




# Use Of Digitalization Tools In Questions Operational Management Of The Company Taken Into Account Of Step-By-Step Implementation Of The Technological Process

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**Abstract:** In connection with various crisis situations in the activities of enterprises, various types of problems arise that have to be solved both strategically and operationally. Methodological problems lie in choosing a set of effective methods and tools that allow, based on digitalization tools, to provide solutions to specific management issues. This article discusses the issues of modeling, planning and creating a digital system of planned calculations at different levels of economic management of a company using simulation analogs that take into account such model parameters as the technological sequence used in the production of a specific type of product, quantitative parameters, as well as the resulting indicators for specific types of work and throughout the entire production time interval. As a result, a digital analog and algorithms were built that made it possible to determine the optimal performance of product production. In the constructed model, a significant part of the analysis of results and decision-making is a function of a team of specialists or, according to common terminology, an expert, and the developed digital model is aimed at strengthening the economic justification of planned indicators and ensuring the storage and automated search of the company's regulatory framework and its periodic updating.

## 1 INTRODUCTION

Management methodology in modern conditions should be built on the following basic elements: approaches, guidelines, priorities; resources, means, restrictions; criteria, models, adjustments. In Western literature, the vast majority of theoretical and applied scientific articles in the field of economic modeling contain as a central part one or another mathematical model (Ashmanov, 1984), developed to test or illustrate hypotheses and identify effects. According to a number of economists, the likelihood of recognition of almost any new economic theory or concept almost to a decisive extent depends on the


extent to which this concept allows for mathematical formalization and its further digitalization, as well as the adequacy of the apparatus used and the effectiveness of the mathematical models obtained during the study results.


## 2 ANALYSIS OF EXISTING TOOLS FOR PROSPECTIVE ENTERPRISE MANAGEMENT

Companies engaged in the production of the same type of products, in the course of choosing a strategy for analyzing their own

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macroenvironment, it is better to use an algorithm implemented through the following steps (Ashmanov, 1984): establishing the main financial features of the industry environment. The sectors of the economy differ significantly among themselves, so at the initial stage we are building a "portrait" of the economic sector according to key financial components. These include the volume and speed of economic market formation, the development and stages of the life cycle, the number of competing counterparties, etc. Based on this "portrait", the vector of prospective management of the company is formed in the future, as well as the forecast of the strategic line of competitors.

On the basis of these data acquired in the process of analysis, it is possible to make a comprehensive assessment of the prospects of the economic sector and to detect its difference from other sectors of the economy, which in the future will enable the most correct choice of the company's business strategy in a particular economic sector and assess its validity. However, this approach to conducting strategic analysis is very time-consuming and professional skills. It provides a wide range of information about the external macro environment of a commercial company, which affects the functioning of large companies in a strategic perspective. Note that for small and medium-sized businesses, this approach is the least effective. For small firms, in the course of implementing a strategic choice, a situational test should be conducted, which is used to assess the strategic vector of the company, taking into account inter-corporate relations.

The analysis of situations consists of a sequence of the following actions: assessment of the company's current strategy (the volume of the market managed by the company increases or decreases; the direction of the company's "net" benefits and the speed of return on capital investments, etc.); implementation of SWOT analysis capabilities and assessment of the company's competitive status; evaluation of price positions from the point of view of competitiveness; finding alternative strategies and the advantages of the company's strategic capabilities. Such an analysis reveals those features of the external and internal environment that have the most significant impact on the company's prospective opportunities and abilities to establish the business orientation of the company as a whole. At the same time, situational and industry analysis for competitiveness is

considered to be systemic and multifactorial ways of evaluating possible strategic plans, based on the results of which strategic alternatives are being developed.

It becomes clear that the management of any company implies the use of a wide range of strategic analysis tools. The choice of the most appropriate method and the analysis of the reasons that most significantly affect the future development of the company is directly dependent on such characteristics as the size of the company, the stages of the life span of the economic sector, the time interval of the state of the external and internal environment that most affect the company's work. Systematization of the tools of prospective management of the company, with the subsequent choice of the vector of development, makes it possible to recognize that all the methods considered have a number of limitations in terms of practical use. The classification of the considered restrictions is presented in Table 1.

Table 1: Limitations of strategic analysis tools.

Method of analysis	Environment factor	Company Size	Stages of the product life cycle
SWOT	External and internal environment	Small, medium, large	Origin, growth, maturity, decline
PEST	External environment (macroenvironment)	Medium, large	Origin, growth, maturity, decline
STP	External environment	Small, medium, large	Growth, maturity, decline
PIMS	External environment	Large	Growth, maturity, decline

SNW	Internal environment	Small, medium, large	Origin, growth, maturity, decline
Industry and competitive analysis	External environment (macroenvironment)	Large	Origin, growth, maturity, decline

In order to conduct strategic analysis and form strategic alternatives, it is advisable to use the integration mechanisms of industry and competitive analysis. They provide information about the macroenvironment of the company, as well as the possibility of conducting situational analysis, providing intra-company analysis of the company and analysis of financial activities (Fig. 1).

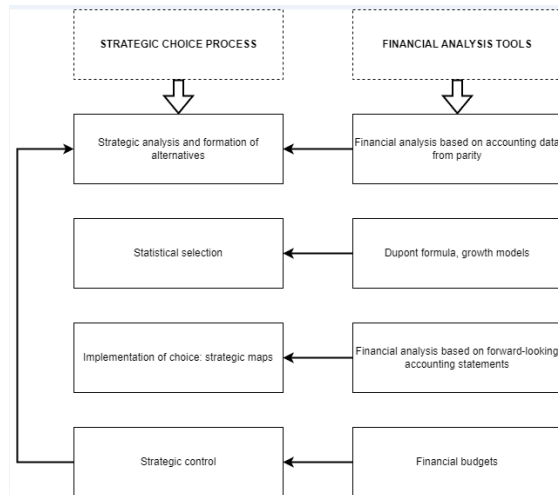


Figure 1: Financial analysis in the structure of the company's strategy selection.

Economic analysis, which provides information about the economic component of a strategic alternative, also carries the function of evaluating the company's strategic alternatives. At the same time, it is a methodological basis for modeling the likely growth of sales, monitoring income and related risks, monitoring the movement of capital and its optimization, the need for external financing. Therefore, at the stage of implementation of strategic choice, this type of analysis is crucial for the formation of the vector of strategic development of

the company. The strategic choice should be justified from the point of view of the budget, and its implementation should contribute to achieving optimal economic results. Basic models of strategic management are used as additional tools for strategic analysis (Danfrd, 1962).

Despite a good analytical apparatus, these models take into account a limited number of alternatives, but, nevertheless, they allow determining the company's place in the market with acceptable accuracy (Danfrd, 1962). Table 2 shows the growth matrix according to I. Ansoff.

Table 2: Growth vector matrix (I. Ansoff).

Market	Products	
	Existing	New
Existing	Market penetration	Market development
New	Product development	Diversification

In the process of strategic analysis, the growth vector matrix helps to establish alternative directions of business growth by the method of market formation or product modernization, although at the same time, the company's investment opportunities, limited financial, labor and other types of resources are not analyzed. The use of the generic strategy model makes it possible to find external forces for the company that characterize the level of its readiness for competition: the danger from novice market representatives, supplier requirements, the company's market power, the threat of substitute products, the level of competition between rival companies (Table 3) (Dubov, Travkin, Yakimets, 1986).

Table 3: M. Porter's model of generic strategies.

		Source of benefits	
		Low costs	Differentiation
Competition framework	Wide	The company is a market participant with low costs and wide market coverage	A company with a wide market coverage, differentiating its products

	Narrow	The company is a market participant with low costs and a focus on a narrow circle of consumers	A company differentiating its product with a focus on a narrow circle of consumers
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The model allows you to identify the exact place of the company in the economic sector, give comparative characteristics of the company and determine competitive advantages. However, this approach is not applicable for products that are at the initial stage of the life of the economic sector. The BCG model corresponds to the place of the strategic position of the business, which can be described on a plane using 2 coordinate axes: the first characterizes the growth rate of the market of the corresponding products, and the second - to determine the conditional part of the products on the market (Table 4) (Dubov, Travkin, Yakimets, 1986).

Table 4: Boston Matrix (BCG).

		Relative market share	
		Low	Tall
Market Growth	Low	"Cash cows"	"The dog"
	Tall	"Stars"	"Difficult children"

The BCG model as a strategic choice tool allows you to essentially find a niche for a company in the business community. In practice, such a model is used as a product classification tool, taking into account its ability to attract financial flows, which is aimed at a reasonable allocation of resources between possible strategic structures using a detailed analysis of products and the market. The main disadvantage of this model is considered to be a very controversial message concerning the fact that at the stage of maturity, the costs of creating products are reduced, and, in fact, the maximum market share corresponds to the indicator of the largest profit. At the same time, other components that have an impact on profit are ignored. It should be noted that high growth rates are sometimes considered a defining characteristic of the attractiveness of the market. The BCG model should not be used in sectors of the economy where the level of competition is low or the size of production is

insignificant. The GE/McKinsey model is focused on the prospect of companies making a profit or return on capital investments in the future, which have the potential to receive them from the sale of a specific type of products or services (Table 5) (Kolemaev, 2002).

Table 5: GE/McKinsey matrix structure.

		Comparative advantage in the market		
Attractiveness of the market	Winner (1). Using additional investment as a protection of market position	Winner (2). Investment intervention to gain strategic advantages from strengths and improve weaknesses	Question	
	Winner (3). Financial investments in the most attractive market segments	Medium-sized businesses	Loser (1). Develop business in low-risk areas	
	Profit Maker	Loser (2). Business Protection	Loser (3). Maximize profits and avoid direct investments	

In order to form alternative strategies, all the analyzed types of the company's products undergo a ranking procedure to determine the need for additional investments in both quantitative and qualitative characteristics. Consequently, the strategic approach of the GE/McKinsey model consists in increasing the amount of resources allocated for the development and strengthening of economic activity in priority sectors of the economy in the case when the company has specific advantages in the market, and, conversely, in reducing the resources allocated for this type of business, in the case when the positions of the market itself or the company on it turn out to be weak. For any type of activity located between these two positions, the strategy becomes selective, taking into account adequately established criteria.

In the analysis, the reasons under consideration are ranked based on their significance, which makes

the assessment of any type of economic activity of the company the most objective. The model provides the company's management with a large amount of analytical data to select a strategic management line.

A significant disadvantage of this model is that it does not provide for such a moment as the feasibility of a certain strategic alternative. Since the strategies proposed in the model are considered preliminary, they can also be considered solely as a guideline, which is not enough for making managerial decisions.

The future frontier of strategic choice is considered to be the formulation of other strategies based on the matrix approach. At the turn of the formulation of strategic alternatives in the course of strategic choice, it is advisable to use such matrix models as: the Shell/DPM model, the Hofer/Shendel model, the ADL/LC model, the Thompson-Strickland model, the SPACE model, the Efremov V.S. model.

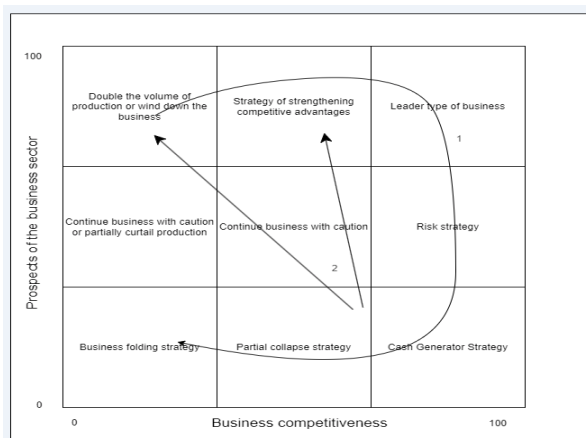


Figure 2: Model Shell/DPM.

The main distinguishing feature of the Shell/DPM model is the principle of the uniqueness of the company's strategy with guaranteed maintenance of a balance between an excess of financial resources and their deficit through the formation of new promising types of business (Fig. 2) (Litvak, 1998). When considering the phases of the formation of industry markets, the Hofer/Schendel model can be used as a tool for developing alternative strategies (Fig. 3) (Malinetsky, 1996).

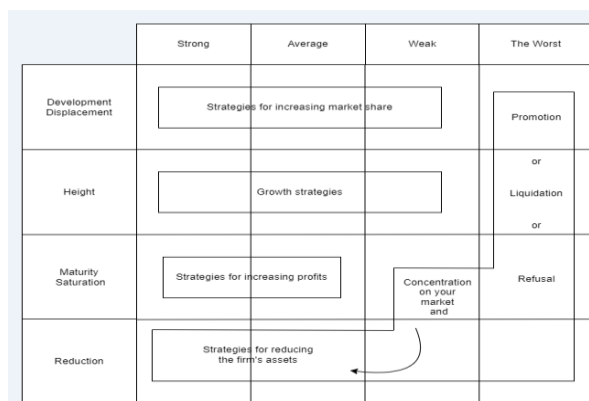


Figure 3: The Hofer-Schendel model.

The Hofer/Schendel model carries within itself both positive factors and significant negative ones. The positive factors include, first of all, the desire to formalize the criteria for the feasibility of a business strategy. In addition to a visual representation of the current state of the business, the model allows you to evaluate strategic sales opportunities and sufficient financial investments. Moreover, both the strategic capabilities of the company are considered, and the exact strategic alternatives to achieve them are implied. At the same time, we note that the disadvantages of the model arise from the peculiarities of adaptation of the strategic adaptation of the strategic choice of a particular company. First of all, the model is based on the assumption that all types of business activities of a commercial organization are connected to each other and their lifetimes are identical.

This circumstance narrows the number of possible strategic alternatives. Secondly, the key strategies proposed by this model are suitable simultaneously for several competitive positions of the business - powerful, weak or medium. The matrix approach based on the ADL/LC model is based on the consideration that it does not matter which sector of the economy methodically passes the boundaries of birth, formation, maturity and regression in its own existence. Therefore, the conditional position of a business in the market can be leading, powerful, visible, durable, weak. The task of strategic choice is formed from 3 steps.

At the first step, which is called "natural selection", the strategy is chosen according to the position of an adequate choice of the type of work, which is related to the position of the organization in the market and the stage of the life of the proposed product. At the second stage, a "specific choice" is made, which is considered, in addition, a cumulative strategic direction. At the 3rd step, a "refined"

strategy is selected that is suitable for the selected path of business formation (Fig. 4) (Saaty, 1993).

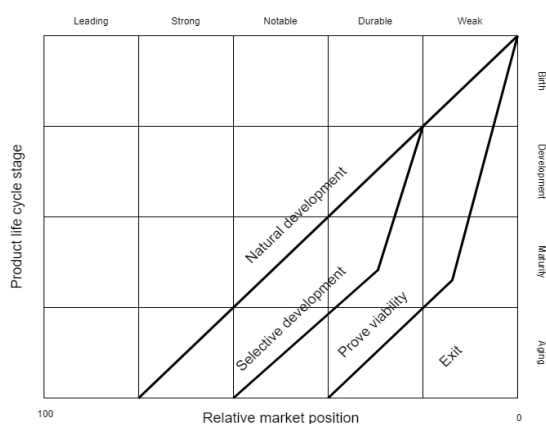


Figure 4: ADL/LC model.

From the point of view of the strategic choice process, the ADL/LC model has an area of application both for the study of the practical competitive position of any type of business and the stage of its life in a particular sector of the economy, and the choice of precise strategies of a commercial organization. Of fundamental importance for strategic choice is the introduction by the creators of the model of the very concept of "choice", its decomposition into stages of working out the choice of strategies in a specific situation.

However, the ADL/LC model implies that the bulk of the sectors of the economy fall under the scheme of life in the prescribed manner, although the form of the cycle may vary from sector to sector of the economy. It should be noted that this model is limited only by those strategies in which no efforts are made to adjust the life span, although mature markets have every chance to transform into younger ones, therefore automatic adherence to the ADL/LC model prevents the creation of strategic candidates and the implementation of the choice taking into account such transformation. Also, despite the external diversity of strategic alternatives, the strategies themselves in this model can be reduced to 5 strategic probabilities: the protection of the market position, the strategy of rapid growth in the market or in the market sector, leadership in tariffs, expansion of production or withdrawal from the market. The SPACE matrix model also deserves attention when forming alternative strategies (Dubov, Travkin, Yakimets, 1986).

As follows from this model, strategic alternatives are developed taking into account the following reasons: the strategic potential of a commercial

organization, external business criteria, the competitive advantages of the organization, the attractiveness of the economic sector. The SPACE matrix is divided into 4 areas, each of which represents the all-possible nature of strategic alternatives: offensive, expectant, competitive and defensive.

Therefore, from the perspective of the SPACE model, it is allowed to implement the choice of strategy taking into account the largest number of factors than those of the previously considered models. It takes into account the strategic potential of the organization, its external conditions, competitive advantages, and the seductiveness of the economic sector. The model is supposed to use a wide range of precise strategic alternatives.

### 3 OBJECTIVE PREREQUISITES AND MEANS FOR FORMALIZING THE CONSTRUCTION OF A DIGITAL ANALOGUE

The processes of development and application of analogue models must ensure the accumulation and integration of various empirical, theoretical and subjective information in the models, as well as the movement of information from one area to another. The model for calculating digital analogues is intended to determine labor and material costs by type, period and in general throughout the entire cycle of work for the full volume for each type of product. It takes into account the totality of technological measures used in the production of a specific type of product and their quantitative parameters (production rate, number of standard shifts, labor costs by type of work), as well as final indicators by period and throughout the entire production interval. An element of a digital analogue is a set of production and technological measures for the production of specific products. The quality and acceptability of the digital analogue is determined by the choice of activities, expressed through the names of the works, and methods of their implementation. The set of such activities is determined by the set, the elements of which are codes of work, ordered by the sequence of their implementation in the production of products of type  $\alpha$ . Other indicators that quantitatively reflect production technology are calculated using an algorithm, taking into account labor and economic resources, as well as

the logistics of a particular company. The total scope of work is established on the basis of data describing the initial parameters and features of technological production used in the production of a specific type of product and differing by type of product, standard indicators adopted in the company for the production of a specific type of product (Dubov, Travkin, Yakimets, 1986). The algorithm for calculating the amount of work in general can be written as follows:

$$O_{\downarrow} i^T((\alpha)) = F_{\downarrow} i(B \delta^{\uparrow}((\alpha)), H^{\uparrow}((\alpha))), \text{ where}$$

$F_i$  is an operator identifying the amount of work  $i$ , transforming input - planned ( $B \delta(\alpha)$ ) and regulatory ( $H(\alpha)$ ) data. Let's move on to the description of the algorithms that determine the indicators of the digital analog of product production. The scope of work for each technical device in physical ( $Q_{ij}^{(\alpha)}$ ) and conventional

( $M_{ij}^{(\alpha)}$ ) units of measurement is calculated

$$Q_{ij}^{(\alpha)} = \frac{Y_{ij} Q_i^{(\alpha)}}{10o}, M_{ij}^{(\alpha)} = Q_{ij}^{(\alpha)} K_{ij}, i \in m^{(\alpha)}, j = 1, \dots, I_j;$$

volume of automated work in conventional units of measurement by period ( $M_{ij}^{(\alpha)}$ ) and in general ( $M^{t(\alpha)}$ ) for the production of a product of type  $\alpha$

$$M^{t(\alpha)} = \sum_{i \in m^{(\alpha)}} M^{t(\alpha)}, j = 1, \dots, I_i, M^{B(\alpha)} = \sum_{i=1}^n M^{t(\alpha)};$$

expressions for calculating labor costs for automated ( $P_{ij}^{(\alpha)}$ ) and manual work ( $P_i^{(\alpha)}$ )

$$P_{ij}^{(\alpha)} = Q_{ij}^{(\alpha)} E_{ij}, i \in m_M^{(m)}, j = 1, \dots, I_i, P_i^{(\alpha)} = Q_i^{(\alpha)} E_i, i \in m$$

number of standard shifts for performing automated ( $D_m^{t(\alpha)}$ ) and manual work ( $D_p^{t(\alpha)}$ ) by period

$$(D_m^{t(\alpha)}) = \sum_{i \in m_M^{(\alpha)}} D_{i,j}^{(\alpha)}, j = 1, \dots, I_i, D_p^{t(\alpha)} = \sum_{i \in m_M^{(\alpha)}} D_i^{(\alpha)};$$

labor costs for performing automated ( $P_m^{t(\alpha)}$ ) and manual ( $P_p^{t(\alpha)}$ ) work by period

$$P_m^{t(\alpha)} = \sum_{i \in m_M^{(\alpha)}} P_{i,j}^{(\alpha)}, j = 1, \dots, I_i, D_p^{t(\alpha)} = \sum_{i \in m_M^{(\alpha)}} P_i^{(\alpha)};$$

number of standard shifts ( $D_m^{t(\alpha)}$ ) and labor costs ( $P^{t(\alpha)}$ ) by period

$$D^{t(\alpha)} = D_M^{t(\alpha)} + D_p^{t(\alpha)}, P^{t(\alpha)} = P_M^{t(\alpha)} + P_p^{t(\alpha)};$$

number of standard shifts for performing automated ( $D_M^{b(\alpha)}$ ) and manual ( $D_p^{b(\alpha)}$ ) work in general for the manufacture of products of type  $\alpha$

$$D_M^{b(\alpha)} = \sum_{t=1}^n D_M^{t(\alpha)}, D_p^{b(\alpha)} = \sum_{t=1}^n D_p^{t(\alpha)};$$

labor costs for automated ( $P_M^{b(\alpha)}$ ) and manual ( $P_p^{b(\alpha)}$ ) work in general for the production of a product of type  $\alpha$

$$P_M^{b(\alpha)} = \sum_{t=1}^n P_M^{t(\alpha)}, P_p^{b(\alpha)} = \sum_{t=1}^n P_p^{t(\alpha)};$$

the number of standard shifts ( $D^{b(\alpha)}$ ) and labor costs ( $P_m^{b(\alpha)}$ ) in general for the production of a product of type  $\alpha$

$$D^{b(\alpha)} = D_M^{b(\alpha)} + D_p^{b(\alpha)}, P^{b(\alpha)} = P_M^{b(\alpha)} + P_p^{b(\alpha)};$$

electricity consumption by type, period, and in general for the manufacture of a product of type  $\alpha$

$$\sigma_{ij}^{t(\alpha)} = Q_{ij}^{(\alpha)}, i \in m_M^{(\alpha)}, j = 1, \dots, I_i, \sigma^{t(\alpha)} = \sum_{i \in m_M^{(\alpha)}} \sigma_{ij}^{t(\alpha)}, j = 1, \dots, I_i, \sigma^{t(\alpha)} = \sum_{i=1}^n \sigma_{ij}^{t(\alpha)}$$

The main indicators of economic planning, as well as the wage fund of workers and engineers, are calculated using digital analogues. The development of company plans based on a multi-level model is formed in stages, as follows:

1) calculation of standards for the manufacture of a specific type of product (implementation of block 3, Fig.);

2) determining the potential of each company included in the association of similar industries, taking into account the development of other industries (implementation of block 4);

3) identifying optimal parameters for the

company's development, taking into account the capabilities of service enterprises (implementation of block 2);

4) development of an optimal company plan (implementation of block 4);

5) drawing up plans for economic units in conjunction with the indicators of the optimal economic plan (implementation of blocks 5, 6).

Based on a multi-level model, a corresponding simulation model was created that allows you to build economic plans for the company (Fig. 5).

1 - user (DM); 2 - database; 3 - adjustment of input parameters; 4 - calculation of cost standards for the manufacture of a specific type of product; 5, 8 - analysis of results; 6 - checking the acceptability of standards; 7 - calculation of the company plan and printing of key indicators; 9 - checking the acceptability of the plan; 10 - printing a detailed plan of the company and recording intermediate information in the database; 11 - calculation of the sector plan and printing; 12 - calculation of the department plan and printing; 13 - end of calculation

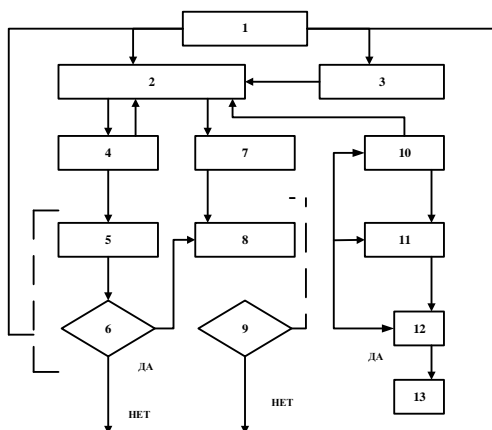


Figure 5: Simulation model for drawing up economic plans.

## 4 RESULT AND CONCLUSIONS

In the proposed model, a significant part of the analysis of results and decision-making is a function of a team of specialists or, according to common terminology, the decision maker (Kolemaev, 2002). The main executor is the company economist; he is guided by computer data on the growth rate of the industry, savings in labor and material resources, as well as the optimal parameters determined during the implementation of the

model.

The decision maker monitors deviations of optimal parameters from the calculated ones and compares the estimated growth rates of the industry with the observed main economic indicators, while having the opportunity to change specialization, placement within the enterprise, and the use of material and labor resources. The model operation consists of the following stages. The decision maker determines the input values of control parameters: the technology adopted in the company for the production of a specific type of product, specialization within the company and other indicators that reflect the initial state of production in the company.

In addition, it provides benchmark figures obtained on the basis of intermediate monitoring, taking into account the introduction of innovative technologies (Malinetsky, 1996; Smolyak, 1997). The criteria for calculating the input values of control parameters are the rational use of technological capacities and the rational specialization of the company with the efficient use of labor and technical resources. Input and control indicators are entered into the computer. The computer determines cost standards per unit of work volume by type according to production technology and prints them out. The decision maker pays special attention to the calculated indicators and the sequence of execution of types of work according to technological and technical requirements. If, in his opinion, the results are acceptable for a given company, then he instructs the computer to write the regulatory information onto external media and proceed to the next stage of calculation (Bag, Dasgupta, 1995). Otherwise, he adjusts the input values, after which the calculation process is repeated from stage 2. Using a computer, digital analogues are compiled for the entire volume of work and the main indicators of the plan for the production of a specific type of product are determined (Chazelle, Edelsbrunner, 1985; Johnston, DiNardo, 1997). The results are printed by product type with a comparison of calculated and control indicators. The decision maker reviews the calculation results. If the results satisfy him, then he instructs the computer to print detailed information about the plan and record it on magnetic media to store intermediate information for further use in planning at the sector and department levels. Then it proceeds to the next stage of calculation, it adjusts the input parameters and repeats the calculation process from stage 4.

Calculation of digital analogues on a computer is carried out for the entire volume of work and task plans of the sector and department. Thus, the

developed simulation model allows: to strengthen the economic justification of planned indicators; carry out variant calculations taking into account the additional use of reserves to correctly establish the scope of work for the enterprise and select the optimal plan option; ensure storage and automated search of the company's regulatory framework, its periodic updating.

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