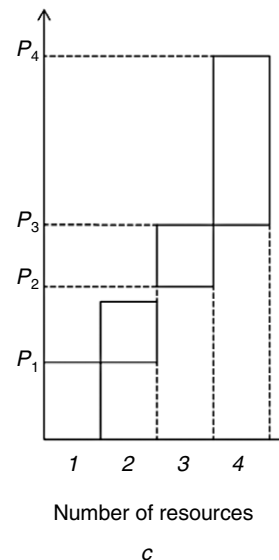


The potential of the resource and the DSK

The potential of the resource and the company



Resource and enterprise potential



Resource and enterprise potential

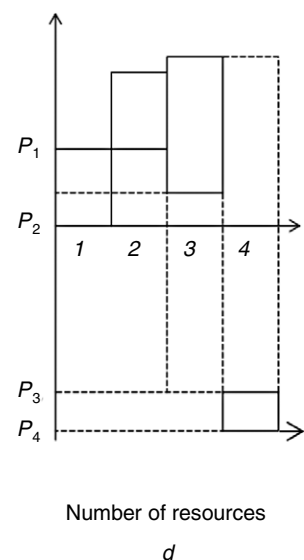


Fig. 4. Alternative options of formation of the aggregate potential of an industrial housing construction enterprise

Currently, it is evident that the behaviour of a manager of an industrial housing construction enterprise depends more on his ideas than "reality". Nowadays managers believe that their freedom of action is largely limited by uncontrolled factors. Potentially, this circumstance can have an impact on the prospects for measuring productivity [13].

When using formula (4), they try to develop and deepen the traditional profit analysis (Column 3). They realize that the ability to assess the causes of profit changes is an important element of the control system. At the same time, the ratio between the actual

and standard duration of the production and construction process determines the potential of the labour productivity growth PI :

$$PI = \left(1 - \frac{Q - \sum D_i}{Q} \times \frac{T_n}{T_f} \right) \times 100\%, \quad (5)$$

where Q — construction cost; D_i — total damages; T_n — standard duration; T_f — actual duration.

Indicators of capital return R and labour productivity PI are interrelated as follows:

$$R = \frac{V}{F} = \frac{V/u}{F/u} = \frac{PI}{K}, \quad (6)$$

where V is the the volume of the construction works; u is the average number of employees/workers engaged in construction and installation; F is the cost of fixed assets used in the performance of

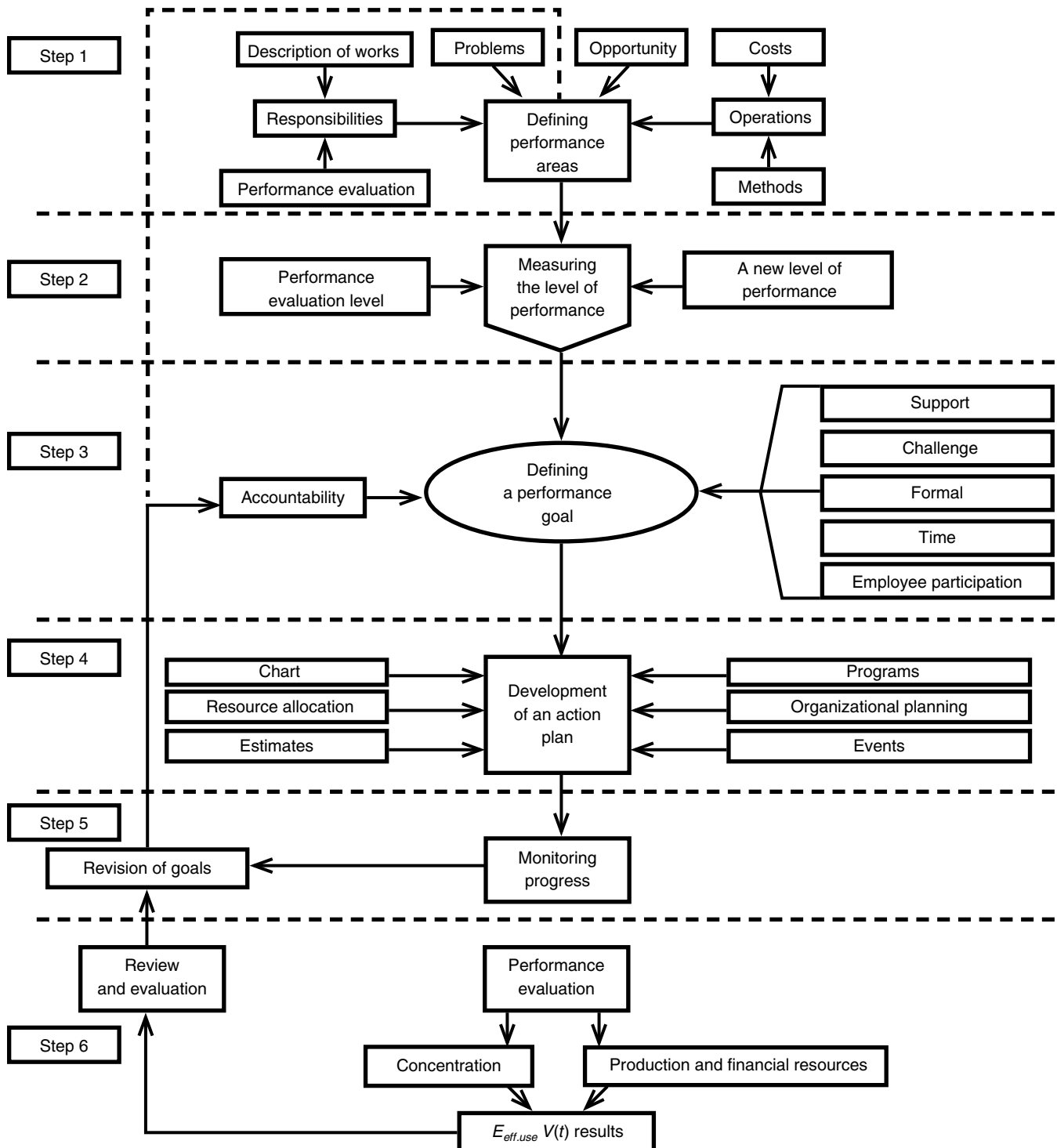


Fig. 5. The process of managing the performance of the DSK

- construction work; K is the capital intensity of the labour of one employee/worker employed at the DSK enterprise (including main production and construction) [14].

The net profit amount in itself is not a sufficient reason to assess the potential intensity of an industrial housing construction enterprise or the efficiency of using its production and technical potential, including labour resources (workforce).

Net profit can only confirm that a satisfactory balance between income and costs has been achieved. Let's go back to formula (4).

Formula (4) shows the main ratio of productivity, a change in the volume of production to a change in costs. Each organizational system has its own performance index for each resource. Column 2 shows the cost recovery index, i.e. a change in product prices relative to a change in resource prices. Column 3 shows the profitability index. Given that all other factors are constant, namely the prices of products and resources, an increase in the productivity index will entail an increase in profits [15]. Similarly, with constant volumes and a long-term cost recovery index (product prices are rising faster than prices of cost elements), profits will be positive, at least, in the short term.

The effectiveness of the integral indicator of potential intensity should be diagnosed using the minimum number of most informative, non-duplicating relative indicators of production and construction activities.

As an option, it is proposed to use a resource approach based on determining the value of the DSK enterprise productivity per unit of production and financial resources (balance sheet currency) with the definition of the areas of efficiency of the use of potential intensity $V(t)$ as the critical value, optimal (normal) value, rational value.

$$E_{\text{eff. use}} V(t) = \frac{Pf}{\text{resources}}. \quad (7)$$

FINAL PART

A rational value can only be achieved in the case of high potential intensity (efficiency) of the production and construction system due to the proper organization of labour and motivation of administrative and managerial personnel (labour resources P_1) related to the structure of fixed assets P_3 , current and intangible assets (P_2 and P_1), which implies the potential efficiency of their use with minimal resources and time.

Fig. 5 shows the process of managing the productivity of an industrial housing construction enterprise and achieving the maximum value of $V(t)$.

The specific weight of the influence of a group of indicators on the integral indicator $V(t)$ is distributed as follows (according to the analysis of the activities of 22 DSK):

- business activity indicators (productivity, return on funds) — 37 %;
- financial stability indicators — 42 %;

- solvency indicators — 8 %;
- profitability indicators — 13 %.

REFERENCES

1. *Surveying. Organization, expertise, management : textbook in 3 parts. Part I. Organizational and technical module.* P.G. Grabovyy (ed.). Moscow, MGSU, ASV Publ., Enlightener Publ., 2021; 584. (rus.).
2. Zavyalov D.V. *Rational choice of the assortment of finished construction products at the enterprises of the construction industry : dissertation of the Candidate of Economic Sciences.* Moscow, 2002; 203. (rus.).
3. Ovsyannikova T.Y. *The market of housing investments: analysis of factors of post-crisis dynamics.* Real Estate: Economics, Management. 2015; 2:38-44. URL: <https://elibrary.ru/item.asp?id=24154317> (rus.).
4. Khovanskaya G.P., Samosudova N.V. *The current state and the challenges in the regulation of housing policy and housing.* Real Estate: Economics, Management. 2018; 3:6-11. URL: <https://elibrary.ru/item.asp?id=36332730> (rus.).
5. *Organization of construction and real estate development : textbook in 2 parts. Part 1: Organization of construction.* 4th ed. ; P.G. Grabovyy (ed.). Moscow, MGSU, ASV Publ., Enlightener Publ., 2018; 648. (rus.).
6. *Economics and real estate management : textbook in 2 parts. Part 2: Real estate Management ;* P.G. Grabovyy (ed.). 4th ed. Moscow, ASV Publ., Educator Publ., MGSU, 2019; 508. (rus.).
7. Baronin S.A., Bizhanov S.A., Lunyakov M.A., Tarkhanova E.V., Yankov A.G. *Theoretical and conceptual foundations of the development of territorial affordable housing markets : monograph ;* S.A. Baronin (ed.). Penza, PGUAS, 2015; 192. (rus.).
8. Ostashko V.Ya. *Economic problems of life cycle management of enterprises of the investment and construction complex : dissertation of the Doctor of Economics.* Moscow, MGSU, 2003; 482. (rus.).
9. Bredikhin V.V. *Analysis of existing methods for solving the problem of reproduction of residential real estate : monograph.* Kursk, SWSU, 2012; 163. (rus.).
10. Martin B. *Foresight in science and technology. Technology Analysis and Strategic Management.* 1995; 7(2):139-168. DOI: 10.1080/09537329508524202
11. Grabovyy P.G. *Reconstruction and renewal of the existing city development : textbook : in 2 parts ;* Grabovyy P.G., Kasyanov V.F. (ed.). Moscow, ASV Publ., 2020; 672. (rus.).
12. Prokopenkova V.V. *Management of the resource potential of associations of housing construction entities : dissertation of the Candidate of Economic Sciences.* Moscow, MGSU, 2016; 197. (rus.).
13. Krylatkov P.P. *Economic aspects of industrial enterprise integrity management. Sustainable Development of Russian Regions: Economic Policy in the Conditions of External and Internal Shocks : Collection of materials of the XII International Scientific and Practical Conference.* (Ekaterinburg, April 17-18, 2015). Ekaterinburg, UrFU, 2015; 1091-1102. (rus.).
14. Pankratov E.P., Pankratov O.E. *Fixed assets of construction : reproduction and renewal. Method of the Academy of Investments and Economics of Construction.* Moscow, Ekonomika Publ., 2017; 351. (rus.).
15. *Risks in modern business: methodology and practice ;* P.G. Grabovyy (ed.). 2nd ed. Moscow, Enlightener Publ., 2017; 285. (rus.).

Производительность предприятия индустриального домостроения как главный индикатор роста потенциалоемкости производственно- строительной системы

Измерению производительности на предприятиях стройиндустрии и в строительной отрасли в целом может мешать разнообразие производимой продукции и ис-

пользуемых ресурсов. Человеко-часы нельзя складывать с м³ выложенной бетонной смеси, рублями капитального оборудования, киловатт-часами и т.п. для получения суммарных ресурсов. ПАО «Казанский ДСК» или строительная группа «Самолет» не вправе складывать м² наружных панелей, м² построенных каркасных площадей объектов жилой и коммерческой недвижимости методом непрерывного бетонирования и т.п., чтобы получить итоговую продукцию. Так как выигрыш и потери, связанные с производительностью, распределяются через системы цен между потреби-

телями предприятием домостроения, то для анализа такого распределения представляется уместным использовать мерило этой системы — деньги; в России удобным общим знаменателем служит рубль. Однако рубль — величина переменная, особенно в нынешних экономических условиях. При использовании денежной единицы рубля в качестве инструмента агрегирования эти колебания необходимо минимизировать. Одна из главных особенностей предлагаемого подхода состоит в наличии соответствующего корректирующего (ревалюирующего) механизма. Этот метод позволяет:

- измерять степень влияния изменений производительности на прибыль;
- определять, насколько приемлемы и разумны изменения производительности в отношении интегрального показателя потенциальности предприятия;
- установить влияние уровня производительности предприятия на его конкурентные позиции на территориальном уровне жилищной и коммерческой недвижимости.

В статье дается оценка основным критериям потенциальности (результативность) и их влияние на прибыльность и производительность [1].

Ключевые слова: потенциальность, производительность, меры прибыльности, совокупные доходы, совокупные расходы, себестоимость, фондоотдача

СПИСОК ИСТОЧНИКОВ

1. Сервейинг. Организация, экспертиза, управление : учебник в 3-х ч. Ч. 1. Организационно-технический модуль / под общ. науч. ред. П.Г. Грабового. М. : МГСУ, Изд-во АСВ, Просветитель, 2021. 584 с.
2. Завьялов Д.В. Рациональный выбор ассортимента готовой строительной продукции на предприятиях стройиндустрии : дис. ... канд. экон. наук. М. : 2002. 203 с.
3. Овсянникова Т.Ю. Рынок жилищных инвестиций: анализ факторов посткризисной динамики // Недвижимость: экономика, управление. 2015. № 2. С. 38–44. URL: <https://elibrary.ru/item.asp?id=24154317>
4. Хованская Г.П., Самосудова Н.В. Современное состояние и проблемные задачи в сфере регулирования жилищной политики и ЖКХ // Недвижимость: экономика, управление. 2018. № 3. С. 6–11. URL: <https://elibrary.ru/item.asp?id=36332730>
5. Организация строительства и девелопмент недвижимости : учебник в 2-х ч. Ч. 1: Организация строительства / под общ. ред. П.Г. Грабового. 4-е изд., перераб. и доп. М. : МГСУ, Изд-во АСВ, Просветитель, 2018. 648 с.
6. Экономика и управление недвижимостью : учебник в 2-х ч. Ч. 2: Управление недвижимостью / под ред. П.Г. Грабового. 4-е изд., перераб. и доп. М. : МГСУ, Изд-во АСВ, Просветитель, 2019. 508 с.
7. Баронин С.А., Бижанов С.А., Луняков М.А., Тарханова Е.В., Янков А.Г. Теоретические и концептуальные основы

развития территориальных рынков доступного жилья : монография / под общ. ред. С.А. Баронина. Пенза : ПГУАС, 2015. 192 с.

8. Осташко В.Я. Экономические проблемы управления жизненным циклом предприятий инвестиционно-строительного комплекса : дис. ... д-ра экон. наук. М. : МГСУ, 2003. 482 с.

9. Бредихин В.В. Анализ существующих методов решения проблемы воспроизводства объектов жилой недвижимости : монография. Курск, Изд-во ЮЗГУ, 2012. 163 с.

10. Martin B. Foresight in science and technology // *Technology Analysis and Strategic Management*. 1995. Vol. 7. Issue 2. Pp. 139–168. DOI: 10.1080/09537329508524202

11. Грабовый П.Г. Реконструкция и обновление сложившейся застройки города : учебник в 2 ч. / под общ. ред. П.Г. Грабового, В.Ф. Касьянова. М. : Изд-во АСВ, 2020. 672 с.

12. Прокопенкова В.В. Управление ресурсным потенциалом объединений субъектов жилищного строительства : дис. ... канд. экон. наук. М. : МГСУ, 2016. 197 с.

13. Крылатков П.П. Экономические аспекты управления целостностью промышленного предприятия // Устойчивое развитие российских регионов: экономическая политика в условиях внешних и внутренних шоков : сб. мат. XII Междунар. науч.-практ. конф. (г. Екатеринбург, 17–18 апреля 2015 г.). Екатеринбург : УрФУ, 2015. С. 1091–1102.

14. Панкратов Е.П., Панкратов О.Е. Основные фонды строительства: воспроизводство и обновление. М. : Экономика, 2017. 351 с.

15. Риски в современном бизнесе: методология и практика / под ред. П.Г. Грабового. 2-е изд., перераб. и доп. М. : Просветитель, 2017. 285 с.

Об авторах: **Грабовый Петр Григорьевич** — доктор экономических наук, профессор, заведующий кафедрой организации строительства и управления недвижимостью; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; РИНЦ ID: 302471; Scopus: 57164862700; GrabovyyPG@gic.mgsu.ru;

Жихарев Дмитрий Федорович — соискатель кафедры организации строительства и управления недвижимостью; **Национальный исследовательский Московский государственный строительный университет (НИУ МГСУ)**; 129337, г. Москва, Ярославское шоссе, д. 26; Zkikharev.77@mail.ru.

For citation: Grabovyy P.G., Zhikharev D.F. The productivity of an industrial housing construction enterprise as the main indicator of the potential intensity growth of the production and construction system. *Real estate: economics, management*. 2022; 2:11-17.

Для цитирования: **Грабовый П.Г., Жихарев Д.Ф.** The productivity of an industrial housing construction enterprise as the main indicator of the potential intensity growth of the production and construction system // *Недвижимость: экономика, управление*. 2022. № 2. С. 11–17.