Краткие сообщения

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MANAGERIAL DECISION-MAKING MODEL TAKING INTO ACCOUNT TECHNOLOGICAL DEVELOPMENT OF THE ENTERPRISE

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In the conditions of accelerating scientific and technological progress, it is required to make effective managerial decisions to raise the level of competitiveness of Russian enterprises. In the article, the model that allows increasing the effectiveness of managerial decisions taking into account the level of technological development of enterprise is described. Through the implementing indicators linking technological process and the financial results of the enterprise, it is shown the ability of making strategic management decisions related to the necessity for improving current processes or the possible transition to new technology.

Keywords: technological development, technological processes, managerial decisions, modeling of economic processes.

Introduction

The twenty-first century in Russia is characterized by the transition from a commodity economy to knowledge-intensive and high-tech industries. This transition is complicated by the lack of managerial decision-making tools in the long-term prospects taking

Considering the historical retrospective, many scientists noted the high priority contribution of the technological development to the economic growth. In the middle of 1920-s, the Russian economist K. Kondratiev noted that non-economic cause of economic cyclicality could be significant inventions appearing in different locations at the same time, independently from each other [1]. Later, long economic 40–60 years cycles were named as Kondratiev's cycles.

In 1930-s the Kondratiev's conception was developed by J. Schumpeter [2]. According to him, the main factor of the development is innovation that can be characterized, firstly, by a new product/service (which was not there before) launch to the market, secondly, the application of a new production method, thirdly, an opening of market niche, which previously was not there or a market that had not existed.

Thus, J. Schumpeter noted that it is not necessary to do something new, but you can do it better than others, due to changes in the technology of goods production.

C. Freeman described in his works the importance of "technology diffusion" from several leading economic sectors to all the others. He supposed that the potential of new technological paradigm is realized better through the people's participation in the development and implementation of new technologies [3, 4].

D. Lvov and S. Glaziev [5] introduced the concept "technological mode": a variety of technology that are specific to a certain level of production development.

Economic papers taking into account technological development are mostly macroeconomic and do not provide reliable managerial decision-making tools at the level of individual enterprises.

Managerial decision-making model

In this paper, there is an attempt to develop a model that can be used for making strategically significant decisions taking into account the technological level of the enterprise development.

The traditional task of managerial decision-making at the enterprise level is to maximize profit (L):

$$L = p \cdot V - C \to \max, \quad (1)$$

where p – the price of a production unit, V – sales volume, C – costs.

Rewrite the formula (1) per unit of output:

$$l = p - c \to \max, \tag{2}$$

where l, c – profit and costs per a production unit (unit revenue and unit cost, respectively).

Most often the price of a certain product is determined on the open market and is the exogenous variable (in this managerial task) on which the company has no influence. In this regard, developing the model it is necessary to focus on formalizing the dependency in relation to the cost.

It should be noted, the technology is the process of transferring the primary resource to the final product (Fig. 1).

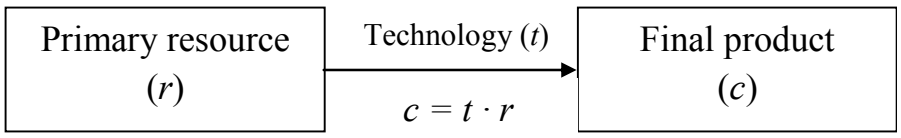

Fig. 1. The essence of the technological process

At the enterprise level of technological development, the applied technology is characterized by a constant technological transformation coefficient (t) that determines the cost of the final product (c) through the primary resource (r). This coefficient reflects the economic effectiveness of the technological process; the coefficient loss leads to lower cost and a growth of the enterprise profit.

Assume n primary resources (materials, energy, labor, etc.) must be used for the production. Then, the technological transformation coefficients (t_i) will reflect the contribution of the i-th resource to finished cost at the formed technological level:

$$c = \sum_{i=1}^{n} \left(t_i \cdot r_i \right). \tag{3}$$

In general each coefficient t_i is a complex function that depends on the set of exogenous (on which the company has no influence) and endogenous (on which a company has influence) factors $X = \left(x_1 \quad x_2 \quad ... \quad x_N \right)$.

The identification problem of the function функции $t_i(X)$ as in wide (a determination of the type of dependency) and narrow (determination of the values of the coefficients) senses is an important problem at managerial decision-making at the enterprise level.

Further technological transformation coefficients are used to improve the existing processes and to support the transition to a new, more efficient technology.

Therefore, we set a task of a constrained optimization taking into account such restrictions $(h_k(X), g_j(X))$, for variables X and their interconnections:

$$\begin{gathered} \max_{X \in D} L(X) = \max_{X \in D} \left[p - \sum_{i=1}^{n} \left(t_i(X) \cdot r_i \right) \right] \cdot V = \left[p - \sum_{i=1}^{n} \left(t_i\left(X^*\right) \cdot r_i \right) \right] \cdot V, \\ D = \left\{ X \middle| \begin{matrix} h_k(X) = 0, k = 1, 2, ..., l \\ g_j(X) \ge 0, j = 1, 2, ..., m \end{matrix} \right\}. \end{gathered} \tag{4}$$

A solution of the problem allows to choose the optimal values of variables (X^*), leading to maximum profits at the current technological processes.

In addition, we can consider a problem of applying another technology by the enterprise that allows reducing significantly the value of the technological transformation coefficients.

Most often, such transitions to another technology are linked with the necessity of making significant investments (I) that must be covered by extra profit from realization of innovations for a certain period of time (T) that can be described the following inequality:

$$\int_0^T \left(L_2(X_2^*) - L_1(X_1^*) \right) \cdot dt \ge I, \tag{5}$$

where $L_2(X_2^*)$ – the enterprise profit obtained at the optimum implementation of new technology,

$L_1(X_1^*)$ – the enterprise profit obtained at optimum implementation of the existing (used currently) technology.

During long periods of investment, you should take into account inflation in the economy by means of discounting coefficient at the rate *d*:

$$\int_0^T \frac{1}{(1-d)^t}\left(L_2(X_2^*) - L_1(X_1^*)\right)\cdot dt \geq I\,. \qquad (6)$$

Conclusion

Applying the proposed managerial decision-making model, described above (formulas (3)–(6)) allows making an analysis of level of technological development at the enterprises with similar technological processes by means of comparing technological transformation coefficients.

For enterprises using various technological processes, but producing the same products (services) you may comparing the economical effectiveness of these processes. Based on the results of this comparing it is decided either to improve current processes, or applying another more efficient technology, with that the project approach with the relevant methods or models is used [6].

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ОРГАНИЗАЦИОННАЯ МОДЕЛЬ ПРИНЯТИЯ РЕШЕНИЙ С УЧЕТОМ ТЕХНИЧЕСКОГО РАЗВИТИЯ ПРЕДПРИЯТИЯ

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Для повышения уровня конкурентоспособности отечественных предприятий в условиях ускоряющегося научно-технического прогресса требуется принятие качественных управленческих решений на уровне предприятий. В статье предложена модель, позволяющая повысить эффективность принятия управленческих решений с учётом достигнутого уровня технологического развития хозяйствующего субъекта. Посредством введения показателей, связывающих технологический процесс и финансовые результаты деятельности предприятия, показана возможность принятия стратегически важных управленческих решений, связанных с обоснованием необходимости совершенствования текущих технологических процессов или возможным переходом на новые технологии.

Ключевые слова: технологическое развитие, технологические процессы, принятие управленческих решений, моделирование экономических процессов.

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