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# INFORMATION MANAGEMENT SYSTEM OF INDUSTRIAL ENTERPRISE IN CONDITIONS OF DIGITALIZATION

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## ABSTRACT

*The article is devoted to the problem of development and application of information technologies in the strategic management of industrial enterprises under uncertainty based on mathematical modeling. The purpose of the article is to develop tools that support decision-making when choosing strategic guidelines for the development of enterprises using economic and mathematical methods. The study of the system of strategic management of industrial enterprises, which has the property of development, based on the application of the methodology of system analysis. A model of the strategic management process in the form of a logical structure containing a combined decision-making procedure for solving problems, ranging from the study of the environment and the development of the mission, and ending with the creation of economic and mathematical tools and its use to evaluate decisions. The economic and mathematical tools to support decision-making on the strategic guidelines for the development of industrial enterprises in the conditions of stochastic uncertainty. As the characteristics of the cost-effectiveness of strategies selected measure of profitability. The toolkit is*

*created in the class of simulation models and allows you to reproduce the dynamics of enterprise profits and capital costs by the method of statistical tests, as well as to predict on this basis the profitability of various options of strategic guidelines for the operation of the enterprise. The constructed economic and mathematical models are algorithmized and implemented in a software product. The article demonstrates the work of the software product in the course of simulation experiments and their processing in the evaluation of the selected strategic benchmark in terms of profitability. The built model tools are designed for use in industrial enterprises to support strategic decisions.*

**Key words:** digitalization, information management, stochastic uncertainty, profitability, simulation model

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# 1. INTRODUCTION

A characteristic feature of the present time is the widespread use of information technologies that radically change the management processes of industrial enterprises. The external environment in which modern enterprises are immersed is characterized by ongoing bifurcation changes that lead to instability in the functioning of industrial enterprises in terms of fluctuations in the business environment. These fluctuations caused by the development of globalization, the intensification of innovation, increasing the role of intangible assets, and more Promising direction for the effective development of industrial enterprises, is applying the strategic management methods, allowing to solve the problems of its long-term development. The formation of the organization's mission, long-term development plans is not proof of the presence of the industrial enterprise strategic management mechanisms. Building long-term plans does not allow taking into account the impact of changes in the environment. The most important result of the development of strategic management processes is the development of information technologies and embedded in their structure economic and mathematical models that adequately respond to changes in the business sphere.

The high dynamism of the external environment, as well as the processes of non-equilibrium and uncertainty occurring in it, make it necessary within the framework of strategic management to carry out a quantitative assessment of various scenarios of industrial enterprise development for the long term, as a guarantee of its sustainable development in the market environment.

The crisis processes taking place in the world economy in combination with anti-Russian sanctions and the policy of import substitution, as well as tough competition with foreign enterprises, actualize the problem of creating an effective management system that is sensitive to fluctuations in the external environment and is able to influence the efficiency of production processes and the quality of products. The use of traditional planning methods based on the system of accounting and analysis does not give the desired effect in the management of time and dictate the need to improve them. This leads to a significant increase in the interest of industrial enterprises in the application of principles and methods of strategic management to improve the competitiveness of products and ensure stable economic growth. Strategic management of industrial companies need to produce based on application of modern

computing systems with in-built economic and mathematical models with the aim of quantifying and scientific validity of decisions.

## 2. LITERATURE REVIEW

As a modern scientific direction, the theory of strategic management was created at the turn of 1980-1990. The Foundation of this theory was laid by such foreign researchers As Bowman E., Ansoff, N., Boyd, W. [1, 2, 3]. As a management term, strategic management became known in the middle of the twentieth century, when organizations exacerbated the problem of influence on the processes of their functioning of environmental factors, which gave rise to a large number of publications of domestic and foreign researchers, which are different interpretations of the concept of "Strategy". Thus, the strategy is represented by the management plan, the implementation of which strengthens the position of the organization and ensures the satisfaction of the needs and the achievement of its goals. Mescon, M., Albert, M. [5] believe that the strategy should be a comprehensive plan, ensuring the implementation of the enterprise's mission. A similar conclusion was reached by Shekhovtseva, L. S., Tebekin, A. [6, 7], and others. Theoretical and methodological problems of improving the strategic management in Russia devoted to the work of Kuznetsov, Yu.V., Kaisarova, V.P. [8], Valdaitsev, S.V., Spiridonova, V.A., Myasnikova, S.V. [9], Rybakov, F.F. [10]. Distinctive features of the strategy of industrial development with structural reforms in the industrial sector of China is seen in the studies Ziyadin, S., Kabasheva, N., Suieubayeva, S., Moldazhanov, M. [11]. The authors of this article support the position that the key issue of strategic management is to ensure the development of the organization under the influence of unstable environment. In this regard, the main direction of creating tools used in strategic management is to ensure adequate response to variations in the parameters of the environment. Among the domestic studies devoted to the development in the cluster approach of the strategy of development of territories of advanced economic development, it is necessary to highlight the work of Bodrunova, S.D., which studied the practical application of this concept in the Russian economy on the example of the Ural region [12].

The research of the current approaches to the management of the strategic development of the territories is devoted to the work of Yurasov, A. A., Mukhin, M.A., Kochin, K. F. [13]. Questions of the effectiveness of clustering of economic processes are reflected in the researches of Adamenko, A., Blaginin, V. A., Vasneva S. A., Prokhorov, V. V., Tupchienko, V. A. [14]. The research in this regard socio-economic space of regions of Russia in article Blaginina, V. A., Plisetskaya, E. L., Comerci, S. I., Vasiliev, N. K. [15]. The research of management information systems in tourism in terms of digitalization, is devoted Watkins, M., Ziyadin, S., Imatayeva, A. Kurmangalieva, A., Blembayeva, A. [16]. The introduction of the results of scientific research into industrial production in the diversification of the ways of commercialization of the R&D, is reflected in the Ziyadin, S., Omarova, A., Doszhan, R., Saparova, G., Zharaskyzy, G. researches [17].

The purpose and formulation of the research problem. The article deals with the problem of improving the tools used in the strategic management of industrial enterprises, which is the driver of its economic development. Carrying out the analysis of functioning of industrial enterprises the authors identified that a distinctive feature of processes is, first, the ever-changing economic conditions resulting from technological aspects and innovation, the need to use high technology etc. Secondly, the key problem of enterprise management is the need to maximize its production efficiency, profits and profitability, retaining old markets and as noted Ziyadin, S. [18], the conquest of new through international economic integration and, as a result, eliminate barriers to movement of goods, services, capital and labor in industrial

enterprises, meet the needs of consumers. In this regard, the authors of the article solve the problem of research of strategic management of industrial enterprises from the point of view of developing systems. The research process is carried out on the basis of the methodology of system analysis using the proposed Streltsova, E. D. concept of dialectical development with consideration as an internal source of development of the dialectical unity of the target category of activity and the category of means to achieve the goal [19], Bogomyagkova [20]. The role of the target category is the selected scenario, a strategic reference point, which leads to a sequence of actions as categories of means to achieve the goal. This sequence of actions also includes strategic management, the result of which is the development of an industrial enterprise strategy. In this formulation, methodological research procedure of system analysis is logically connected four objects: <the strategy formulation process are related to the category of funds reaching the goal> ⇔ <strategy as the development object belonging to the target category> ⇔ <strategy as a sequence of actions that are related to the category of means to achieve goals> ⇔ <strategic benchmark (target)>.

The concept of logical link means that all goals are placed in a single logical chain of activities in the process of phased achievement of the goal in the strategic management system, as a developing system, where the goals are transformed into funds, and then the means – into goals. In the concept of "quality of decisions" is the meaning of a set of properties by which the control object is transferred to a state that allows achieving the goal. As for efficiency, this concept has the meaning of the properties of actions that can lead to the desired results [15]. The article considers profitability as an indicator of strategic management efficiency. The application of the method of system analysis to the proposed object led to the consideration of a complex management goal, which is a dialectical unity of sub-goals: <improving the efficiency of the strategic development management process> ⇔ <improving the quality of management decisions> ⇔ <improving the efficiency of decisions to determine the strategic direction of development> ⇔ <improving the quality of decisions>.

The application of the methodology of system analysis to the proposed object of study implicated the conceptual representation of the strategic management of the interaction of systems $S_1$ and $S_2$ (Fig.1).

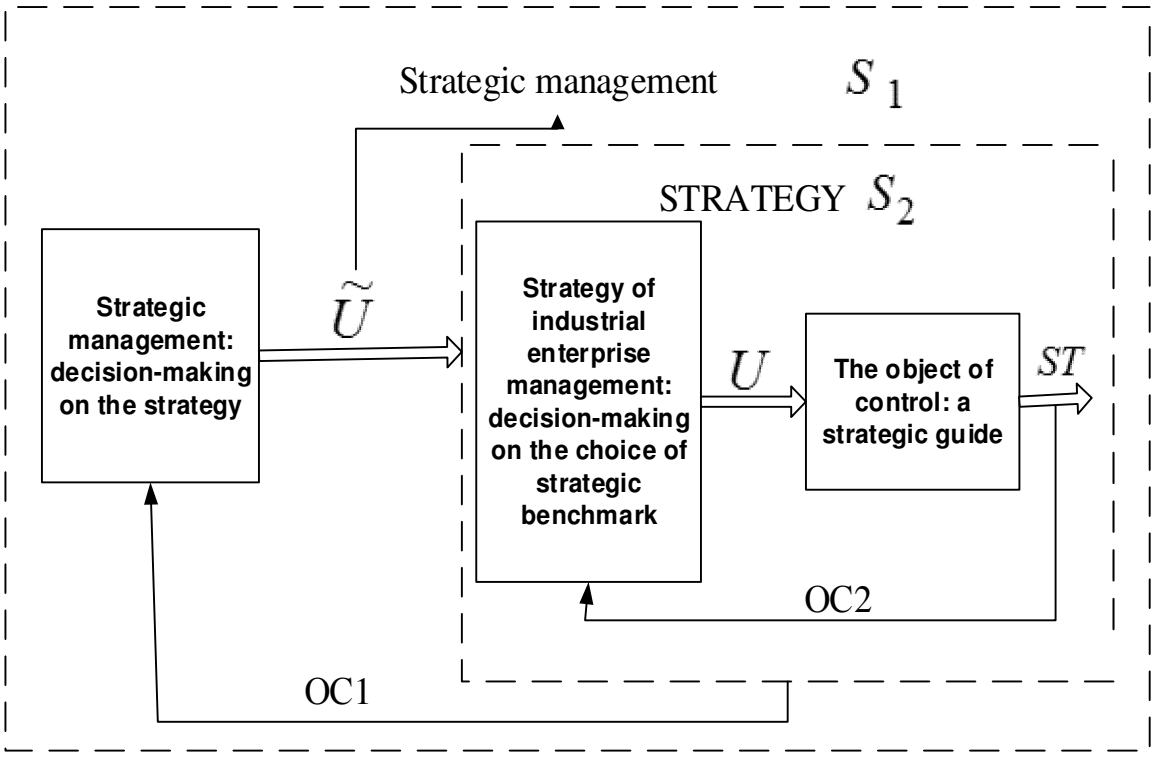


**Figure 1** Conceptual model of strategic management as a developing system

The system $S_1$ identifies strategic management, in which the object of decision-making $\tilde{U}$ is the choice of management strategy. The system $S_2$ carries out the target use of the adopted strategy in the process of choosing a strategic reference point for the operation of an industrial enterprise. The process of strategic management is represented by the author in the form of a actions sequence to establish the trajectory of productivity growth and efficiency of the industrial enterprise in relation to the level of competitors: <study of the state of the business environment> ⇔ <purpose of the mission and objectives of the enterprise> ⇔ <formation of a set of strategic guidelines> ⇔ <choice of strategic guidance>.

The implementation of each of the designated actions involves the implementation of many tasks to be solved during the iterative process with feedbacks OC1, OC2, and providing correction of solutions to problems in the previous stages. Following the methodology of the system approach, the task "Strategic management" $Z$ is divided into sub-tasks $Z = \{Z_{ij}\}$, indexes $i = \{1, 2\}$ and $j$ which mean, respectively, the stage of strategic management and the number of tasks, where $i = 1$ identifies the stage of strategy development, and $i = 1 -$ the stage of its implementation.

The authors propose a model of formal representation of strategic management in the form of a logical structure of decision-making sequence. In the logical framework of the local tasks $Z_{ij}$ described by the tuple $\langle N_{ij}, T_{ij}, U_{ij} \rangle$ with the components of the signifying respectively: the name of the problem being solved; the solution to a procedure or instrumentation; managerial decision. The logical structure makes it possible to set the order on a set of tasks $Z_{ij}$, considering them as an integral, logically connected, controlled complex [15], solved with the help of a holistic procedure $T = \{ T_{ij} \}$, the use of which allows to obtain a strategic reference point of the enterprise.

The integral procedure $T = \{ T_{ij} \}$ includes the model tools constructed by the authors, which gives an assessment of the chosen strategic reference point and set out in the next section of this article. In Fig. 2 the logical structure of strategic management of the industrial enterprise is given. In the proposed logical structure of the problem $Z_{11}$, $Z_{14}$, $Z_{21}$, $Z_{24}$ are solved through the use of built by the authors of decision-making procedures as a tool of strategic management. The strategy development stage ($i = 1$) uses decision procedures $T = < T_{11}, T_{12}, T_{13}, T_{14} >$, which include both formal economic and mathematical methods ( $T_{11}$ – mathematical and statistical methods, $T_{14}$ – computer modeling methods) and heuristic methods, which are not formal decision methods $T_{12}$, $T_{13}$.

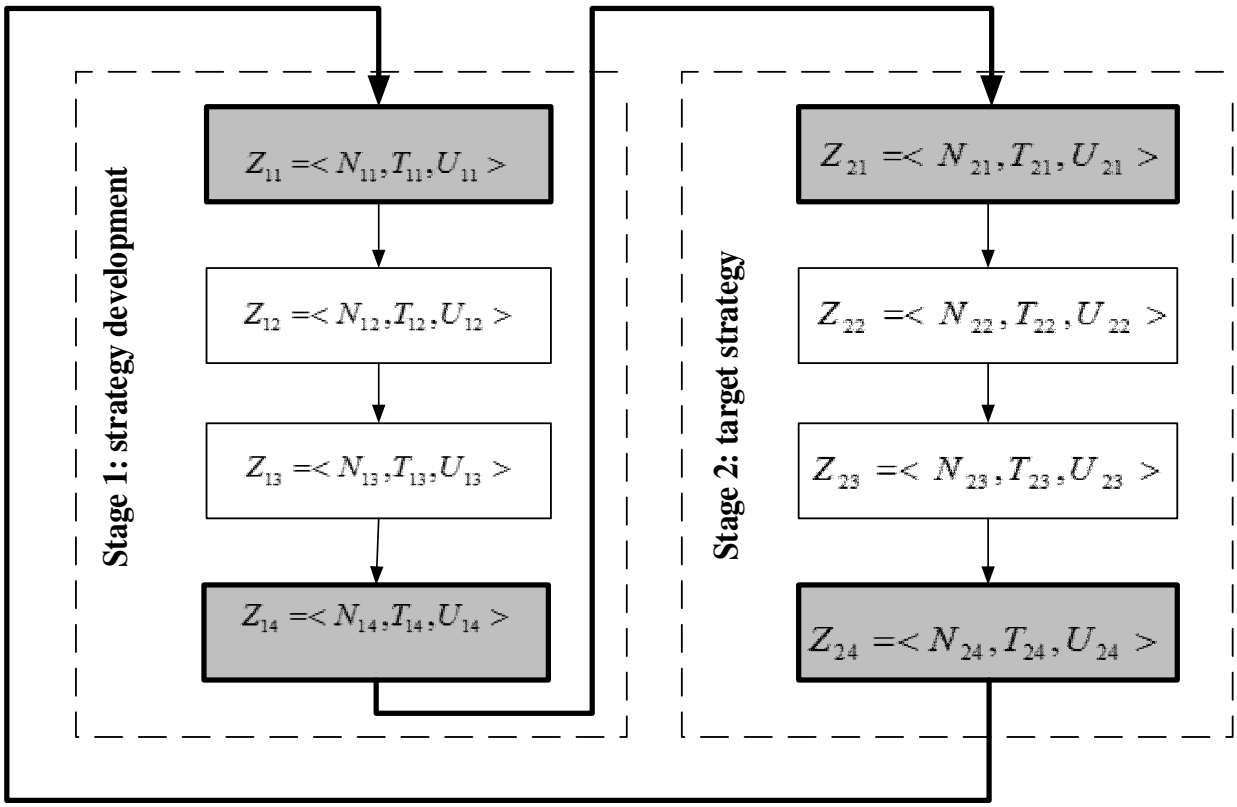


**Figure 2** Logical structure of strategic management of an industrial enterprise

Based on the use of formal methods, the following model tools have been created:

- $U_{11}$ – the mathematical model of construction of laws of distributions for the financial flows reflecting sizes of profit and expenses of the capital (further in article this model is designated as $MOD_1$);

- $U_{14}$ – a model that allows you to predict the profitability of a strategic benchmark (hereinafter referred to as the model $MOD_2$).

At the next stage, related to the implementation of the strategy ($i = 2$), the decisions $U_{11}$, $U_{14}$ are the means used in the selection process of management strategic decisions. Thus, at the stage of targeted use, the solutions $U_{11}$, $U_{14}$ perform the functions of decision-making

procedures $T_{21}$, $T_{24}$, thereby demonstrating the transformation of goals into means , as in the developing system. The tasks $Z = \{Z_{ij}\}$, on the set of which the order relation is given by means of a logical structure are described in table 1.

The development of economic-mathematical apparatus and computer technology will allow creating further tools for solving semi-structured problems and use formal procedures, models, algorithms instead of informal decision procedures.

**Table 1** Objectives and decision-making procedures in the logical framework of strategic management

| Stages | Task designation | Tasks | Decision procedures | Control solutions |
|---|---|---|---|---|
| $i = 1$ STRATEGY DEVELOP MENT | $Z_{11}$ | $N_{11}$ – approaches and tools for environmental impact researches | $T_{11}$ – statistical methods of information processing | $U_{11}$ – economic and mathematical models of the description of laws of distribution of environmental influences ($MOD_1$) |
| | $Z_{12}$ | $N_{12}$ – development of the mission of the industrial enterprise | $T_{12}$ – an informal method | $U_{12}$ – mission of the industrial enterprise |
| | $Z_{13}$ | $N_{13}$ – formation of a variety of strategic decisions | $T_{13}$ – an informal method | $U_{13}$ – a lot of strategic decisions |
| | $Z_{14}$ | $N_{14}$ – development of approaches and tools for assessing the results of management decisions used at the stage of selecting strategic guidelines | $T_{14}$ – computer simulation methods | $U_{14}$ – computer model of forecasting profitability ($MOD_2$) |
| $i = 2$ THE INTENDED USE OF THE STRATEGY | $Z_{21}$ | $N_{21}$ – environmental research: formalization of random variables "profit" and " capital expenditures» | $T_{21}$ – economic-mathematical model of formal description of random variables "profit" and " capital expenditures» ($MOD_1$) | $U_{21}$ – formal description of random variables "profit" and "capital expenditures" ($MOD_1$) in the form of distribution law |
| | $Z_{22}$ | $N_{22}$ – testing of compliance of strategic decisions of the mission adopted at the enterprise | $T_{22}$ – informal method | $U_{22}$ – conclusion on compliance of strategic decisions of the mission adopted at the enterprise |
| | $Z_{23}$ | $N_{23}$ – preparation of a set (portfolio) of strategic guidelines | $T_{13}$ – informal method | $U_{13}$ – strategic alternatives included in the portfolio |
| | $Z_{24}$ | $N_{24}$ – forecasting profitability that characterize a strategic benchmark | $T_{24}$ – computer model of forecasting profitability ($MOD_2$) | $U_{24}$ – quantitative justification of the strategic benchmark using the profitability indicator |

## 3. METHODOLOGICAL FRAMEWORK

Before the presentation of the material on the creation of strategic management tools in the article, guided by the principle of formal logic identity, the concept of "tool" of strategic management is defined. The meaning of the word "instrument", borrowed from the Latin "instrument", means a means of labor or a machine-built mechanism that performs some work. The authors of the article the concept of "a tool of strategic management" a meaning of a family of conceptual positions, theoretical and methodological approaches, methods, models and characteristics used in the course of making and implementing management decisions, allowing their implementation to make a choice of strategic guidance to ensure efficient progress of the companies in the long run, in conditions of uncertainty of external environment.

The key problem of strategic management of the industrial enterprise in the conditions of uncertainty of influence of environment is to ensure its efficiency and competitive advantages.

In a variety of performance indicators of industrial enterprises, indicators that reflect profitability play one of the main roles. Management of these indicators, reflecting the ratio between the values of profit and invested capital, has a strategic orientation and occurs in conditions of uncertainty, as profits and costs change randomly over time. Formal description of uncertainty and creation of economic and mathematical models to support decision-making is dictated by the need for quantitative justification of strategic decisions.

Considering the set of relative indicators of "profitability", we can conclude that these are the relative characteristics $\{REN_i\}_{i\in I}$, $I = 1,2,3,...,N$ of the economic efficiency of how different kinds of resources are used:

$$REN_i = \frac{PRIB_i}{CAP_i},\ i = \overline{1,N}, \tag{1}$$

Where, $REN_i -$ profitability indicator of the form $i$;

$PRIB_i -$ Profit gained from the profitability of the form $i$;

$CAP_i -$ Capital that generates profit $PRIB_i$.

If you designate a set of strategic guidelines in the portfolio, as $\{ST_i\}_{i\in I}$, and their characteristics of profitability, as $REN_{ij}$, where $i$ – a strategic benchmark, and $j$ – its rate of return, the task of decision-making management based on profitability indicators can be represented as the choice of such a strategy $ST_\alpha \in \{ST_i\}_{i\in I}$, in which profitability $REN_{\alpha j}$, $\alpha = \overline{1,k}$, $j = \overline{1,N}$ is the maximum (Fig. 3).

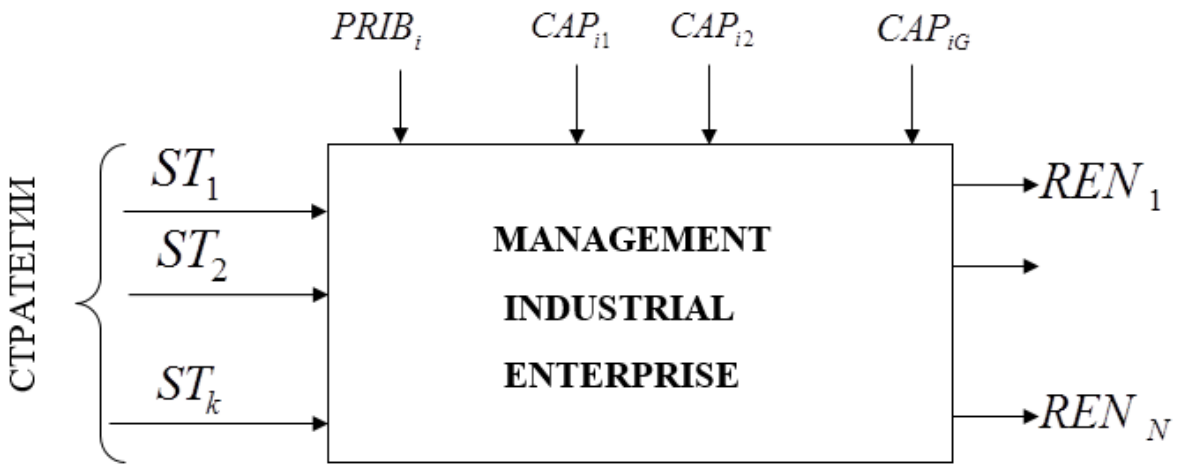


**Figure 3** Conceptual model of strategic management problem statement

In Figure 3, the alternatives $\{ST_i\}_{i\in I}$ play the role of control variables $REN_{ij}$ – outputs, and the values of profit $PRIB_i$ and capital $CAP_{ig}$, $g=\overline{1,G}$, used in the creation of profit – the role of perturbations. Elements $CAP_{ig}$ are assets, resources, flows, etc. (their total costs $CAP_i=\sum_{l=1}^{G} CAP_{ig}$).

The formal formulation of the strategic management problem has the form:

$$\forall ST_1, ST_2, ..., ST_k \ \exists ST^* / \ REN_1(ST^*) \Rightarrow \max; ...; REN_N(ST^*) \Rightarrow \max \quad (2)$$

The solution of the problem of management of the choice of strategic guidelines requires the creation of economic and mathematical models of forecasting profits $PRIB_i$ and capital expenditures $PRIB_i$ for the implementation of the strategic orientation of the industrial enterprise $ST_\alpha \in \{ST_i\}_{i\in I}$. Due to the random nature of changes in values $PRIB_i$ and $CAP_i$, $i=\overline{1,k}$ their formal description is made on the basis of the methods of mathematical and statistical research. The authors propose tools in the form of a family $MOD =< MOD_1, MOD_2 >$ of economic and mathematical models for assessing the results of decisions on the choice of strategic guidelines $ST_\alpha \in \{ST_i\}_{i\in I}$ for the operation of the enterprise, where $MOD_1$ formally describes the flow of current costs and profits for the implementation of the strategic benchmark, $MOD_2$ is designed to predict profitability and is made in the class of simulation models.

The laws of distribution of profit $PRIB_i$ and capital $CAP_i$, $i=\overline{1,k}$ flows are constructed in the form of interval series on the sample $X=\{x_1, x_2, ..., x_l\}$, reflecting through its elements $x_i \in X$ the current values of profit and cost (Table 2).

**Table 2** Range of distribution of relative frequencies of random variables

| The coordinates of the midpoints of the intervals | $\hat{x}_1$ | $\hat{x}_2$ | … | $\hat{x}_z$ |
|---|---|---|---|---|
| Estimate of probability | $\frac{n_1}{l}$ | $\frac{n_2}{l}$ | … | $\frac{n_z}{l}$ |

In Table 2, the values $\hat{x}_i$ represent the middle of the intervals into which the entire range of variation of sample data is divided by the length determined by the formula:

$$\Delta = \frac{x_{\max} - x_{\min}}{1 + 3{,}22 \ln(l)} \tag{3}$$

Where, $x_{\min}$, $x_{\max}$ – respectively, the minimum and maximum values in the sample, $l$ – are the sample length. The values $\frac{n_i}{l}$ are the relative frequencies of the random values in each interval.

The functioning of the mathematical model $MOD_1$ takes place according to the algorithm in the form of a sequence of the following actions:

1) Analysis of samples of random variables describing the financial flows of profits and costs from the point of view of the scope of their variation $RW = (x_{\max} - x_{\min})$, where, $x_{\max}$ – is the maximum and $x_{\min}$ – minimum values of the sample data $x_i \in X$.
2) The division of the range of variation $RW = (x_{\max} - x_{\min})$ at intervals $\Delta_\beta$, $\beta = \overline{1, z}$ of the size $\Delta = \frac{x_{\max} - x_{\min}}{1 + 3{,}22 \ln(l)}$.
3) Calculates the coordinates $\tilde{x}_\beta = x_0 + \beta \cdot \Delta$ of the points at the end of each numbered interval $\beta$. The coordinate of the beginning of the first interval $x_0 = x_{\min}$.
4) Calculating the coordinates $\hat{x}_\beta = x_0 + \frac{2\beta - 1}{2} \cdot \Delta$ of the midpoint intervals $\Delta_\beta$ ,$\beta = \overline{1, z}$.
5) Calculation of relative hit $\frac{n_\beta}{l}$ frequencies of values $x_i \in X$ for each interval $\beta$, $\beta = \overline{1, z}$, where, $n_\beta$ – the number of hits of values of random variables in each interval, $l_i$ – the length of the sample.

The constructed distribution laws are the initial data for the simulation model $MOD_2$, which functioning on the basis of the method of statistical tests for the generation of random numbers on the given distribution series describing the flows of profit $PRIB_i$ and capital $CAP_i$, $i=\overline{1,k}$. Drawn random numbers, considered as possible values of random variables $PRIB_i$ and $CAP_i$, $i=\overline{1,k}$, participate in the expression to determine the profitability $REN_i = \frac{\sum_{t=1}^{T} PRIB_i(t)}{\sum_{t=1`}^{T} CAP_i(t)}$, where $T-$ is the time interval; $CAP_i(t) = \sum_{g=1}^{G} CAP_{ig}(t)$.

The family of models is programmatically implemented in C++ as a PROFIT software product and allows you to reproduce the dynamics of the flow of quantities $PRIB_i$ and $CAP_i$, $i=\overline{1,k}$ and predict the value of profitability $REN_i$. The main window of the software product that appears when the program starts is shown in Fig. 4.

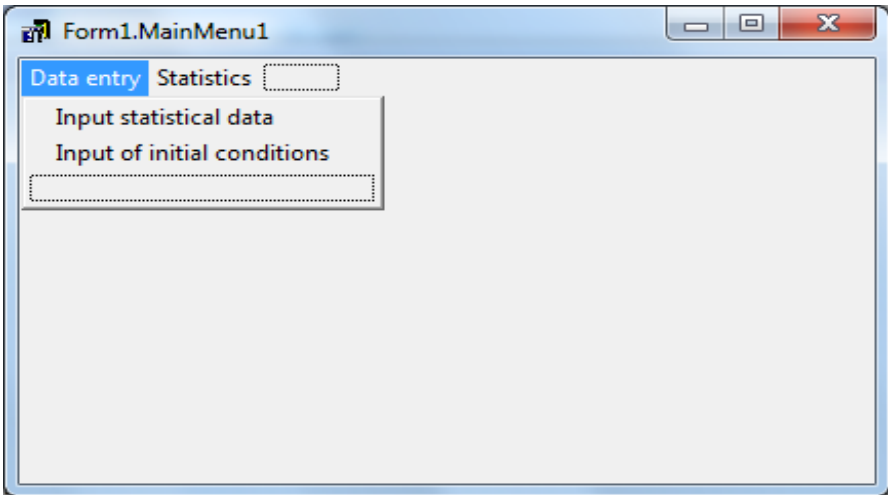


**Figure 4** The main window of the software product PROFIT

When you activate the menu item "data Entry" the program invites the user to enter statistical data characterizing random variables $PRIB_i$ and $CAP_i$, $i=\overline{1,k}$. When you select the "Statistics" menu item, a window appears on the computer screen with the image of the interval distribution series for the values $PRIB_i$ and $CAP_i$, $i=\overline{1,k}$ (Fig. 5).

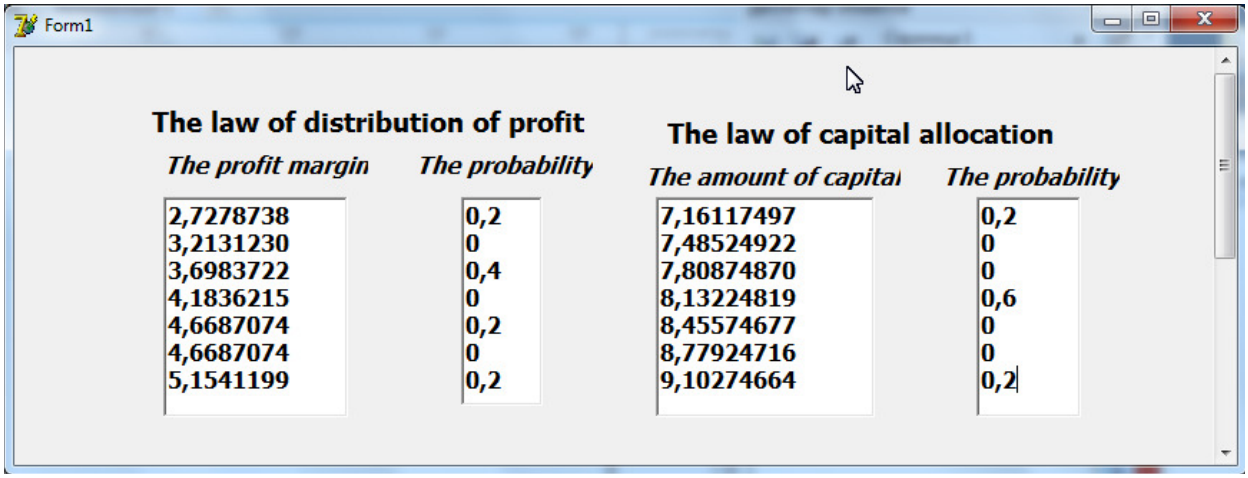


**Figure 5** The laws of distribution of random variables $PRIB_i$ and $CAP_i$, $i = \overline{1,k}$

The result of the program are generated projected values of profit $PRIB_i$ and cost $CAP_i$, $i = \overline{1,k}$, as well as the value of profitability (Fig.6).

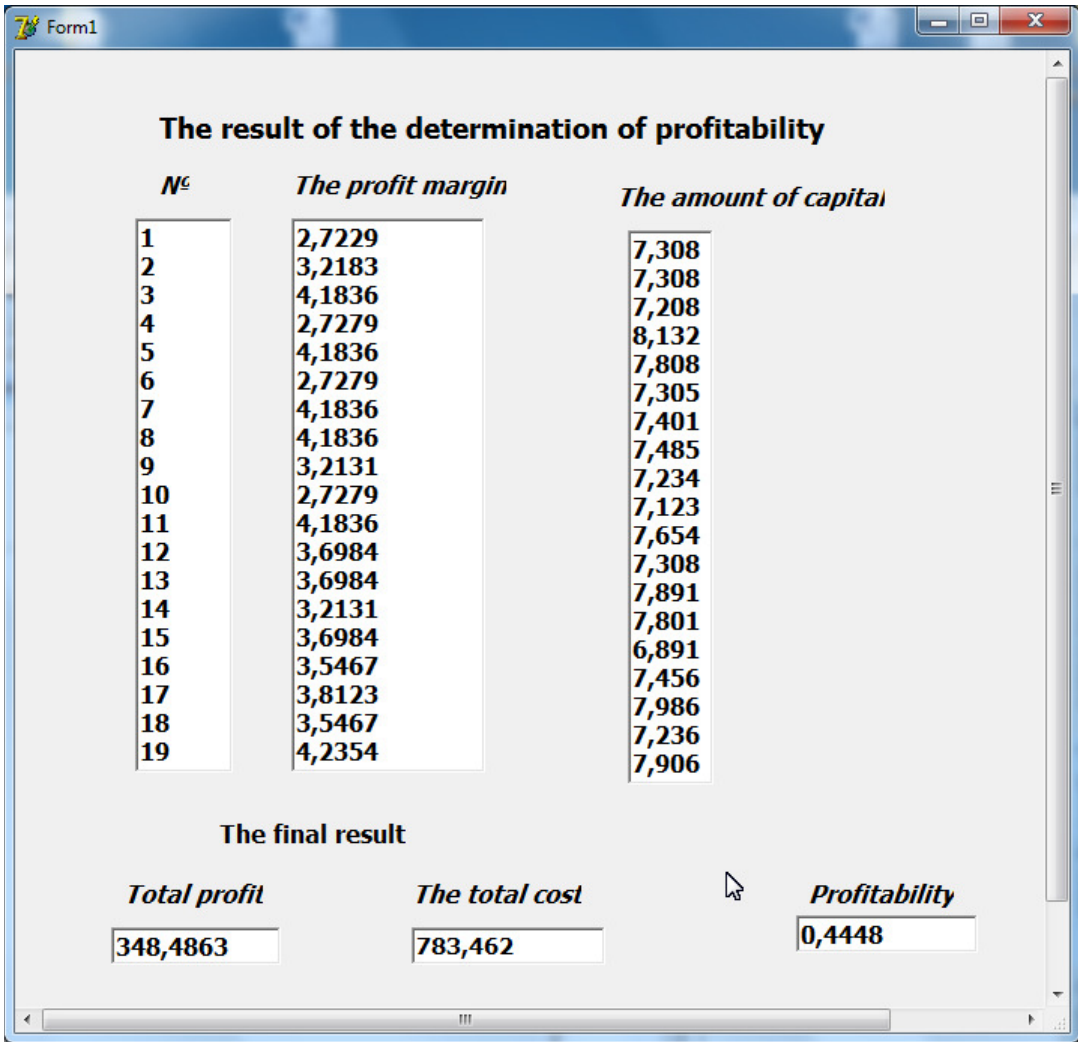


**Figure 6** The result of the determination of profitability

The PROFIT software product developed based on economic and mathematical models allows to make forecasts concerning profitability of a strategic reference point of development of the industrial enterprise and to estimate various alternatives of decision-making at strategic management.

Based on the application of the PROFIT software product, the authors propose a methodology for assessing the strategic orientations of an industrial enterprise, which is a sequence of actions.

1. Start the PROFIT program.
2. Preparation and input into the computer of the sample data characterizing the current size of profit $PRIB_i$ and expenses $CAP_i = \sum_{g=1}^{G} CAP_{ig}$, which values characterize the chosen strategic reference point $ST_i \in ST$ in development of the industrial enterprise.
3. Formal description of the laws of probability distribution, which are subject to random variables $PRIB_i$ and $CAP_i$ by running the menu item "Statistics" PROFIT software product.
4. Enter the initial conditions for the PROFIT program in the form of random $PRIB_i$ and $CAP_i$ sample data length.
5. The breaking of the values that are possible values of random variables $PRIB_i$ and $CAP_i$ according to the laws of distribution and the calculation of the profitability of the proposed strategic guideline.
6. Making an alternative decision on the strategic development of the industrial enterprise in the long term.
7. The proposed method allows you to make strategic decisions about the development of the enterprise in the dialogue mode, supported by the PROFIT software product.

## 4. RESULTS AND DISCUSSION

The article demonstrates the results of experiments conducted at an industrial enterprise using the constructed economic and mathematical models that allow assessing the strategic orientation of development taking into account the conditions of stochastic uncertainty. Earlier in the article, it was noted that the management of such an indicator as profitability has the character of strategic management in view of the influence of the external environment. In the course of the experiments the statistical data characterizing random variables $PRIB_{th}$ (Table 3) and $CAP_{vp}$ (Table 4) for some enterprise were processed.

**Table 3** Statistics of a random variable $PRIB_{th}$

| № | $PRIB_{th}$ (in t. RUB) | № | $PRIB_{th}$ (in t. RUB) | № | $PRIB_{th}$ (in t. RUB) |
|---|---|---|---|---|---|
| 1 | 223163 | 8 | 216939 | 15 | 254623 |
| 2 | 184693 | 9 | 241592 | 16 | 97352 |
| 3 | 76523 | 10 | 188936 | 17 | 215436 |
| 4 | 95675 | 11 | 129749 | 18 | 89641 |
| 5 | 146837 | 12 | 251648 | 19 | 65982 |
| 6 | 56485 | 13 | 78451 | 20 | 198578 |
| 7 | 65874 | 14 | 175842 | 21 | 145786 |

**Table 4** Statistics of a random variable $CAP_{vp}$

| № | $CAP_{vp}$ (in t. RUB) | № | $CAP_{vp}$ (in t. RUB) | № | $CAP_{vp}$ (in t. RUB) |
|---|---|---|---|---|---|
| 1 | 989154 | 8 | 428563 | 15 | 359629 |
| 2 | 396986 | 9 | 582436 | 16 | 197397 |
| 3 | 146413 | 10 | 498395 | 17 | 298479 |
| 4 | 183755 | 11 | 345815 | 18 | 189346 |
| 5 | 586373 | 12 | 501836 | 19 | 265385 |
| 6 | 156590 | 13 | 128678 | 20 | 199588 |
| 7 | 125915 | 14 | 179853 | 21 | 345731 |

The values $PRIB_{th}$ and $CAP_{vp}$ formally described by the distribution law in the form of interval series, built on the basis of the economic and mathematical model $MOD_1$, implemented in the software product PROFIT (Table 5, 6).

The model $MOD_2$, which included in the PROFIT tool was used to generate random numbers of values $PRIB_{th}$ and $CAP_{vp}$ according to the distribution laws given in Tables 5, 6.

**Table 5:** The law of probability distribution of a random variable $PRIB_{th}$

| № | Profit | Estimate of probability |
|---|---|---|
| 1 | 65655,2 | 0,14 |
| 2 | 83995,6 | 0,14 |
| 3 | 102336 | 0,09 |
| 4 | 120676,4 | 0,048 |
| 5 | 139016,8 | 0,095 |
| 6 | 157357,2 | 0 |

| | | |
|---|---|---|
| 7 | 175697,6 | 0,095 |
| 8 | 194038 | 0,095 |
| 9 | 212378,4 | 0,095 |
| 10 | 230718,8 | 0,048 |
| 11 | 249059,2 | 0,14 |

**Table 5:** The law of probability distribution of a random variable $CAP_{vp}$

| № | The cost of capital | Estimate of probability |
|---|---|---|
| 1 | 165867,3 | 0,43 |
| 2 | 245771,9 | 0,048 |
| 3 | 325676,7 | 0,19 |
| 4 | 405581,3 | 0,095 |
| 5 | 485485,9 | 0,095 |
| 6 | 565390,6 | 0,095 |
| 7 | 645295,3 | 0 |
| 8 | 725199,9 | 0 |
| 9 | 805104,6 | 0 |
| 10 | 885009,3 | 0 |
| 11 | 964913,9 | 0,048 |

Simulation experiments were carried out during the period T=100 days. The screen form of forecasting results is shown in Fig. 6. Due to the limitation of the screen form in Fig. 6 the period T=15 days is reflected, but using the scrolling on the right of the screen, you can display the results of the experiments for the remaining days $t > 15$. The values of random variables $PRIB_{th}$ and $CAP_{vp}$ played by the method of statistical tests and participated in the calculation of profitability by the formula $REN_{pr} = \frac{PRIB_{th}}{CAP_{vp}}$. For the sample data given in tables 3, 4, the profitability of the strategic reference point is $REN_{pr} = 0{,}398$ (Fig. 6). By comparing the values $REN_{pr}$ for the different strategic orientations contained in the portfolio, the strategic Manager is given the opportunity to use the tools of making quantitatively sound strategic decisions.

## 5. CONCLUSIONS

The modern economic environment, in which Russian industrial enterprises are immersed, is characterized by a wide range of problems, including the development of globalization and widespread informatization, activation of innovative activity, crisis phenomena, economic sanctions of Western and American countries etc. The Consequence of the changes is the need for a radical restructuring of the management system of industrial enterprises with a focus on strategic management, built based on information systems. The process of strategic decision-making is in urgent need of creating and using model tools based on economic and mathematical models that adequately respond to the uncertainty of environmental impacts and allow on a formalized basis to make decisions about the strategic guidelines for the development of the enterprise. The authors propose economic and mathematical models that

allow from a quantitative point of view to evaluate various alternatives to the strategic development of organizations in the conditions of stochastic uncertainty. As characteristics of efficiency of functioning of the enterprise, the profitability indicators having strategic character are chosen. The constructed economic and mathematical models are algorithmized and integrated into the PROFIT software product that supports strategic decision-making in the Manager-computer dialogue mode. The article demonstrates the results of experiments conducted in the process of strategic decision-making based on the application of the created software product.

As a result of the research, the authors obtained the following scientific results.

1. Research of strategic management of the industrial enterprise based on methodology of the system analysis which object is logical communication of target categories and categories of means of achievement of the purpose in the course of the choice of strategic reference points is carried out.
2. The process of strategic management of an industrial enterprise is represented by a developing system with feedbacks, through the introduction of which decision-making is considered as an iterative process with the adjustment of results.
3. A logical structure for solving strategic management problems with the help of a combined decision procedure combining formal and informal methods at the stages of development and targeted use of the strategy is proposed.
4. Economic and mathematical models of evaluation of decisions made in the process of strategic management based on profitability forecasting by means of profit and cost flows simulation are constructed.
5. The software implementation of the constructed economic and mathematical models in the software product PROFIT is carried out.

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