

# *Implementation of corporate information system at the companies of knowledge-intensive activities*

*Vinogradova E.Yu.*

Ural State University of Economics  
Yekaterinburg, Russia  
katerina@usue.ru

*Galimova A.I.*

Ural State University of Economics  
Yekaterinburg, Russia  
anna.baibuz8@gmail.com

**Abstract**—The article considers the problem of the need for an innovative process of transformation of the modern economy. The authors developed a corporate information system of management with new characteristics. The existing system of financial and budget planning at the micro level has outlived its usefulness and no longer meets modern requirements. The analysis of theoretical and practical developments allowed determining the main shortcomings of the current system of management accounting at the enterprises of knowledge-intensive activities. Based on this, the authors propose an approach to the development of a corporate information system, which will overcome the fragmentation of the enterprise management process and achieve significant improvements in key indicators in contrast to existing approaches. The automated control system at the enterprises of knowledge-intensive activities should be largely flexible and ready for changes.

**Keywords**—*corporate information system, management, knowledge-intensive activities, high-tech products, digital economy.*

## I. INTRODUCTION

Nowadays it is difficult not to notice the formation of a new stage of the economy characterized by its digitalization. According to the statement of the President of the Russian Federation Vladimir Putin the development of the digital economy is unprecedented in its scope and influence of the project, which can be compared with the construction of railways in the late nineteenth century or the electrification of the country the first half of the twentieth century. [21]

In addition, the development of knowledge-intensive activities is becoming a priority in the modern economy. High technologies add such factor of production as knowledge to classical resources (land, labor, capital and entrepreneurship). This approach is the basis of the knowledge economy, the development of which allows for the growth of the competitiveness of most business profiles. Information processing and application of new knowledge through the introduction of high technology complements and increases the efficiency of classical resources. Knowledge-intensive activities are closely related to science and high technology.

Features of such an economy are the presence of a highly educated workforce, a high level of investment in innovation and the active use of acquired technologies.

These two factors determine the relevance of the study conducted by the authors and confirm the need for digitalization of the management process of enterprises knowledge-intensive activities.

## II. LITERATURE REVIEW

Many Russian and foreign authors consider the issue of automation of the management process at the enterprise through the introduction of a corporate information system. In their articles the subject of research is the peculiarities of the production sector as a whole (for example, the works of Piksajkina O. V., Hodeneva Ye. A., Yushchenko N. [11, 16]) or in certain industries. The second approach is more reasonable, since each industry assumes the appearance of specific characteristics of the business automation model. For Example, Verstina N. G. and Akimova E. M. [17] study the use of economic and mathematical models at the enterprises of the construction industry, Zakharova S. G. and Tadevosyan A. T. [20] consider automotive industry, Savchuk I. N., Fadeeva S. S. [2, 14], Mayorova I. A., Pavlik V. P. [8, 10] consider agricultural industry, Domozhirova I. V. considers food industry [1]. Despite a significant number of studies, now there is a significant shift from the primary and secondary sectors (agriculture and industry) to the rapid development of the tertiary sector (services) [4, p.192]. And if the construction of management models for enterprises of the service sector was considered in the works of Pavlova Y.A., Rudenko L.G., Zaitseva N.A., Larionova A.A., Melnichenko L.N., Komissarova I.P. [9, 13], the construction of economic and mathematical model of management of production of high-tech products is an insufficiently studied issue.

Some authors touch upon the issue of automation of individual business processes, for example Stepina K. G. studies the issue of automation of costs [15], L'vov V. P., Gareeva G. A. and Grigorieva D. R. consider the improvement of inventory management [7]. But this approach does not bring the expected effect, because it does not cover all the

links of the management system. In addition, it is absolutely unsuitable for knowledge-intensive activities. In this case, automation should affect both General economic activity and technological and administrative processes of the enterprise, be connected with the well-established management structure. [18, p.104]

**III. RESEARCH METHODOLOGY AND PRACTICAL SIGNIFICANCE**

The theoretical and methodological basis of this study are the modern views of economic planning and management of enterprises and organizations in a market economy, guidelines for the creation of a corporate information system, as well as research in the development and implementation of corporate information systems of Russian and foreign authors.

The practical significance of the research results lies in the possibility of using the developed methodological framework for the formation of a corporate information system in knowledge-intensive activities. This will improve the quality and efficiency of production, help in determining the strategy, as well as in the preparation of short-term and long-term plans.

In the framework of this study, it is proposed to develop a balanced scorecard at the enterprise, which is an effective tool of strategic management, but has not previously been used in enterprises for the production of high-tech products [3, p.177]. The introduction of the system will allow to establish a balance of cause-and-effect relationships and to determine the target values of not only key indicators, but also to establish the required values of financial and operational indicators. For example, a key indicator such as stock levels is directly linked to productivity. When a certain level of performance is achieved, fixed costs are reduced, which in turn lowers the break-even point.

**IV. DEVELOPMENT OF CORPORATE INFORMATION SYSTEM**

The development of high-tech products necessarily includes research and development work, which reduces the probability of the planned effect of the use of funds in the case of insufficient control and maneuverability, if it is necessary.

In addition, the development of a high-tech model is mainly carried out by a number of organizations, one of which plays the role of the chief Executive. In this regard, the process of research and development is divided into a significant number of interrelated activities, the coordination of which is carried out by monitoring the progress of their implementation. Taking into account the amount of necessary resources for the development of high-tech products in the formation of a corporate information system should take into account the possible options for creating a new model: full-scale development or modernization of the existing sample, as the size and characteristics of the required resources will vary significantly [19, p.342].

Components of the phantom stock item are assigned an additional attribute-the utilization forecast indicator. A component-specific forecast value of 55% implies that in 55% of cases, the phantom stock item is replaced by the component. In a plan structure, the cumulative usage forecast for all components of a phantom stock item, which is the sum of the usage forecast values, is typically 100%.

However, a cumulative usage forecast can be more than 100%. In this case, the specification is planned specification with the possibility of excessive planning, which makes it possible to create an insurance stock of components to neutralize the negative impact of component distribution deviations in the phantom nomenclature of the position and demand fluctuations.

It is possible to include the components of the stock item in the product not necessarily, but with a certain probability, which is very important in the case of high-tech products. Then the optional nature of inclusion in the stock item and the forecast of use, equal less than 100%, is established.

The results of the descriptions of the needs of the enterprise in the stock items must be reflected in the form of a calendar plan. Recommendations and planned orders are formed.

The recommendations are the final product of the system. They define the type of actions that are required to resolve current or potential problems. For example, "start order", "cancel order", "reschedule order". The recommendations do not propose full-scale cases for possible variation, which gives the system limited decision-making support.

Planned orders include information about the size of the order, the planned launch date and the date of fulfillment of the order, when the system is found with the presence of net requirements. The creation and use of planned orders is carried out only within the computer system. In case of changes in the original data, they can be updated or deleted by the computer system on subsequent launches.

Schematically developed corporate information system can be presented in the form of figure 1.

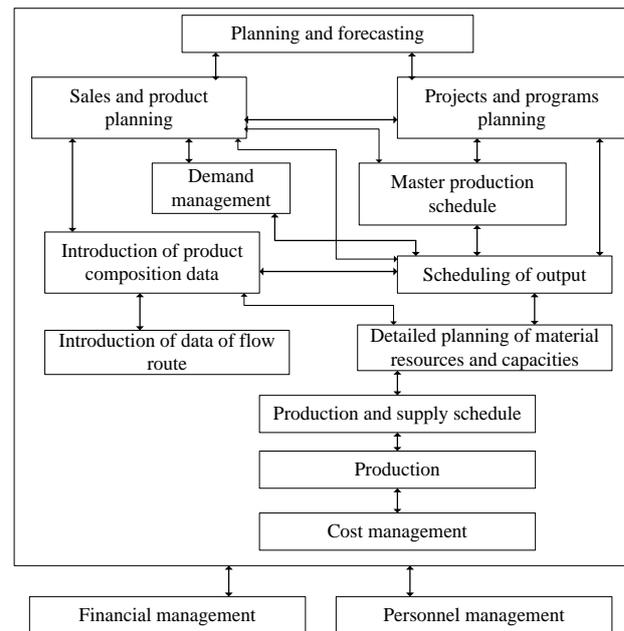


Fig.1. Corporate information system

It is necessary to explain in detail the content of the elements of the proposed system:

- Planning and forecasting. Calculation of the plan in value terms, assessment of the future state of the

elements of the production process and the expected impact of the environment.

- Sales and product planning. The purpose of the plan is to determine the expected number of final products.
- Projects and programs planning. The need for planning and management of projects and programs is due to the presence in the production of high-tech products of a large number of enterprises-co-executors, long life cycle stages, as well as the complexity of internal and external relations. Therefore, functions should also be included in the corporate information system.
- Master production schedule. Specification of the production plan (specified after Research and Advanced Development).
- Demand management. Forecasting implementation inventory customers, management co-contractors needs, and service orders for themselves and others. The needs of individual customers are taken into account.
- Scheduling of output. Definition of production in final units (products) with terms of production and quantities. Within one type of product, there can be hundreds of different deep level units. The production schedule shows how much is planned for the release of each type of product. The total quantity for each product in the graph is equal to the master production schedule. The production schedule is linked to the level of production capacity.
- Detailed planning of material resources and capacities. The material plan shows what resources are needed and at what time; it is executed for each unit and is formed according to the planning time-frame.
- Introduction of product composition data. This part of the system provides users with the required level of information about products, Assembly units, parts, materials, as well as tooling and accessories. Suitable adaptation of various structures of products, completeness of data, fixing of all changes by results of a stage of development of hi-tech production, at transition to direct creation of hi-tech samples is provided.
- Introduction of data of flow route. As part of the solution of the problem of operational planning and production management requires information about the duration of operations included in the flow routes, their sequence, as well as the number of performers required to perform them [22].
- Cost management. This part of the system makes it possible to assess the work of both production and other divisions of the enterprise in terms of costs. Within the framework of this subsystem, work is carried out to determine the actual and planned costs. The role of this section is to provide a link between financial management and production management through planning, accounting, control and cost management. The solution of these problems is made in different sections: by departments, orders, types of products, etc.
- Financial management. The problems of financial management are solved.
  - Personnel management. The problems of human resources management of the enterprise are solved.

Formation of planned decisions is made by means of cyclic construction of two stages. In the first stage, a plan is created without regard to capacity constraints. In the second stage, the resulting plan is checked for validity. The process is checked until the plan obtained at the next iteration is valid.

Information that can be used in queries, forms, and reports is stored in tables. For the formation of forms and reports used information from the tables or via queries through the sample.

As a result, we can note the presence of risks that have a significant impact on the formation of the cost of the event, the degree of influence of which directly depends on the complexity and novelty of the planned high-tech products. Therefore, the planning of research and development work, as well as the production of prototypes and serial samples should be carried out through the use of an automated information system with the possibility of timely adjustment [5, p.308].

In order to achieve the maximum possible economic effect from the implementation of the proposed system, it is necessary to adhere to the following rules:

1) The economic impact is assessed by measuring the return on investment, which depends on:

- The cost of implementing the system: the cost of labor, hardware and software costs for external services and consultations (in case of their occurrence);
- Time spent directly on the implementation of the system, as well as the time required to recoup the implementation of the information system.

2) During the development and implementation of the system, it is important to adhere to the plan and schedule that describe the implementation process in detail [6, p.45].

3) A modular implementation is required. First of all, modules that will allow to get real results in a short time are introduced.

4) If there is an existing information system in the enterprise, it must be carefully analyzed for possible integration with the developed system, possibility of data conversion is considered.

Economic efficiency depends on a clear sequence of actions for the implementation of the information system [12, p.197]. Each stage should be time-limited and have specific objectives. To control the process of implementation of the information system, a management group should be created, whose responsibilities include the approval and adjustment of corporate standards, monitoring the implementation stages, assessment of the activities of employees involved in the process of implementation of the system. Within the framework of the activities of the management group, it is impossible to make decisions for a long time, as this negatively affects the economic effect and can destroy the project for the implementation of the system.

The analysis of the existing regulatory legal and instructive-methodical base has shown that the planning and evaluation of the cost of high-tech products is not enough explored both at the planning stage by the state and in the formation of plans by the enterprise that performs contracts for the creation of these products. Using the already developed information systems, which seem to be optimal for use by any enterprise, when planning and managing the production of

high-tech products can be faced with low efficiency information system due to the uniqueness of this type of product.

## V. CONCLUSION

Thus, the introduction of a corporate information system in enterprises, the main activity of which is directly associated with the development and production of high-tech samples, requires the inclusion in the generally accepted set of subsystems of sales and operations planning, planning of the necessary resources and management of the production and procurement process, execution of the plans of unique modules. Their application will allow to take into account the specifics of the industry products, as well as to analyze the effect of the development and production of high-tech samples.

## VI. DISCUSSION OF THE RESULTS

By comparing the existing methods with the proposed in this article, an improved approach to the construction of an economic management model becomes noticeable. This technique allows to take into account the specifics of knowledge-intensive activities in the construction of economic and mathematical models of management. This will optimize the automation of business processes of the company and increase the effect of the model. In addition, the proposed approach offers consistent commissioning of automation systems for all business processes of the company, which allows detailed control of all stages of the life cycle of high-tech products. This approach is most valuable because knowledge-intensive activities require huge financial investments and total monitoring of all business processes. The effectiveness of the tools used for accounting and formation of plans for the creation of high-tech products, the quality of methodological support, significantly depends on the feasibility of planning documents and the effectiveness of the use of resources allocated for this purpose.

## References

- [1] I.V. Domojrova Ekonomiko-matematicheskie modeli operativnogo upravleniya proizvodstvennoj programnoj predpriyatiya pishchevoj promyshlennosti. [Economic and mathematical models of operational management of the production program of the enterprise of the food industry.], *Izvestiya Tul'skogo gosudarstvennogo universiteta. Ekonomicheskie i yuridicheskie nauki*, 2017, № 4-1, pp. 94-100.
- [2] S.S. Fadeeva Ekonomiko-matematicheskaya model' optimizacii upravleniya sel'skohozyajstvennym proizvodstvom. [Economic and mathematical model of optimization of agricultural production management.], *Ekonomika i predprinimatel'stvo*, 2015, № 1 (54), pp. 830-835.
- [3] A.I. Galimova, Special'nye principy ocenki stoimosti vysokotekhnologichnoj produkcii. [Special principals of high-tech products.], V sbornike: *Konkurentosposobnost' territorij*, 2017, pp. 177-179.
- [4] V.P. Khorolskiy, L.P. Rybalko, E.V. Khorolskaya Intellektual'naya sistema upravleniya korporativnym predpriyatiem s ispol'zovaniem sbalansirovannoj sistemy pokazatelej. [Intellectual management system of the corporate enterprise with use of the balanced scorecard.], *Marketing i menedzhment innovacij*, 2016, № 2, pp. 188-202.
- [5] V.P. Khorolskiy, O.V. Khorolskaya, K.D. Khorolskiy, L.P. Rybalko Identification of corporate situations is in the system of intellectual management an enterprise. *Marketing i menedzhment innovacij*, 2016, № 4, pp. 301-314.
- [6] E.V. Kuznetsova Avtomatizaciya byudzhetrovaniya v stroitel'nyh kompaniyah. [Budgeting automation in construction companies.], *Biznes-informatika*, 2016, № 3 (37), pp. 45-53.
- [7] V.P. Lvov, G.A. Gareeva, D.R. Grigorjeva Sovershenstvovanie upravleniya zapasami produkcii v avtomobil'noj promyshlennosti. [Improvement of stock management in the automotive industry.], V sbornike: *Vnedrenie rezul'tatov innovacionnyh razrabotok: problemy i perspektivy*, 2018, pp. 130-133.
- [8] M.A. Majorova Ekonomiko-matematicheskie modeli v upravlenii proizvodstvenno - ekonomicheskoy deyatel'nost'yu sel'skohozyajstvennyh predpriyatij. [Economic and mathematical models in the management of production and economic activities of agricultural enterprises.], *Internet-zhurnal Naukovedenie*, 2014, № 4 (23), pp. 109.
- [9] Yu.A. Pavlova Novye informacionnye tekhnologii i razvitie metodov matematicheskogo modelirovaniya. V sbornike: *Rol' matematiki v stanovlenii specialista*, Ufimskij gosudarstvennyj neftyanoj tekhnicheskij universitet, 2018, pp. 222-227.
- [10] V.P. Pavlyk Economic and mathematical support of innovative management in agricultural enterprises. [Economic and mathematical support of innovation management in agricultural enterprises.], *Mezhdunarodnyj, nauchno-proizvodstvennyj zhurnal "Ekonomika APK"*, 2017, № 2 (268), pp. 45-49.
- [11] O.V. Piksajkina, Ye.A. Hodeneva Ekonomiko-matematicheskaya model' optimizacii upravleniya biznes-processami proizvodstvennogo predpriyatiya. [Economic and mathematical model of optimization of business processes of industrial enterprise.], *Vestnik Gumanitarnogo universiteta*, 2017, № 1 (16), pp. 14-19.
- [12] R. Rajnoha, J. Dobrovič Managerial information support for strategic business performance management in industrial enterprises in Slovakia. *Polish Journal of Management Studies*, 2017, Vol. 15, № 2, pp. 194-204.
- [13] L.G. Rudenko, N.A. Zaitseva, A.A. Larionova, L.N. Melnichenko, I.P. Komissarova Organizational-economic model of management of infrastructure of small business support in the service sphere, *Journal of Advanced Research in Law and Economics*, 2016, T. 7, № 2, pp. 362-371.
- [14] I.N. Savchuk Primenenie ekonomiko-matematicheskikh modelej v upravlenii proizvodstvenno-hozyajstvennoj deyatel'nost'yu sel'skohozyajstvennyh predpriyatij. [Application of economic and mathematical models in the management of industrial and economic activities of agricultural enterprises.], V sbornike: *Nauchno-tekhnicheskie i inzhenernye razrabotki - osnova resheniya sovremennyh ekologicheskikh problem*, 2017, pp. 550-553.
- [15] K.G. Stepina Upravlenie zatratami promyshlennogo predpriyatiya. [Cost Management of industrial enterprise.], *Ekonomika i socium*, 2016, № 5-3 (24), pp. 487-490.
- [16] N. Yushenko, Ekonomiko-matematicheskie modeli analiza i upravleniya proizvodstvennoj sferoj. [Economic and mathematical models of analysis and management of the production industry.], *Aktual'nye nauchnye issledovaniya v sovremennom mire*, 2018, № 6-4 (38), pp. 137-139.
- [17] N.G. Verstina, Ye.M. Akimova Perspektivy i prakticheskie voprosy ispol'zovaniya ekonomiko-matematicheskikh modelej v upravlenii sbalansirovannyh razvitiem stroitel'noj otrasli goroda. [Prospects and practical issues of using economic and mathematical models in the management of balanced development of the construction industry of the city.], *Ekonomika i predprinimatel'stvo*, 2016, № 2-1 (67), pp. 574-577.
- [18] E.Yu. Vinogradova Aktual'nye voprosy proektirovaniya i realizacii korporativnyh sistem podderzhki prinyatiya upravlencheskikh reshenij na predpriyatii. [Topical issues of design and implementation of corporate decision-making systems at the enterprise.], *Izvestiya Dal'nevostochnogo federal'nogo universiteta. Ekonomika i upravlenie*, 2018, № 1 (85), pp. 102-111.
- [19] E.Yu. Vinogradova, A.I. Galimova, S.L. Andreeva, N.V. Mukhanova Peculiarities of creation of information system at the enterprises of telecommunication branch. 2017. T. 10531 LNCS. pp. 337-350.
- [20] S.G. Zaharova, A.T. Tadevosyan Ispol'zovanie ekonomiko-matematicheskikh modelej v upravlenii avtoservisami. [The use of economic and mathematical models in the management of car services.], *Ekonomika i obshchestvo*, 2017, № 3 (3), pp. 52-59.

- [21] Website, Received from <https://tass.ru/ekonomika/4389411>
- [22] M. Alyuhna Korporativnaya social'naya otvetstvennost' vs. biznes-strategiya [Corporate Social Responsibility vs. Business Strategy] Upravlenets, 2018, T. 9, №4, pp. 2–8.