

# Process Approach to the Creation of Intellectual-Information Management System of Industrial Enterprise Development

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**Abstract.** The article deals with the application of the process approach to the creation of intellectual- information management system for the development of industrial enterprises, in order to improve the efficiency and ensure the specified parameters and the overall purpose of its functioning. The importance of studying the influence of artificial intelligence on the development of existing information management systems and their elements applicable to modern industrial enterprises based on the study of their significant characteristics is noted. Some elements of interaction of the industrial enterprise with subjects of the market within process representation at modeling of intellectual-information system of management of its development are defined. The basic elements of intellectual-information management system of industrial enterprise development are proposed. The necessity of continuous authentication process of control objects in real time, along with the use of pre-created automated blocks of management decision-making is emphasized. Set the dependency formula, which determines the measure of development efficiency of industrial enterprises in the introduction or improvement of intelligent information management system. The necessity of introduction of own cryptocurrency by large industrial enterprises as a means of increasing the efficiency of internal management accounting within the intellectual-information system is substantiated.

## 1. Introduction

The active development of information technologies, the global nature of information systems, require the adaptation of the internal management system of the enterprise in terms of information support and in order to ensure competitiveness to a high level of leading market players using international computer networks and having a high level of automation. The most effective automated intellectual-information system of the enterprise is the one that covers all interrelated - business processes, all aspects of internal and external economic activity of the enterprise and with minimal costs for its deployment and maintenance provides the opportunity to achieve the specified criteria for its functioning. The analysis of foreign experience in the field of creation and application of automated information systems of enterprise management indicates that at present there is a widespread transition from the automation of the functions of individual structural units to the automation and redesign of multi-link business processes, the creation of end-to-end computer systems covering the entire organizational structure of enterprise management. This ensures the complexity and integration of functions, strengthening the focus on the rapid formation of alternative information options for management personnel. It is known that the solution of even individual problems with the use of

computer technology gives a significant economic effect. Foreign and domestic specialists have already proved that a single integrated enterprise management information system provides a much greater effect. The use of modern intellectual-information systems leads to the creation of new forms of information of the required quality, and therefore is essential to ensure the required parameters of industrial enterprise development.

## **2. The relevance of the study of the process approach to the creation of intellectual-information management system for the development of industrial enterprises**

As a result of integration into the technology of management processes at the enterprise fundamentally new means of information processing, integration processes of linear and functional personnel of enterprise management, the introduction of new forms of transmission, storage, and display of information, new technologies of communication, information processing and management decision-making can be created. [1] application of process approach to creation of intellectual-information system of management of development of the industrial enterprise is expedient, because modern conditions of functioning of the enterprises in many respects depend on their competitiveness which can be considered and reflects process sequence: supplier – producer – consumer. In other words, the formation of competitive advantages of enterprises is carried out in a process sequence: from product design, through production, including the provision of material and information resources, to sales. [2, 3, 4, 5, 6, 7, 8, 9] the Deployment is significant for the formation of an effective functioning of the industrial enterprise element within the intelligent information system of an enterprise can be considered a process of assessment of quality costs within the development of the quality management system. Tools for the analysis of costs for quality will allow to make competent management decisions, adequate situations and aimed at achieving the planned business goals with optimal resource consumption and minimizing losses, including through constant monitoring of the actual manageability of the analyzed processes and their operations. It will also provide an opportunity to implement one of the basic principles of the company QMS based on ISO 9000 standards – making decisions based on actual data. [10, 11] A more detailed process approach is studied in relation to the creation of algorithmization of elements of a significant data field for an industrial enterprise. That emphasizes the use in the articles of the strategic approach to the analysis of the required parameters with constant (continuous) identification of objects of this field and processing, followed by the distribution of computing power within the intellectual- information system of an industrial enterprise. Moreover, the articles pay attention to psycho-emotional and social factors included in the system of motivation of industrial enterprise personnel in the framework of algorithmization of personnel management. The articles discusses the possibility of increase of efficiency of functioning of industrial enterprises through the definition of algorithmic approaches to complex integrated process of development of the personnel motivation system. The basic indicators of algorithmization of management of the personnel motivation system of the industrial enterprise on the basis of which the formula defining the level of motivation of the personnel of the industrial enterprise is received are developed. It is noted that the prerequisites for the creation of a comprehensive system of motivation to work should be the emphasis on human resources management, taking into account the mutual influence of their environment, both near and far. In matters of this direction should take into account the motives of national, regional character, and the motives of human level. The motives are formed within the influence of factors of cultural, social, personal and psychological levels. [12, 13, 14, 15, 16] Practical methods of evaluating the effectiveness of the information system are considered through the prism of business processes of the organization. [17] This approach allows to obtain a holistic view of the role of the methodology in decision-making, data sources for the methodology, the use of calculation results, etc. [18] However, the effectiveness of the implementation of ERP systems in industrial enterprises does not bring a guaranteed increase in the efficiency of their operation and remains alarming, and the information systems of large industrial enterprises should be implemented taking into account the specifics of the national economy. [19] when developing an intellectual-information system, it is necessary to use a systematic approach that helps to move to knowledge

management in the system of an industrial enterprise, providing a synergistic effect. [20, 21] it is Necessary to take into account the global trend of digitalization of economic objects, so the introduction of digital technologies in traditional industries is of great importance to improve their competitiveness by increasing the total factor productivity. [22] information generated on the basis of accounting and analytical data plays an important role in solving the problem of ensuring economic security of enterprises. In today's business environment, especially at the international level, the role of information technology and optimization of reporting data as a source of reliable and objective accounting and analytical information on financial and economic activities aimed at solving problems to ensure economic security. [23] Questions of development of industrial enterprises and construction of information systems adequate to this process are of particular relevance for specific industrial structures and have been studied previously in monographic scientific publications. [24-28]

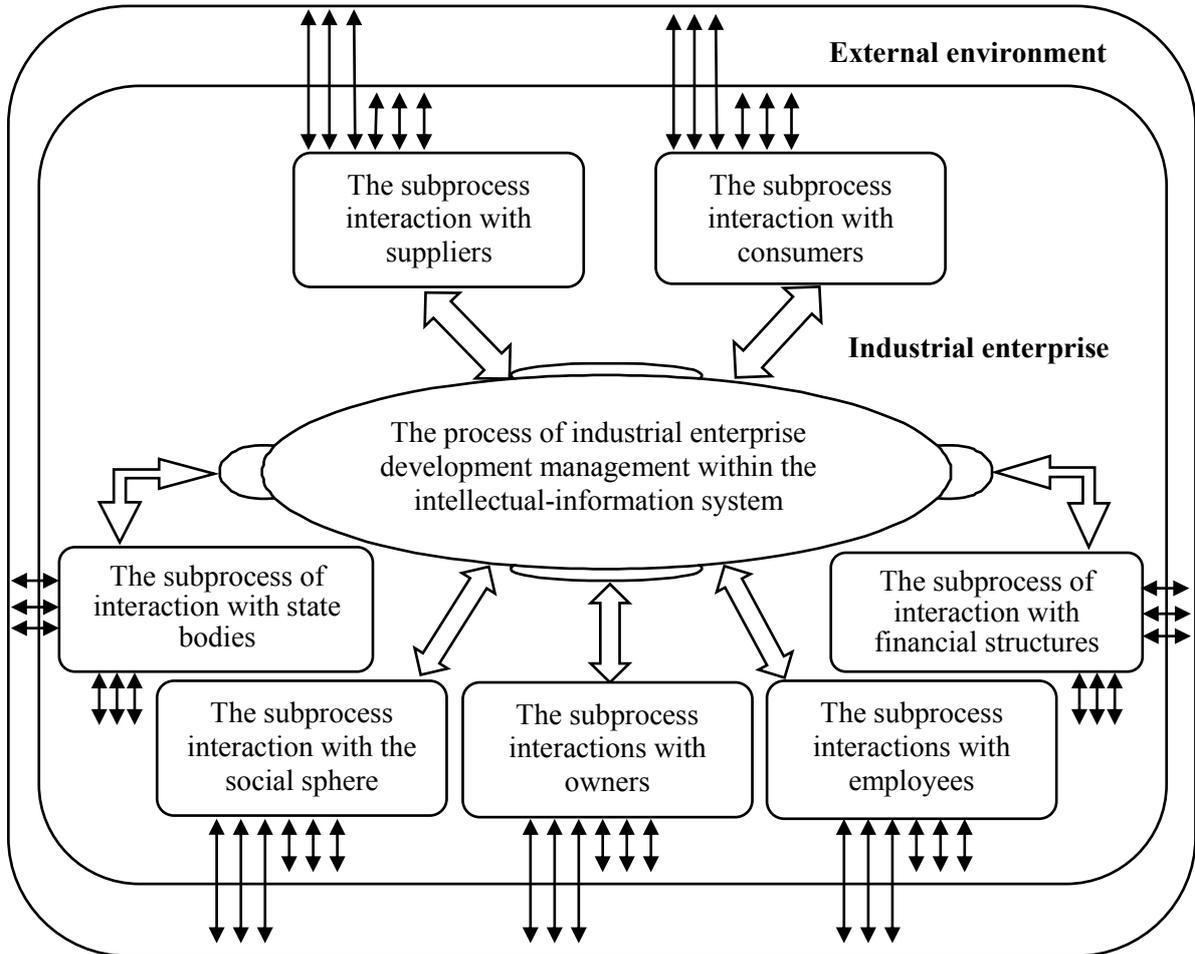
### **3. Formulation of the problem of developing a process approach to the creation of an intellectual- information management system for the development of an industrial enterprise**

The management system of industrial enterprises must meet modern market conditions: have a high flexibility of production management, allowing you to quickly change the range of products (services) in order to ensure the specified parameters of development. Requirements for improvement of the enterprise management system is caused by a high degree of competition between production structures, both within the national economy and in the world market. The life cycle of products manufactured by industrial enterprises becomes shorter, and the capital intensity, range and volume of single batches – higher. The development of modern information technologies, in many areas of production, directly affects the strengthening of competitive positions of industrial enterprises using them. Under these conditions, the requirements for the management system itself are changing, which should be transformed into an intellectual-information system for managing the development of an industrial enterprise, adequate to the requirements of external and internal environments.

The purpose of the article is to substantiate the need to generalize the theoretical and practical aspects in the development of intellectual-information management system of industrial enterprises on the basis of the process approach and the formulation of some proposals in this area, disclosed in the following tasks. Problems solved in this work: to propose elements of interaction of an industrial enterprise with market entities within a workflow representation for simulation of intelligent information system of management of its development to ensure its competitiveness; to propose the basic components of intelligent information system of management of development of industrial enterprise; to determine the measure of the efficiency of development of industrial enterprise subject to the introduction or improvement of intelligent information management system.

### **4. Theoretical aspects of the process approach to the creation of intellectual-information management system for the development of an industrial enterprise**

Requirements to intellectual-information system of management of development of the industrial enterprise in many respects are defined by tasks of the enterprise on formation and retention of its competitive position in the market. Competitiveness is a complex systemic and multifactorial economic category that combines the diverse interests of consumers, suppliers, owners, employees, the state, creditors and other market actors. At the same time, the external competitive environment, as the main environment, the processes in which affect the competitiveness of the enterprise, consists, as is known, of the mobile forces of competition. The industrial enterprise is influenced by economic, political and other elements of the external environment. The internal environment includes: changes in technology and management organization, including the organizational structure of the enterprise, which affect the nature and level of business activity, ownership relations, logistics flows; changes in production technologies and other aspects. The elements of interaction of an industrial enterprise with market participants in the framework of process representation in the modeling of intellectual-information management system of its development in order to ensure its competitiveness are displayed in figure 1.



**Figure 1.** Elements of interaction with market participants in the modeling of intellectual-information management system.

The main components of intelligent information system of management development of industrial enterprises can offer the following: unit of enterprise management for the decision of problems of management, design and production; block system of planning, regulation and cost accounting; block financial and information support, including for accounting, managerial and tax accounting; unit information and marketing system; control unit product quality; unit of innovative development, controlling and determining the changes of information technology and modern means of communication; block optimization jobs; unit process automation businesses, including in engineering-economic services of the plant and its structural production units.

In General, the  $I_{ie}$  indicator characterizing the efficiency of industrial enterprise development, subject to the introduction or improvement of the intellectual-information management system, can be presented in the form of a formula dependence (1).

$$I_{ie} = \sum_{i=1}^m \sum_{j=1}^n (TC_{0ij} - TC_{1ij}) \rightarrow \max, \tag{1}$$

where  $TC_{0ij}$  - aggregate the costs of the process of enterprise development at the  $i$ -th subprocess and the  $j$ -th event, aimed at improving of intelligent information system of management of enterprise development, respectively to their implementation.

$TC_{1ij}$  - aggregate the costs of the process of enterprise development at the  $i$ -th subprocess and the  $j$ -th event, aimed at improving of intelligent information system of management of enterprise development, respectively, after their introduction.

$m$  - number of subprocesses processed by the intelligent information system,

$n$  - the number of factors taken into account in each sub-process, including the efficiency of operation and overall competitiveness of the enterprise.

Separately it should be noted that the development and optimal functioning of accounting and analytical support economic security determines the reaction speed of the enterprise on the impact of external and internal threats, which is a crucial factor in increasing the economic viability of the business and its efficiency. In the system of ensuring economic security, there is an urgent question of forming complete and reliable information adapted to specific requests arising in the process of optimizing profits and making management decisions by the management of economic entities. Field objects for threats to industrial enterprises in the formation of complete, accurate and relevant management information may depend on unstable (opaque) in the area of development and achieve the strategic goal of the national currency, especially for multinationals, enterprises actively involved in international trade. Therefore, it is advisable to introduce a system of own cryptocurrency of an industrial enterprise, which will ensure the stability and predictability of the movement of management information in the management accounting system of an industrial enterprise.

### **5. Practical aspects of the process approach to the creation of intellectual-information management system for the development of industrial enterprises**

The research is based on the experience of advanced foreign and domestic corporate machine-building enterprises and provides the basis for a fundamentally important conclusion that the creation of a unified intellectual-information computer system of development management is a reliable and real direction to improve the efficiency of the enterprise potential, by filling information systems with new content. Combining individual information blocks, their harmonious combination within a single system, using artificial intelligence, and not a constant increase in the functionality of modules in isolation from the strategic goals of improving the efficiency and competitiveness of the enterprise, makes it possible to create qualitatively new business management processes. In fact, we are talking about the creation of an information model of the enterprise, which comprehensively reflects all economic objects and operations, all the variety of their relationships.

The introduction of advanced information technologies based on artificial intelligence enables corporations to obtain a good tool that allows them to solve such complex economic problems as product cost management, creation of an end-to-end integrated production modeling system, provision of information at all levels of management.

Practical development of corporate information management systems contributes to the growth of efficiency and validity of management decisions, flexible adaptation of internal management to the realities of market relations and this actively contributes to the increase in the efficiency and competitiveness of the corporate enterprise. And as evidenced by the experience of real industrial enterprises [24, 25, 26, 27], the development of the information system always leads to an increase in the competitiveness of the enterprise. There is a real opportunity to develop end – to – end technology "modeling - design-implementation-reengineering", highly intelligent systems for the preparation of management solutions based on multidimensional databases and the development of a corporate system of effective information protection.

A special role is given to the implementation of a cross-cutting intellectual-information corporate system that allows to form a single management infrastructure. The solution to this challenge by strengthening the influence of information technologies on the process of technical preparation of production, direct production and management on the basis of the transition from the automation of individual departments to end-to-end business processes spanning on-premises networks into a single information network of enterprises, introduction of modern information technologies artificial intelligence constant monitoring of facilities management.

## 6. Concluding Remarks and Research Needs

Thus, it can be concluded that the creation of intellectual-information systems to improve the efficiency of enterprise management – one of the urgent problems in a market economy. Despite the fact that there is no universal algorithm for creating such control systems, however, it is possible to develop General principles of their construction. Among the most advanced methods of building information systems of effective management is a process approach to management. This approach consists in the allocation of the enterprise network of processes and management of these processes to achieve maximum efficiency of the organization. The industrial enterprise needs to implement and improve the intellectual- information system of development management on the basis of a process approach, taking into account the specifics of the national economy and in order to achieve the objectives. Including the tasks of improving competitiveness on the basis of achieving the required criterion of the effectiveness of the implementation of intellectual-information system of development management. The implementation of the process approach to the creation of intellectual-information management system of the enterprise should be considered as an innovative project, since its main goal is to improve management systems based on the optimization of the use of all available resources of the organization, at the level of world standards, and requires the use of modern technical means (tools of business modeling, automation and intellectualization of processes). For effective management of information assets in industrial enterprises it is necessary to introduce a single intellectual-information system that could ensure the coordination of all business processes of the organization as a whole. This is justified by the fact that a successful industrial enterprise should be in a state of continuous development and improvement of the management process. One of the important factors determining the competitiveness and dynamism of an industrial enterprise is a developed intellectual-information system, which should also be in a state of constant improvement.

## References

- [1] Altukhov P L 2005 Trends in the development of enterprise management information system *The Scientific Work of Degree Candidates: a Collection of Articles*, ed V T Denisov and N A Nazarieva et al (Saratov: Publishing House V P Latanova) pp 100–103
- [2] Altukhov P L 2005 Process approach to enterprise competitiveness *Bulletin of Economic Science of Ukraine* vol 2, ed M G Chumachenko and B M Andrushkiv et al (Donetsk: Institute of Industrial Economics of NAS of Ukraine) pp 3-5
- [3] Altukhov P L and Altukhova N V 2005 Algorithm of optimal enterprise management as the basis of competitive development *The Scientific Work of Degree Candidates: a Collection of Articles*, ed V T Denisov and N A Nazarieva et al (Saratov: Publishing House V P Latanova) pp 87-93
- [4] Altukhov P L 2000 Modular approach to ensure the competitiveness of enterprises and organizations *Abstracts of the International Scientific-practical Conf. on Bank Competition* ed G G Korobova and U I Korobov et al (Saratov: Publishing Center SGSEU) pp 194-196
- [5] Altukhov P L 2003 Ways to improve the competitiveness of enterprises in foreign markets *Development of Foreign Economic Activity of Enterprises in Russia and the Saratov Region, RSTEU, Saratov Institute Monograph* (Saratov: Publishing House of Saratov Provincial Chamber of Commerce and Industry) pp 116-131
- [6] Altukhov P L 2004 Improving the competitiveness and sustainability of public enterprises *Public Sector Management: Technologies and Tools. Materials of the All-Russian Scientific-practical Conf. Ural state University of Economics* (Yekaterinburg: Printing Center AMB) pp 3-5
- [7] Altukhov P L and Blinov M V 2004 The reserves of competitiveness of the product and industrial enterprises *Proceedings of Applicants and Candidates for the Degree of Candidate of Sciences: a Collection of Articles* ed V T Denisov and E A Chistyakova et al (Saratov: Publishing House V P Latanova) pp 119-127

- [8] Altukhov P L 2005 Factors of realization of ensuring competitiveness of the enterprise *Integration of Russia Into the International Community: Economy and Education (Abstracts)* (Saint-Petersburg: Publishing SPBGUEF) pp 40-43
- [9] Altukhov P L and Resnick E P 2007 Innovation as an element of increasing the competitiveness of enterprises *Directions and Models of Transformation of Innovation in the Context of International Integration Materials of the Research-scient. Conf. Furnace ed. O I Amosha and L M Kuzmenko et al* (Donetsk: NAS of Ukraine. Industrial Economy Institute) pp 135-137
- [10] Dushevin L L and Dushevina E M 2014 Recommendations on the use of the process of assessing quality costs to improve the efficiency of the QMS of an industrial enterprise *Certification* vol 4, ed. M L Rakhmanov and I Z Aronov et al (Moscow: All-Russian Research Institute of Certification) pp 25 – 31
- [11] Altukhov P L and Yakushev M V 2009 Quality and competitiveness as strategic priorities of industrial enterprise development *Collection of Scientific Works of Teachers, Postgraduates and Students: Collection of Articles* ed V T Denisov and L G Akulova et al (Saratov: IC Science) pp 100-115
- [12] Predeus N V, Baryshnikova N A and Altukhov P L 2020 Algorithm of development of motivation system of industrial enterprise personnel *Smart Technologies and Innovations in Design for Control of Technological Processes and Objects: Economy and Production. FarEastCon 2018. Smart Innovation, Systems and Technologies* vol 138 ed. D Solovev (Cham: Springer) pp 307-315
- [13] Altukhov P L 2005 Algorithm of optimal human resources management of the enterprise *Bulletin of Orenburg State University* vol 8 ed. V A Bondarenko and M G Lapaeva et al (Orenburg: Orenburg State University) pp 29-32
- [14] Altukhov P L and Parfenova A S 2010 The role of the system of motivation in the development of external non-economic activity of the enterprise *Interuniversity Collection of Scientific Works of Teachers and Students* (Saratov: Publishing House of the Saratov Region Chamber of Commerce and Industry) pp 41-46
- [15] Altukhov P L 2017 Development of intelligent automated control system of industrial enterprises *III-th All-Russian Scientific-practical Conf. Actual Problems of Regional Economy Development* (Makhachkala: Publishing House of Dagestan State University of National Economy) pp 17-21
- [16] Altukhov P L 2008 Algorithm of creation of system of stimulation of convergence of the goals of the industrial enterprise and the interests of staff *Bulletin of Saratov state socio-economic University* vol 3 ed V M Larin and V A Rusanovsky et al (Saratov: Publishing House of Saratov State Socio-Economic University) pp 36-38
- [17] Altukhov P L 2008 The role of the unified enterprise management information system *Modern Problems and Tendencies of Development of Domestic and Foreign Trade: Collection of Scientific Articles* (Saratov: Publishing House Scientific book) pp 21-23
- [18] Skripkin K G 2014 Economic efficiency of information systems in Russia *Monograph* (Moscow: MAX Press)
- [19] Altukhov P L 2008 Information system development of management of industrial enterprise with foreign investment *Bulletin of Donbass State Engineering Academy* vol 2 ed I S Aliev and G P Klimenko et al (Kramatorsk: Publisher Donbass State Engineering Academy) pp 16-19
- [20] Altukhov P L and Lui Ting 2011 Synergetic effect of knowledge management in the system of industrial enterprise *Materials of the 1st International Scientific-practical Conf. Actual Problems of Modern Economy Development Saratov Branch of NOU VPO International Academy of Business and Management* (Saratov: Publishing Company SP-Print) pp 47-49
- [21] Altukhov P L 2001 Systematic approach to the effective development of enterprises *Regional Trade and Training of Merchants: Problems of the New Century. Collection of Scientific Articles* ed L I Barilenko and A N Yakovluk et al (Saratov: Publishing House V P Latanova) pp 34-37

- [22] Mavlyutova G A, Nozhkina E B and Altukhov P L 2018 Sustainable development of the digital economy as an element of national security of the Russian Federation *Economic Security and quality* vol 1 ed N S Yashin and A V Bystrov et al (Saratov: Saratov Socio-economic Institute (branch) of PRUE. G. V. Plekhanov) pp 19-24
- [23] Altukhov P L, Predeus N V and Predeus J V 2019 Development of the Elements of the Mechanism Accounting and Analytical Support of Economic Security of Construction Enterprises *IOP Conf. Series: Earth and Environmental Science* 272 032205
- [24] Altukhov P L and Denisov V T 2000 Management of development of enterprises *Monograph* (Saratov: Publishing House of Saratov State Technical University)
- [25] Altukhov P L 2007 Management of industrial enterprises: contemporary tendencies of development, ed V T Denisov (Saratov: Publisher SGSEU)
- [26] Altukhov P L and Denisov V T Management of industrial enterprise development (Saratov: Publisher SGSEU)
- [27] Denisov V T, Altukhov P L, Grishchenko O V and Reznik E P 2004 Development of industrial enterprise management (Saratov: Publishing House of Saratov state University)
- [28] Davletshina M R, Stolpovskii M V, Solovev D B 2019 Decomposition of Methane Hydrate with Heat Exposure *IOP Conference Series: Earth and Environmental Science* 272 paper № 032239. [Online]. Available: <https://doi.org/10.1088/1755-1315/272/3/032239>