CHAPTER «ECONOMIC SCIENCES»

FEATURES OF THE INFORMATION SUPPORT FORMATION OF THE ENTERPRISE'S INTELLECTUAL CAPITAL MANAGEMENT

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Abstract. The study substantiates the relevance of rapid changes in the intellectualization of economic processes under the influence of information systems and computer technology, and these components are interdependent. The study found that the selected factors stimulate the development of intellectual capital, which determines the new conditions for the functioning of the enterprise management system and the adoption of sound management decisions. Accordingly, the subject of research is a set of theoretical provisions, methodological tools and practical aspects of intellectualization of business management processes. The study used logical and system-structural analysis in the study of the features and role of information resources in the activities of modern enterprises, in the study of the impact of cloud technologies on the development of enterprise management. Economic and mathematical methods, tabular method and grouping methods are used to evaluate and analyze specific research results. The most important task of the study is to identify features of the functional potential of new information systems in enterprise management, processing of their economic information and formation of information management processes, as well as solving current problems related to the need for information systems.

The study substantiates that the integration of the national economy into the global information space today is one of the determining factors of its

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efficiency and competitiveness. Under such conditions, the transformation processes related to the formation of an innovative model of the economy focused on scientific high-tech production, sustainable development and the creation of infrastructure for the formation of intelligent information space become relevant in the national industry. It is established that one of the most important elements of modern innovative transformations are information systems and technologies that are able to produce large amounts of information and knowledge, transmit them remotely, accumulate, store and form new intelligent products in both national and international economic systems. Emphasis is placed on the fact that the introduction of cloud technologies is especially important, which is a necessary condition for the development of enterprise management systems. It is theoretically substantiated that cloud technologies provide new tools for the development of management systems, intensification of interaction in the external environment of the enterprise. They also determine the progressive trends in the development of enterprises and their associations (cluster systems), the main directions of development of high-tech industries and information potential of enterprises. This allowed us to build a mathematical model for calculating the probability of making the right decision, evaluating the effectiveness of decision-making. It is proved that intellectual capital is the basis for the development of the knowledge-based economy and determines the new course of socio-economic development of Ukraine.

1. Introduction

The objective reality of last decade's domestic economics transformations reveals complicated social development disproportions, reduction in scientific and technical research and industrial production, lack of highly-qualified specialists, and exhaustion of national wealth. That is why the problem of new economic development paradigm proves particularly important for Ukraine. Such a paradigm should be based on industrial enterprises' competitive recovery, speeding up the scientific-and-technological advance, and widening the use of scientific knowledge. All the above given conditions not only define the qualitatively new development level of the social and economic processes, but also promote their adaptability to new challenges and international cooperation.

One must take into consideration the fact that existing national production structure corresponds with the operational market model. At the same time it is not able to generate the macroeconomic system innovative approach. As a result Ukraine's economic and geopolitical safety risks continue to increase. So the main factor of national economic development strategic directions implementation is its reconstruction with raising cooperation priority of governmental, scientific and business institutions and clustering processes. It should also be aimed at high-technological, intellectual, informational, and science intensive production with quality products highly demanded in the global market.

Under such conditions, the intellectualization of production processes, the development of the potential of information systems and computer technology and the acquisition of new knowledge to reduce potential risks and their effective use are especially important.

2. Cloud technologies as a tool to increase the efficiency of information support for management decisions

The rapid development of scientific and technological progress, increasing the level of computerization and intellectualization of economic processes are considered to be widely recognized trends in the development of solidarity information economy [19; 20]. Therefore, an important factor for an enterprise to achieve success in competition is its ability to organize activities using the latest information and communication technologies and related software [19; 20].These circumstances determine the need to solve the problem of improving the economic efficiency of existing and developed information systems of subjects of economic activity, as well as the quality of their adaptation to the needs of the functioning of specific enterprises. It is important to take into account the circumstances that in the implementation of projects for the development and maintenance of systems, including software and computer and telecommunication equipment, it is possible to use different types of technologies and software for the purposes of managing social-economic systems, changes in their development and prompt reasonable management decision making [6; 19; 20]. Modern approaches to the design and implementation of IT projects, as well as the tools of their team development and integrated approach in use, make possible the process of project implementation

on the basis of procedures for the distribution of works or business functions between a large number of highly specialized, highly qualified geographically distributed contractors, which allows to use the most modern technological solutions for minimizing business costs [30; 31]. Cloud technologies, as a type of digital technology, particularly, enhance management [25]. The idea that cloud-based software can be used by business, was mentioned in 1961 by scientist John McCarthy [30; 31], at first the term "cloud technologies" was offered by President of Google Eric Schmidt in 2006, when the program Salesforce.com became the first "cloud" customer relationship management service [26]. In the initial stages of implementation, Saas services were not widely used, but during 2013–2016, a revolutionary "global migration" in cloud technology took place, that is, from virtualization, the world economy gradually transitioned into an "era of clouds" [19]. This requires every business entity (both large companies and small businesses) to adapt quickly to the requirements of the environment and rebuild their own business management systems. Reasoning for the choice of redevelopment of ways requires appropriate research, use of practical experience in combination with scientific methods and models to reduce risks in the introduction of new technologies and to successfully implement sustainable development strategies.

In economic theory, scientific approaches with the use of optimization methods of modeling of many economic processes have become widely used [39]. V.M. Andrienko, I.Yu. Ivchenko, Z.M. Sokolovskaya, A.O. Epifanov and many other scientists consider problems of usage of economic-mathematical modeling in the study of complex economic systems and phenomena [16; 41]. Studies in the sphere of use of computer technologies in management systems mainly focus on evaluating their effectiveness based on the results of the activity of enterprises [43], or are carried out from the standpoint of assessing their impact on cost capitalization [40], or determining the effect of an IT project realization and calculation of its payback period [29], etc. However, the problem of finding new ways of using different types of information and digital technologies in management practice, in particular, to make effective management decisions under the conditions of complex interaction of different components and components of the automated control system, is extremely urgent now. We share the

opinion of Yu. Samokhvalova, E.M. Naumenko, that economic and mathematical methods (one of which is the Markov process), can act as a constructive tool for the study of complex economic conditions and the sequence of management decision making in automated control systems in enterprises of different industries [33]. This will provide an objective assessment of the effectiveness of alternative solutions, optimize business cost management measures to reduce operating costs and move to a new level of economic development.

Social and economic transformations, digitalization and cloud technologies as key components of economic processes informatization require further development of principles and conceptual provisions of enterprises' management systems functioning. This creates the basis for improving algorithms and optimization in the managerial decision-making, with the use of new tools provided by cloud technologies.

Therefore, the problem of interoperability in managerial decisions, made by the enterprise management system, encompasses teams of specialists, geographically responsible contractors, technical objects and technologies, as well as communication relations between them provided by information flows. Traditional requirements for managerial decision-making remain relevant, among them are: reliable information, quick decision-making, promptness of information transfer, intensification of decision-making processes and cycles, risks reduction and achievement of social and economic effects of the system, taking into account its state.

Based on the above, it should be concluded that the enterprise management system belongs to dynamic systems of the stochastic type. Management process carried out by the system can be formalized as a random sequence of operations to achieve the enterprise's ultimate goal. If we put this sequence in correspondence with the state variables of the control system that arise under the influence of the orderly interaction of technologies, processes and other elements of the system, then its managerial influence will be a Markov process. This process is characterized by a finite set of states and continuous time, which is conditioned by the system of data collection from remote and tracked objects, technologies of their management, information exchange between objects, redistribution of tasks, and their planning taking into account availability of certain services in the object's coverage area [31; 33]. The control system can

solve complex problems that require significant computing resources (for example, real-time video processing when the local wireless network uses cloud computing resources).

3. Development of an enterprise management system functioning model in the conditions of cloud technologies

The management patterns determine the most essential links and relationships between various management aspects within the enterprise and with the environment's elements. Theoretical research showed that there is a regular dependence of organizational forms and management methods on the organizational structure of management, material and technical basis and the level of modern information systems implementation and types of cloud and other technologies.

The process of managing all spheres of enterprise is cyclical and occurs in time and space. It is determined by the conditions of interoperable information systems, which consist of components that make up random information resources (software components, databases, knowledge bases, data files, etc.). The latter interact basing on information sharing.

Thus, the control cycle is characterized by the following main types of determiners: time period and information flow. The management cycle duration is determined by the technologies used, their operational modes, the information processing time, development and decision making, and organization of decision implementation. A fundamental model of the management system functioning reflects the generalization of the above (Figure 1).

The model reflects the continuous process of interaction between the management object and the management system as well as the multivariate response of the mentioned object to the decisions made. Once the decision is made, the information field informs the management object of the occurring changes.

Proposed model assumes development of a number of mathematical models for probabilistic indicators calculation of the enterprise management system functioning in the use of cloud technologies. Namely, they are: probability calculation models of an error-free decision-making; decision-making efficiency assessing models; models of decision making for a certain time with parallel method of enterprise management system elements.

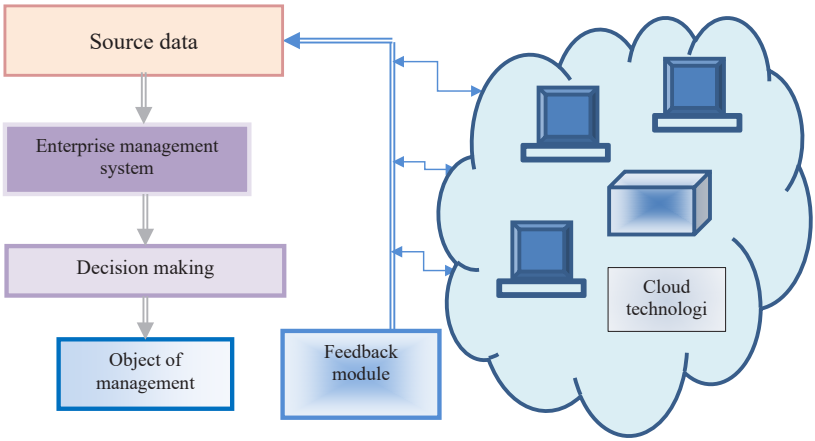

Figure 1. The basic model of the enterprise management system functioning in the use of cloud technologies

4. Calculation of probabilistic estimation of a successful managerial decision-making efficiency

Due to the properties of the Markov process noted above, the mathematical model of the control function is obtained in the form of two distributions: a discrete distribution of operations performed over a fixed time interval $\{0, t\}$; continuous distribution of the fixed number of operations. Using the distributions, you can calculate some indicators that will characterize the effectiveness of management.

To simplify the management function model calculation, we have introduced the following conditions: the number of management operations that provide the final goal is known and equal to n; the operation intensity is constant and remains the same for each operation, $\lambda = const$; the first operation execution begins with receiving the information produced by information technology in conventional time ($t_0 = 0$); each subsequent operation begins immediately and only at the moment of the previous operation completion, which allows the mode and conditions for the information technologies functioning and their provision of information exchange; moving to the next operation with an unfinished previous one is impossible.

The end of the *i-th* operation ($i = 1,2\ldots n$-1) does not stop the management process. After the *n-th* operation execution at time $t_n = t$ of interval $\{0, t\}$ the management process is considered complete. Time distribution τ of performing the *i-th* operation over a time interval $\{t_{i-1}; t_i\}$ is subject to exponential law

$$p_i(\tau) = 1 - e^{-\lambda\tau}, \quad (1)$$

where τ is the time of operation, h.; λ is the intensity of operation, 1/h. Figure 2 shows a graph of the control object state. The vertices of the graph correspond to two object states: S_0 – operation failed; S_1 – operation performed.

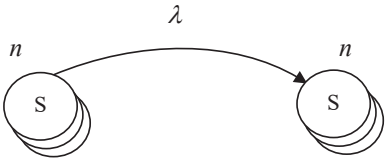

Figure 2. A graph of the control object state

Accordingly, such a control object reflexivity can be shown by *n* arcs according to the number of operations on the graph vertices and by only one arc of transition from S_0 to S_1 state. The Kolmogorov differential equation system for the graph (Figure 3) will have the following form

$$\begin{cases} n\dfrac{dp_0}{dt} = -\lambda p_0 \\ n\dfrac{dp_1}{dt} = -\lambda p_0 \end{cases} \quad (2)$$

Let us integrate system (2) for the initial conditions $p_0(0) = 1$; $p_1(0) = 0$. We receive

$$\begin{cases} p_0(t) = e^{-\frac{\lambda}{n}t} & (3) \\ p_1(t) = 1 - e^{-\frac{\lambda}{n}t} & (4) \end{cases}$$

Received function (3) is a function of time distribution of the management operations sequence non-execution, i.e. the probability that the decision is not fulfilled. Function (4) is an integral function of time distribution of successful execution of all *n* scheduled management operations and

characterizes the probability of reaching the end goal. That is, function (4) is a stochastic function of successful control. The final management stochastic function can be written in this form

$$F(n,t) = 1 - e^{-\frac{\lambda}{n}t}, \tag{5}$$

where λ is the intensity of operations, 1/h; n is the number of operations; t is the time of execution of n operations, h. As can be seen from the received results, the higher the number of operations, the less the likelihood of processing the operations in full within a certain time, which makes it difficult to make decisions according to the situation. From the obtained model (5) it is possible to calculate the value of mathematical expectation (probability time) of the execution time of all n operations by the formula:

$$M_t = \frac{\lambda}{n}\int_0^{\infty} t \cdot e^{-\frac{\lambda}{n}t} dt = \frac{n}{\lambda}, \tag{6}$$

where M_t is the probable time of performing n operations, h.; n is the number of operations; λ is the intensity of operations, 1/h. (according to the level of management systems and technologies development). Dispersion of the execution time of n operations is calculated by the formula

$$D_t = \frac{\lambda}{n}\int_0^{\infty} t^2 \cdot e^{-\frac{\lambda}{n}t} dt = \frac{n^2}{\lambda^2}, \tag{7}$$

where D_t is dispersion of the execution time of n operations, h^2; n is the number of operations; λ is the intensity of operations, 1/h.

For practical application of the obtained model (4), it is advisable to turn to the inverse function. As the result we obtain

$$t = -\frac{n \cdot \ln(1 - F(n,t))}{\lambda}, \tag{8}$$

where t – a sequence of operations' execution time, h.; n is the number of operations; $1 - F(n,t)$ is a set probability of performing operations; λ is the intensity of operations, 1/h. Figure 3 shows the dependence of the standard decision-making time on the determined probability (λ=*const*).

The graphical dependence obtained shows that the higher the requirement for the standard decision completeness, the more time it takes. According to the formula (8) it is possible to predict the execution time of operations sequence with a given probability of their execution.

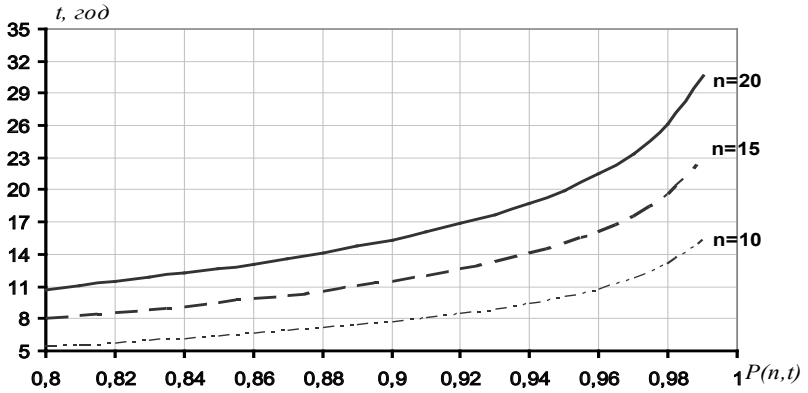

Figure 3. Dependence of the standard decision-making time on the determined probability

Thus, we have defined the function of successful execution of operations (5) and obtained a formula for calculating the probable time for performing sequential operations with the given probability (8).

In the conditions of a dynamic environment, scientific and technological progress, and economic instability, decision-making efficiency is an important factor in achieving the ultimate goal of a high-tech management system. In calculating the decision-making model efficiency, we used principles and assumption generally accepted in the theory of probabilities and graph theory, as well as existing principles and methods of enterprise management based on modern cloud technologies. As much as we detail the time spent in the stochastic model that we are calculating, we will limit ourselves to the study of the basic phase states of the decision-making process. This will allow for the most complete consideration of the influence of the basic parameters over time and to obtain simple enough formulas for practical application. Suppose that T is a random time to make a decision, from the initial moment $t = 0$ is getting information about the situation change (in the external environment) up to the present moment t is bringing the solution to the enterprise infrastructure, so that $0 \leq T \leq t$. That is, we consider T a random function of the form

$$T = T_1 + T_2 + T_3 + T_4 = \sum_{i=1}^{4} T_i \,, \tag{9}$$

where T_1 is random time required to analyze information received, h.; T_2 is random time needed to assess options, h.; T_3 is random time required to make the decision of the main plan and sequence of actions, h.; T_4 is random time it takes to bring the solution to the executors, h. The constituents of formula (9) are detailed as follows

$$\begin{cases} T_1 = T_{11} + T_{12} + T_{13} + T_{14} \\ T_2 = T_{21} + T_{22} + T_{23} \\ T_3 = T_{31} + T_{32} + T_{33} + T_{34} \\ T_4 = T_{41} + T_{42} + T_{43} \end{cases}, \tag{10}$$

where T_{11} is time to analyze the main goal, h.; T_{12} is time to analyze the place in the external environment (in the system), h.; T_{13} is time to coordinate issues with cooperating businesses, h.; T_{14} is time to organize the ongoing activities of subordinate infrastructures, h.; T_{21} is time to analyze information about competitors' businesses (firms), h.; T_{22} is time to gather more information, h.; T_{23} is time to transfer additional information to higher infrastructure, h.; T_{31} is time to process all information received, h.; T_{32} is time to fully analyze information and develop options for possible events in the external environment, h.; T_{33} is time for comparative analysis of the developed options for possible events in the external environment, h.; T_{34} is time for additional analysis of the remaining options and the choice of alternatives, h.; T_{41} is time for approval of the decision made, h.; T_{42} is time to finalize an agreed (alternative, if needed) optimum decision and make a final decision, h.; T_{43} is time to transfer the final solution to the infrastructure (executors), h. We assume that the time distribution of the constituent phases of the T_{i} decision-making process is subject to exponential law, so that

$$f(t_i) = \lambda_i e^{-\lambda_i t} \,, \tag{11}$$

where λ_i is intensity of decision-making stages T_i, 1/h.; t is time of decision-making, h. We also introduce the condition that the intensity (λ_i) of decision-making stages (T_i) are different for each stage and are expressed by the average value of their components intensity (T_{ij}) in the form

$$\lambda_i = \frac{n_i}{\sum\limits_{i=1,\,j=1}^{n,m} \frac{1}{\lambda_{ij}}} \,, \tag{12}$$

where n_i is number of decision-making stages; λ_{ij} – the intensity of the decision-making stage components (T_{ij}), 1/h. Let us consider the option of preparing managerial decision making by the method of parallel operation of the enterprise management system elements, which is ensured by the use of the latest information technologies.

5. Evaluation of the managerial decision-making efficiency by the method of parallel operation of the enterprise management system elements

With the parallel method of operation of the enterprise management system elements, a random decision-making process based on a Markov process model can be constructed as a graph of phase states (Figure 4).

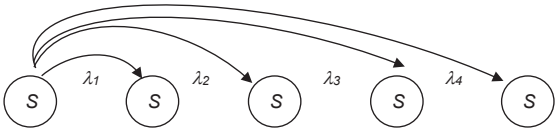

Figure 4. A graph of phase states of the managerial decision-making process stages

By transitivity property graph (Figure 3) becomes a graph (Figure 5).

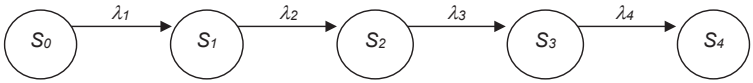

Figure 5. A graph of phase states of the managerial decision-making process stages

In Figure 4 and Figure 5: S_0 – the information is received on changing circumstances, early analysis of information; S_1 – the information is analyzed, beginning of the options assessment; S_2 – options are assessed, the beginning of management decision making; S_3 – decision is made, start of bringing it to infrastructures (executors); S_4 – solution is obtained by infrastructure to carry out.

The system of differential equations of probabilistic states corresponds to the marked state graph

$$\begin{cases} \frac{dp_0}{dt} = -\lambda_1 p_0 \\ \frac{dp_1}{dt} = \lambda_1 p_0 - \lambda_2 p_1 \\ \frac{dp_2}{dt} = \lambda_2 p_1 - \lambda_3 p_2 \\ \frac{dp_3}{dt} = \lambda_3 p_2 - \lambda_4 p_3 \\ \frac{dp_4}{dt} = \lambda_4 p_3 \end{cases} \quad (13)$$

Equations (13) are integrated sequentially one by one under the initial conditions

$$p_0(0) = 1; \qquad p_1(0) = p_2(0) = p_3(0) = p_4(0), \quad (14)$$

where $p_i(0)$ is the probability of the state phases of decision making at $t = 0$. The system's solution will take the form

$$p_4(t) = 1 + A_1 e^{-\lambda_1 t} - A_2 e^{-\lambda_2 t} + A_3 e^{-\lambda_3 t} - A_4 e^{-\lambda_4 t}, \quad (15)$$

where

$$A_1 = \frac{\lambda_2 \lambda_3 \lambda_4}{(\lambda_1 - \lambda_2)(\lambda_1 - \lambda_3)(\lambda_1 - \lambda_4)} \quad (16)$$

$$A_2 = \frac{\lambda_1 \lambda_3 \lambda_4}{(\lambda_1 - \lambda_2)(\lambda_1 - \lambda_3)(\lambda_1 - \lambda_4)} \quad (17)$$

$$A_3 = \frac{\lambda_2 \lambda_2 \lambda_4}{(\lambda_1 - \lambda_2)(\lambda_1 - \lambda_3)(\lambda_1 - \lambda_4)} \quad (18)$$

$$A_4 = \frac{\lambda_1 \lambda_2 \lambda_3}{(\lambda_1 - \lambda_2)(\lambda_1 - \lambda_3)(\lambda_1 - \lambda_4)} \quad (19)$$

The function $p_4(t)$, p4 (t), which determines the probability of an absorbing state, is nothing more than an integral function of the of decision-making time distribution. Generally, the number of phase states (except for the initial one) may be different. This is due to the number of components in formula (9) and the specific problem. For random n (let us replace, as usual, p p by F), formula (15) takes the form

$$F(n,t) = 1 + \sum_{i=1}^{n} (-1)^n \cdot e^{-\lambda_i t} \cdot \frac{\prod_{j=1}^{m} \lambda_j}{\prod_{i \neq j}^{n} (\lambda_i - \lambda_j)}, \quad (20)$$

where n is the number of decision-making phases; λi, λj is intensity of decision-making stages, 1/h.; t is time of decision-making, h.

From the obtained formula (20) the mathematical expectation (average value) of the time of managerial decision-making is calculated. The mathematical expectation is calculated by the formula

$$M_t = \int_0^{\infty} t \cdot f(n,t)dt = \sum_{i=1}^{n} \frac{1}{\lambda_i}, \quad (21)$$

where Mt is probable average value of decision-making time, h.; λi is intensity of decision-making stages, 1/h.

In our case (for formula (9)) the probable average value of decision-making time is calculated by the formula (according to formula (21)

$$M_t = \frac{1}{\lambda_1} + \frac{1}{\lambda_2} + \frac{1}{\lambda_3} + \frac{1}{\lambda_4}, \quad (22)$$

$\lambda_{i\ i}$ is intensity of decision-making stages, 1/h.

The obtained formula (20) allows us to calculate the probability of an event, which is in that the random decision-making time (T) will not occur before a predetermined value (t), i.e.

$$F(n,t) = P(T \le t) \quad (23)$$

Provided that $\lambda = \lambda_j = const$ (λ_i are equal), formula (20) becomes (a partial case)

$$F(n,t) = 1 - e^{-\lambda t} \cdot \sum_{i=1}^{n-1} \frac{(\lambda t)^n}{n!} \quad (24)$$

In this case, the mathematical expectation of the managerial decision-making time will take the form

$$M_t = \frac{n}{\lambda} \quad (25)$$

Thus, according to the formulas (20) and (24), the probability of managerial decision-making for a certain time by the method of parallel operation of the enterprise management system elements is calculated.

Practical aspects of usage of cloud technologies in the enterprise activity management system are based both on theoretical studies and expert evaluation of the results of the enterprises' activity obtained from the introduction of the latest systems. In particular, the use of cloud technologies provides the tools to combine the extensive capabilities of managing computing resources (if this function is necessary for the user)

with cost savings in maintaining the physical and hardware infrastructure of the information and computing system.

For users, the benefits of using cloud services are the ability to obtain the necessary service on terms that are personally defined by them in the context of interaction with the components of the cloud environment system (Figure 6) [31], which is the basis of a hybrid enterprise information system.

Therefore, the main ways to improve the reliability of the information management system of the enterprise are to systematically control the progress of the management tasks, the introduction of organizational measures to increase the responsibility of employees of the personnel management service for the reliability of information and quality of management activity. On the basis of the above, we can distinguish the general principles of construction of modern automated control systems.

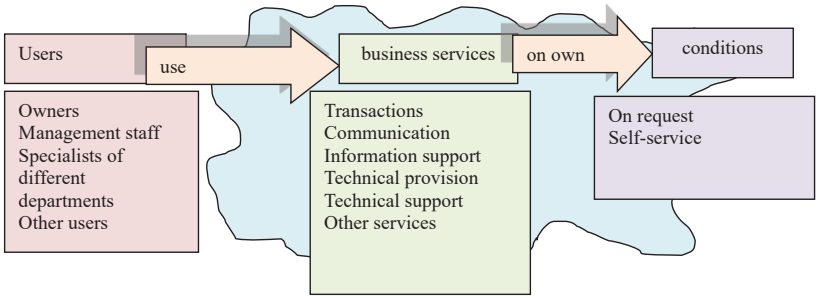

Figure 6. Terms of use of cloud technologies by users

These principles are grouped due to the following features: functional, technological, ergonomic and social-economic (Table 1).

The automated control systems developed by the above principles provide the basis for more efficient use of cloud technologies in organizational systems. In addition, the important benefits of operating the automated control systems of enterprises with the use of cloud technologies are economic benefits.

These economic effects are due to the fact that cloud technologies allow to save on the acquisition, maintenance, modernization of software and equipment, as well as the maintenance of special departments for the use and maintenance of software and technical complexes. The results of the use of

cloud technologies increase the efficiency and effectiveness of management decisions, the initiative management of the IT infrastructure; unlimited data storage is used; the conditions of availability of data from different devices and jobs to data systems are determined; data loss protection is enhanced; it becomes possible to perform many activities; the control of the whole process expands.

Table 1

Basic principles of building automated enterprise management systems

Name of group of principles	Components of group of principles
Functional	System approach; continuous development of the system; the emergence of new tasks; maximum end-user targeting; problem orientation; principles of reliability, compatibility and flexibility
Technological	A considerable number of modes of functioning of automated control systems; creation of local databases; maximum focus on paperless technology; unity of information base; maximum "embedding" of elements of new information technology
Ergonomic	"Affordable" or "friendly" interface; adaptation to the level of user training; easement of use of information
Social-economic	Efficiency of the management system; redistribution of functions, rights and responsibilities; regulation of procedures performed by employees of one department

Of great importance for the effectiveness of the implementation of innovative business processes are IT, the feasibility of which can be justified on the basis of assessing the effectiveness of their implementation, which involves the gradual consideration of all costs and risks. The use of cloud technologies ensures the formation of an integrated information system for managing new types of innovative business processes and building an effective mechanism for their implementation.

6. The role of information technology in ensuring the intellectualization of enterprise processes

Today, in the transition to the information society, this sector of the economy has a significant impact and great importance on the organization of the management process. To obtain the most up-to-date information,

users spend significant funds, which are paid for their information support, while the information industry operates at the expense of these funds. From this we can conclude that the information industry does not include the media (press, radio and television), because such a resource as information must be relevant and valuable.

The combination of informatization and globalization in one time space indicates the emergence of a new stage of economic development of the world, which today is characterized as the information economy.

The spread of the information economy in developed countries has led to a significant gap in the level of technological and socio-economic development from other countries and provided them with visible advantages and opportunities in setting standards of production and consumption for decades to come. The progressive development of information technology, changing the worldview of their users leads to an understanding of the inevitability of the modern economy in the direction of intellectualization in both services and production. This is especially true for IT professionals.

In the context of the national program of informatization of Ukraine, information technologies become the fundamental basis of innovative business processes of modern enterprises, promote globalization and access to foreign markets, provide comprehensive reorganization of management, become a source of added value for businesses. These factors cause an increase in the rate of informatization of Ukrainian enterprises.

The basis for its implementation should be an effective management system for the implementation of information technology in business processes of enterprises. The purpose of the functioning of information technology is to reduce the complexity of the processes of using information resources and increase their reliability and efficiency. The basis of qualitative assessment of information technology is a variety of methods and ways to design them. The most important indicator is the degree of compliance of information technology with the scientific and technical level of its development. Before choosing one of the methods of assessing economic efficiency, it is necessary to determine the criteria by which the main result of the implementation and use of IT in the business process is expected to be achieved.

The most common criteria for assessing the effectiveness of IT are functional and resource, criteria for saving social time and criteria for cost-benefit ratio.

Functional criteria are those whose values characterize the degree of achievement in this technology of the desired indicators of the information process, which are necessary for the user, namely:

1) volume-time characteristics of the implemented information process (data transfer rate, amount of memory for storing information, etc.);

2) characteristics of the reliability of the information process (the probability of correct transmission or transformation of information, etc.);

3) parameters that characterize the degree of achievement of the main end result of the information process, which is implemented using this technology (correctness of language or image, the quality of the formed graphic information, etc.).

The values of resource criteria characterize the quantity and quality of different types of resources required for the implementation of this information technology. Resource efficiency criteria allow us to fundamentally compare different types of technologies. In addition, they provide an opportunity to quantify the effect obtained from the use of these technologies in terms of their social utility in terms of saving the following types of resources:

1) material resources (technical and technological equipment necessary for the successful implementation of this technology);

2) energy resources (energy costs for the implementation of the information process or technology);

3) human resources (number and level of training required for the implementation of this technology);

4) time resources (the amount of time required to implement the information process with this technology of its organization);

5) information resources (composition of data and knowledge necessary for the successful implementation of the information process).

Criteria for saving social time are used as one of the most common indicators of social development, including for comparative quantification of the effectiveness of different types of information technology. It is generally accepted that any savings can ultimately be reduced to time savings. This is the most common indicator of technology of any kind (industrial, social or information).

Criteria for the ratio of costs and output should be used in the analysis of data processing technology. The issue could be considered to meet the information needs of users, participants in business processes.

Monitoring the effectiveness of IT implementation should be based on a single system of criteria throughout all stages of their life cycle. The general rule in determining the criteria for monitoring efficiency is the target approach, according to which – is the level of achievement of the goal of managing business processes of the enterprise.

Based on the fact that the purpose of implementation is to establish information technology to achieve certain goals, respectively, the effectiveness will be determined as the degree of their achievement.

Analysis of the practical experience of implementing IT for the management of innovative business processes shows that the common approach to the interpretation of efficiency is the ratio of benefits (effects) and costs of innovation. But to focus only on the assessment of this indicator is a mistake, as measuring the effectiveness of information technology implementation of this approach is somewhat limited, as the impact of information technology on enterprise profitability is indirect through improving management of innovative business processes, employee competence, customer satisfaction. Measuring these effects in the financial dimension is difficult, so the value of the efficiency indicator will not provide accurate information on the effectiveness of IT implementation in the innovative business process.

Thus, under these conditions, the effectiveness of the implementation of information technology means the adequacy of functional characteristics of technology to specific goals and objectives of innovative business processes, which are determined when deciding on the implementation or modernization of information systems. Thus, the set of effects from the introduction of information technology, and consequently efficiency, depends on the goals of informatization, first of all.

Assessment of the effectiveness of the implementation of information technology should be aimed at analyzing the potential benefits for the company and, consequently, the implementation of the project that will maximize this benefit.

Thus, based on the above material, the authors concluded that it is appropriate to apply the method of assessing the effectiveness of information technology in the management of innovative business processes of the enterprise, which can be presented in stages.

The first stage is the evaluation of innovative business processes from the standpoint of determining their role in solving enterprise problems,

which allows you to link IT processes to solve problematic aspects of the enterprise. At this stage, the implementation of the innovation strategy of the enterprise is planned, taking into account critical factors and indicators of success, the most important elements of innovative business processes are identified and a plan for their implementation is drawn up.

The second stage selects IT solutions that can be used to improve the efficiency of innovative business processes. At this stage, an analysis is performed, which identifies bottlenecks in each of the selected components of innovative business processes and justifies a solution that eliminates the shortcomings and get a quality result from IT.

3. Risk forecasting. At this stage, the study identifies and measures the risks inherent in IT solutions (taking into account the uncertainties that arise directly at the assessment stage).

4. Estimate the cost of IT solutions. At this stage, the amount of funding in IT required to achieve the goals is determined. Cost estimation consists of:

1) cost estimates for IT solutions (involves determining all capital and current costs associated with the implementation and use of information technology, namely: assessment of direct costs for the implementation of IT solutions; estimates of indirect costs of IT implementation; estimates of IT maintenance costs for the period of their life cycle, which provides for forecasting the annual cost of maintaining information technology during their useful life; assessment of possible losses from the implementation of IT which provides for the determination of losses from failures and downtime (planned or unplanned), losses from the elimination of malfunctions and others;

2) assessment of the validity of a certain amount of costs for IT solutions, which is carried out by: comparing costs with the average performance of enterprises in one industry; determining the cost-effectiveness of IT solutions.

The fifth stage evaluates the effectiveness of the introduction of information technology in the innovative business process. To this end, the expected benefits of implementing one of the above methods of assessing the effectiveness of IT implementation are identified and evaluated.

To ensure the completeness and reliability of the assessment of the effects of the introduction of information technology, it is necessary to take into account the impact of external factors that affect the innovative business

processes of the enterprise and determine the current level of efficiency of innovative business processes. This approach will determine the level of efficiency of automation of innovative business processes of the enterprise.

Thus, at this stage of economic transformation in Ukraine the primary task of domestic industrial enterprises is to form a management system strategy of innovative business processes and mechanisms to meet the information needs of management in an unstable environment and growing competition from foreign manufacturers, which must not only take into account environmental changes and actively influence them. Such an active innovation policy in combination with modern management technologies can increase the company's profits without attracting investment from outside.

Thus, an innovative approach to socio-economic development of the enterprise involves the formation of an innovative strategy, the implementation of which is ensured by innovative business processes using modern computer technology, which requires constant monitoring, systematization and control to achieve goals, increase profitability and competitiveness.

As innovative business processes are characterized by a certain degree of uncertainty and risks, which are also inherent in IT, there is a need for their constant monitoring, diagnosis, control and identification of ways to effectively implement and improve. The mechanism of management of innovative business processes of the enterprise which sequence of realization is following should be directed on performance of the set tasks.

Thus, the first stage involves a systematic diagnosis of innovative business processes of the enterprise, which allows to establish qualitative and quantitative characteristics that determine the degree of effectiveness of innovative business processes management. The proposed system of key performance indicators identifies business processes as well as IT implementation measures that need to be improved and developed in order to strengthen competitive advantages.

In the second stage, using the methods of qualitative analysis, it is necessary to identify the most problematic components of business processes, and identify their "bottlenecks". The result of the diagnosis should be the formalization of the problem and identify the causes of inefficient management of innovative business processes, as well as the factors that cause these causes.

The third stage includes a qualitative and quantitative assessment of the resource capabilities of the enterprise to implement measures to manage innovative business processes. The results of the comprehensive assessment of innovative business processes and identification of resource opportunities of the enterprise will be the basis for the fourth stage – the definition of measures to improve them.

The main purpose of the fifth stage is to determine the economic effect of the proposed measures of innovative business processes in IT, calculate the integrated effect, as well as control and implementation of measures to improve innovative business processes in the introduction (use) of IT.

7. The latest information systems in providing enterprise management system

Due to the rapid development of market relations, the speed and scale of technological changes, it is impossible to ensure the enterprises competitiveness only through the use of material and financial resources available to most economic subjects. The results of scientific research show that the effectiveness of the company strategy implementing primarily depends on the quality of information produced by its information system, as well as knowledge and tools for their use, determining the enterprise's further strategic and tactical objectives aimed at increasing its competitiveness and ensuring sustainable development [9; 10].

The conditions of the economy sustainable development, the environmental problems solution, rational nature management, as well as the current state of enterprises' development require a comprehensive analysis of factors that affect the enterprises activities, and require scientifically based ways and methods for management system building and options for optimizing plans for the information systems and technologies further development that can provide enterprises with the management system's effective functioning, additional income and active positions on both international and domestic markets.

Scientists grounded the fundamental provisions that provide the basis for the information processes study from the point of view of their impact on the enterprise management system [13; 32; 33]. However, automated information systems and technologies are extremely dynamic. Their use and development are accompanied by the emergence of new problems connected both to the

information systems functioning, and to the corresponding structural changes in the enterprise, which occur under their influence (transition to another policy, a new type of labour, business operations formalization, interactive networks use, employees qualifications increase, etc.) [6; 19; 26]. Therefore, a number of information phenomena and processes, their economic consequences are still insufficiently researched and need further study.

Thus, the research of the theoretical and methodological positions of the industrial enterprise management system formation based on the full integration of modern information systems, its information support, as well as the effective use of investments to create the preconditions for the continuous development and improvement of information systems and expenses optimization for conducting appropriate measures by using economic and mathematical methods and models [5; 11; 17; 44].

The task of optimizing different types of enterprises activities on the criterion of cost at a given efficiency is relevant for enterprises' management systems and research organizations [25]. The company's activities management is continuous and bases on information flows that ensure the interconnection between its management system elements. The movement and use of information involves the implementation of managerial influences, which are carried out on the basis of making appropriate management decisions. In general, management can be represented as a process of developing, making and implementing managerial decisions aimed at achieving the enterprise goals.

Consequently, the process of making a managerial decision is a set of consequent actions of the subject of management, which begins with the problem emergence and ends with certain measures implementation aimed at eliminating this situation [2]. The effectiveness of making managerial decisions depends on the orderly interconnection of elements and subsystems of the management system, as well as on the correct organization of information flows. At the same time, the attention of the management focuses on the goals of the whole system, and the properties of the elements and subsystems that function and develop within the system are subject to its properties in general.

Therefore, for the technology of production enterprise management the task of management process optimizing becomes permanent, and excludes such activities and operations that reduce the enterprise efficiency [17].

The development of management technology for a particular enterprise involves determining the quantity, sequence and nature of operations that constitute the process of managing, developing and selecting the appropriate methods, techniques and technical tools, identifying the optimal conditions for the managerial decisions making for each operation. The precise operation of a production enterprise management system requires the division of the management process into separate, consistently executed operations, and the effective organization of the management process requires the proper combination of operations taking into account the responsibilities and capabilities of the executives. Each individual operation must be linked to the previous and subsequent operations of this management process cycle.

The logically presented management process allows us to conclude that management technology is directly related to the process of algorithmic operations in the framework of certain functions of the control system as a whole on the enterprise, regardless of the management level. The fulfilment of this condition confirms that virtually all areas of the management process can be formalized, so the technical side occupies a special place in management technology today. The management techniques, as a rule, include a set of material resources (office equipment, communication facilities, computing equipment, etc.), which reduce the complexity of management work, and their implementation timing, as well as improve the quality of the decisions taken. The intellectual capabilities of an individual have certain inclinations, features, reserves and limitations, but the use of operational and long-term memory of modern computer technology allows expanding the professionals' intellectual capabilities to solve managerial problems and to make optimal managerial decisions [32].

Thus, modern managerial technologies can only be realized on the basis of the latest information technologies. Nowadays, information technologies and complex systems are becoming increasingly important for enterprises, as they help to accurately and promptly solve problems starting from production preparation to product sales, and ensure the integration of management functions.

Managers who make decisions on industrial enterprises are essentially information handlers, and an industrial enterprise can be considered as an organization that acts as a processing information system. Hence, we can conclude that an organized system of collecting, processing, distributing,

accumulating, systematizing, storing and using information in defined periods of time and in a regulated form is called the information management system.

Information systems that have achieved a new qualitative level during the last decade greatly expands the possibilities of effective management, since they provide managers of all levels with the latest methods of processing and analyzing economic, managerial information necessary for decision-making (Table 2) [6; 7; 12; 13; 21; 30].

Table 2

The main characteristics of the latest information systems and the results of their use

Methodology	The main feature	Information Management System
Fundamentally new means of information processing	Integration into management technology	Information provision of the enterprise strategic and tactical tasks
Integrated technological systems	Integration of the specialists and managers functions	Integrated basis of economic information in different directions of the enterprise operation
Purposeful creation, transmission, storage and display of information	Taking into account the regularities of the social environment, individual abilities and knowledge of the user	Full information exchange, formation of mutual trust and scientific and technical development
Advantages of information processes integration: acceleration of information exchange; systematization of information flows, introduction of scientific and technological progress rates, increase of labor productivity, social standards, reduction of research and development costs, efficiency of the solution of current production tasks, flexible adaptation to the requirements of the environment		

These methods provide the processing of dispersed output data into reliable and operational information of the decision-making mechanism by means of hardware and software to achieve optimal market parameters of the management object.

Today there is a tendency to combine different types of information technologies into a single integrated complex. It is possible thanks to the modern communications facilities that provide not only the extremely wide

technological capabilities of management activity automation, but also are the basis for creating the most diverse network variants of automated information technologies: local, multilevel, distributed, global computer networks, e-mail, digital networks of integrated services [13; 17; 31; 33]. All of them are focused on the technological interaction of a set of objects created by means of transmission, processing, accumulation and storage, data protection, and also allow the creation of complex data integrated computer processing systems, virtually unlimited operational capabilities for the management processes implementation. Such systems can be called information management systems, designed as information and technological and software complex. The protection of information when it is transmitted and processed is of particular importance in such systems.

Influencing the quality of intellectual decisions of the organization, information systems increase the development level of the organization itself. On the other hand, the intensification of the information technology using at the enterprise leads to an increasing need for their constant development and improvement, and simultaneous solving the problems of the activities cost reducing, and the resource base efficient use. Therefore, both the long-term and the operational plan for the enterprise information system further development should be considered as a physical system of measures that provide the necessary level of economic information processing and the enterprise operation efficiency, which is considered sufficient for fulfilling their tasks. The physical system efficiency is understood as an aggregate quantitative indicator whose value estimates this system effectiveness.

To plan activities for the enterprise information systems further development, it is necessary to take into account their features. Among them are: the introduction and development of information systems cause a wide range of extremely important results that do not always acquire adequate monetary terms; these results may serve the enterprise as a tool for obtaining additional income, as well as the possibility of maintaining a market position; along with the introduction or improvement of information technology, there are qualitative changes in the enterprises' organizational and production structure.

Therefore, highly skilled experts capable of identifying and assessing the management and production needs of the company in information provision (taking into account factors of the internal and external environment) and

the corresponding directions of the information systems and technologies development (meaningful filling of factor characteristics and their weight value) should be involved in planning of measures for the information systems and technologies improvement and development. The plan of carrying out the measures on the enterprise information system development or improvement will be defined as the finite orderly set of controlled factor indicators.

$$X = \{X_i\}, i = 1,2,...,n \tag{26}$$

which ensure the effectiveness of the plan. We consider that the set has a clearly defined sequence relation

$$X_1 < X_2 < ... < X_n \tag{27}$$

where the element X_1 precedes an element X_2, X_2 precedes an element X_3 and so on.

The criterion for establishing order in a set X will be a numerical set of weights p of factor indicators Xi, so that

$$p = \{p_i\}, i = 1,2,...,n \tag{28}$$

where p_i are real numbers that satisfy the inequality

$$p_1 < p_2 < ... < p_n \tag{29}$$

We will define the concept of weight as a reflection $f : X \to R$ (R is the set of real numbers), which sets a defined number $f(X_i) = p_i \in R$ for each factor Xi according to the defined rules. From (29) it follows that the smaller the weight of the factor, the less significant this indicator is, the smaller its role in the overall effectiveness of the current plan, the more its place tends to the right in the established order (27). The development of various plans for the same purpose and comparing them is admissible only on the same factor set $\{X_i\}$ following the rules of weights p_i calculation.

Therefore, the weights p_i of factor characteristics X_i, although different in effect (29), still do not change from plan to plan. In other words, for a single set of destinations and assignments, the set $\{p_i\}$ is a constant set (set of constants).

The difference in plans is expressed in the difference between the sets of numerical values of factor characteristics

$$x = \{x_i\}, \quad i = 1,2,...,n \tag{30}$$

In different plans numerical sets X_i are diverse, but the order of following the numbers x_i in all plans must correspond the order (27), established on

the factor set (26). Unlike a constant set $\{p_i\}$, the set $\{X_i\}$ is a parametric set. Variable values x_i from plan to plan are partial measurements of the compared plans effectiveness. We will consider the weights of partial indicators. Then, the aggregate indicator of the plan effectiveness can be represented as a complex efficiency indicator in the form of a linear model:

$$F = p_1x_1 + p_2x_2 + ... + p_nx_n = \sum_{i=1}^{n} p_ix_i \quad (31)$$

where x_i is conditional (or normalized) values of factor characteristics X_i.

A function F that contains n efficiency variables, linear to its own performance indicators xi, is called the function of the plan's efficiency.

If in the formula (31) we fix the values of factor characteristics x_i, then the number

$$K = \sum_{i=1}^{n} p_i x_{i(fix.)} \quad (7)$$

will simultaneously characterize this plan by the sum of its established partial performance indicators. The number K as an integral performance indicator in the general case is different for various plans, so it is acceptable to use it to evaluate the effectiveness of the plans in their comparative analysis.

Approval of the results of the integral efficiency indicator use for assessing the information systems development plan was carried out at the machine-building enterprises of Khmelnytsky region [16], the sequence of approval is schematically summarized in Figure 7.

It is expedient to carry out the planning optimization step by step: at the first stage of the plan optimization it is necessary to estimate the expenses for the full plan of measures implementation. To do this, it is necessary to decompose the costs by type of measures and to propose a methodology for calculating the real investments required for each measure.

The next stage in the formation of an optimal plan is to determine the reducing costs options. The result of the second stage should be the reduction of relevant plans with a quantitative estimate of the cost of their implementation according to the methods developed at the first stage.

At the third stage it is necessary to evaluate the potential efficiency of the enterprise, its qualitative and quantitative characteristics due to the implementation of an effective plan for the development of enterprise information systems.

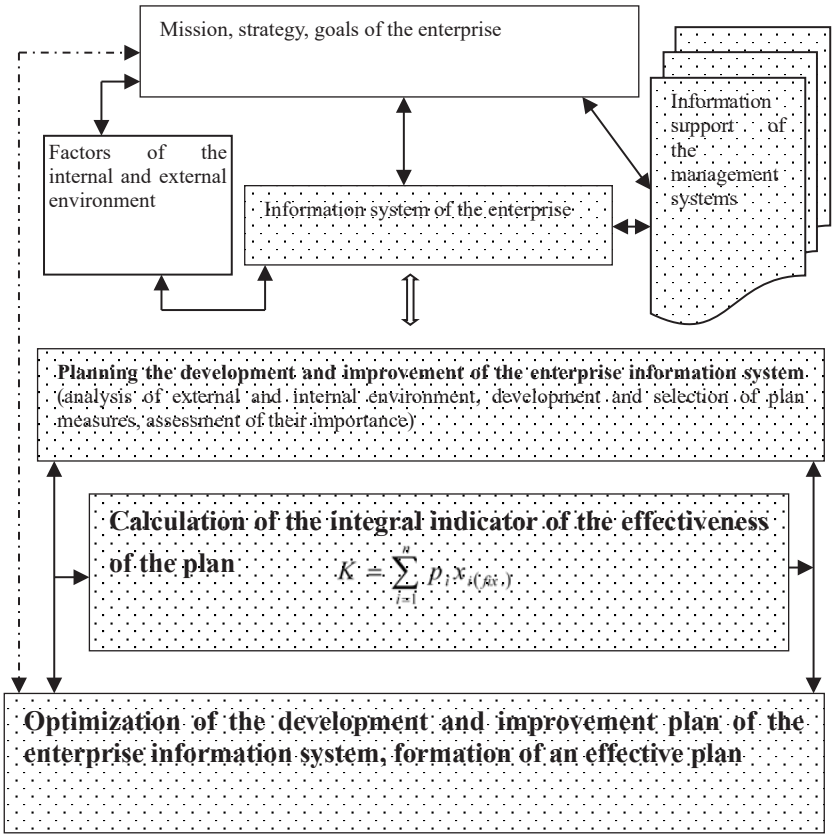

Figure 7. Structuring the optimization of the enterprise information system development planning process

8. Improving the development of information systems as a basis for information support of the enterprise

Information systems every year have an increasing influence both on the development of the economy of each country and on the social life of people. An increase in the quality development of many industries (science, production, trade, the financial sector, etc.) is associated with the introduction of information systems and technologies. In turn, trends

in the development of automated information systems are determined by various factors: integration processes, scientific discoveries, new industrial technologies, and the situation in the financial markets.

In such conditions, changes in production technologies, information technologies and ideas are being carried out at a very fast pace. Therefore, when introducing information systems at a specific enterprise, it is necessary to take into account their potential development in the long term in direct correlation with financial support.

Consequently, automated information systems are one of the main factors in the growth of labor productivity, improving its quality and efficiency, both in the field of management and in the field of material production, since the software embedded in automated information systems allows you to adapt existing enterprise management systems to new requirements, taking into account the specifics of the enterprise.

However, when designing the stages of introducing information systems and forming a budget for their financing, it is necessary to consider this process as a long-term investment, which can be accompanied by variable costs of an indefinite value over time, and to take them into account for the future, an appropriate mathematical apparatus is needed to predict all the costs of implementation. as well as in-line maintenance of information systems software for the purpose of their constant updating and support at a modern level. To accomplish such tasks, it is advisable to build a functional model of the processes of introducing an information system at an enterprise, taking into account the interaction of each process and a structural unit of an enterprise or a separate function, which will allow determining the optimal option for introducing information systems, predicting all the costs of their implementation and use during its operation, which ultimately will contribute to improving the efficiency of the enterprise as a whole.

The accelerated rates of development of global information processes pose a very important task for the Ukrainian economy – the rapid technological re-equipment of all sectors of the national economy, taking into account the high world level of development of automated information systems. The solution of the assigned task will create conditions under which the acceleration of scientific and technological progress, the introduction of modern computer technologies will allow Ukraine to enter the system of the global information space at a sufficiently high level, together with industrially

developed countries. The expansion of the scale of the introduction of information systems and technologies depends on the level of both material and non-material support of the basic processes: the production of software and hardware, staffing, the development of international cooperation in the field of information technology, the formation of information and communication infrastructure. For this purpose, Ukraine has introduced a law "On the National Informatization Program". Thus, the development of information and computer technologies and systems forms a single information space for building the information society of our country. The Law of Ukraine "On the Basic Principles of Development of the Information Society in Ukraine for 2007–2015" defines the following strategic goals for the development of the information society in Ukraine, namely: accelerating the development and implementation of the latest competitive information and computer technologies in all spheres of public life; ensuring computer and information literacy of the population by creating an education system focused on the use of the latest information and computer technologies and the formation of a comprehensively developed personality; development of the national information infrastructure and its integration into the global infrastructure; the use of information and computer technologies to improve public administration; improvement of legislation on the regulation of information relations; improving the state of information security in the context of using the latest information and computer technologies.

Thus, Ukraine has, first of all, a powerful intellectual potential and can become one of the largest software producers in the world, which can bring significant income to the state. However, the difficult political and economic situation in Ukraine creates a number of problems that cannot but affect the development of the information systems and computer technologies sector. At the same time, the most important is the problem of introducing the latest scientific achievements and developments into the practice of industrial enterprises.

Thus, the analysis carried out indicates that the potential for building an information society is increasing in Ukraine, and the corresponding measures affect all areas of the country's economy. The building of an information society is also accompanied by such new economic phenomena as intellectual property, changes in labor motivation, the emergence of new professions, and the formation of an information culture.

The massive development of information systems, communications and communications, the introduction of advanced technologies form the foundations of a knowledge economy based on knowledge and information, which are key components of the information society and are the most important components of the production of material goods and the development of the economy of any country.

In a knowledge and information economy, information systems and technologies play a critical role. Information systems are used primarily to systematize the flows of information and knowledge within each industrial enterprise and serve as an incentive to maximize the stock of knowledge. Both large industrial enterprises and small firms need various types of information systems to obtain the necessary information, implement operational and strategic tasks, support decision-making and help in performing functions at different levels of enterprise management. In addition, modern information systems in the era of the formation of the information society and the knowledge economy allow each enterprise, effectively interacting with the external environment, to optimally structure information flows and timely provide all levels of management with high-quality information.

It should also be noted that the introduction of modern information systems into the management system of an enterprise provides for the integration of management functions at all levels of the hierarchy, which can significantly increase the efficiency of enterprise management and significantly reduce the time for making informed management decisions.

A clear definition of the automation of management functions is provided by corporate information systems, which are currently being implemented at all large industrial enterprises. The corporate information system supports the automation of management functions in the enterprise and provides information for making management decisions. This is an integral software and hardware complex that allows you to meet both current and strategic needs of the enterprise in data processing, with the allocation of functions and tasks for the management personnel of each management level.

A mandatory requirement for corporate information systems is to provide distributed work of clients and the ability to remotely access the necessary data.

Management information systems have little analytical capacity. They serve managers who need daily information on the state of affairs.

The information comes from the operational level information system. These systems are used to support decision-making of structured and semi-structured tasks at the level of control over operations; focused on monitoring, reporting and decision-making on operational status; rely on data and its flows within the organization; have insignificant analytical capabilities and a rigid structure. Decision support systems serve semi-structured tasks, the results of which are difficult to predict in advance, and have a more powerful analytical apparatus with several models. They receive information from management and operational information systems.

It is at this level that the capabilities of information systems for the integration of management functions become important, which makes it possible to use the same type of information resources for analysis, processing and management decisions.

Due to the wide variety of computer systems and technologies, the problem arises of assessing the effectiveness of their implementation at each enterprise, taking into account the specifics of its economic activities. Traditionally, when introducing information systems, they take into account, first of all, the main types of costs for technical means, their locations; on software and on the possibility of training service personnel from the staff; losses arising from errors in the system [13].

We propose to take into account such an important point as the dynamic process of changing the cost of maintaining the use of an information system throughout the entire period of its operation, already at the beginning of the implementation of information systems.

Thus, our proposal makes it possible to conduct a comprehensive assessment of the cost effectiveness of the implementation of information systems, taking into account the dynamics of changes in the cost of maintaining the functioning of information systems throughout the entire period of their operation.

Taking into account the development trends of the world economy, which are determined by the growing influence of information systems, the gradual transition of developed countries from an industrial economy to a knowledge economy, building an information society, the main macroeconomic tasks should be determined: ensuring sustainable economic growth of the state and the material well-being of its citizens through the introduction of information systems; ensuring an increase in the contribution

to the economic growth of the state of enterprises operating in the field of informatization, and industries that widely use information systems, through the formation of a balanced regulatory and, in particular, tax policy; promoting entrepreneurial activity in the field of information systems through the formation of a system of administrative, legal and economic mechanisms that will stimulate the demand for information products, attract investments in the IT industry, develop competition, and promote domestic products to the international market.

New trends in the economic development of the leading countries of the world economy indicate that the use of the achievements of the information technology industry and information support systems in the management of enterprises are necessary conditions and components of the success of any enterprise, or associations of enterprises [10; 11]. The strategic perspectives of each enterprise depend on whether information systems are able to function in a strategic perspective. For the qualified creation and use of an information system, it is necessary to clearly understand its purpose and functions.

Therefore, it should be borne in mind that modern software and hardware systems ensure the interaction of various information technologies, the exchange of information flows, and increase the efficiency of the implementation of information systems for enterprise management. In such conditions, an important point is the correct calculation of the cost of implementation and maintenance of information systems throughout the entire period of their operation, taking into account the possibility of their development.

Therefore, the approach we have developed to improve the modeling of the processes of introducing information systems at an enterprise creates conditions for accounting for all costs even at the stage of introducing information technologies, including the costs associated with changing the cost of supporting the functioning of an enterprise information system during the entire period of its operation.

Thus, the information economy includes the following main components: production of information technology, including means of communication and data transmission; production of information products and information resources; providing information services to users.

The information economy affects virtually all aspects of social development.

Note that the creation of a planetary information space with the help of global computer networks can have serious consequences for national security.

The information space has no state borders, no institutions for the protection of state interests, such as border and customs services, so far there are no ways and means to control the value and importance of information resources "transported" across the border. So far, the state border is virtually transparent to information resources.

Introduction of information and telecommunication technologies, equipping state structures with them puts the problem of information security on a completely new, priority level.

Modern information technologies have dramatically increased the effectiveness of information on the psyche of people and public consciousness, to create new forms of covert manipulation of individual, group and mass consciousness.

The main purpose of informational influence is a person, various social formations and institutions. The radical deformation of the social sphere with the help of the media is to provoke extreme social stratification of the population by violating the rights in the distribution of goods and services; decomposition of institutions designed for the comprehensive development of the individual; incitement to national and ethnic hatred, etc.; which shows the significant impact of information processes on social security. Many of the results of such information aggression in the social sphere are already quite tangible in Ukraine today.

The new information economy is forming just as new, unusual relationships between companies, changing the structure of companies themselves and the standards of their management. This requires new knowledge and new people who are able to generate and use this knowledge.

The fourth type of assets, which allows you to adequately forecast the future effective demand and adjust it to the organizational and financial structure of the firm, profit-oriented, can be called information capital.

Information capital at the micro level of economic research allows you to reliably assess non-price information and make on this basis adequate management decisions about the future behavior of the firm.

The value of information capital is determined by the uncertainty of market conditions at the time of the decision.

Unlike the first three types of assets, information capital cannot be measured directly. However, indirect indirect assessment of information capital is quite possible and is regularly carried out by the market. The market price of information capital of the firm is equal to the difference between the total value of the firm in the market and the book value of the first three types of its assets. The greater this difference, the greater the cost of information capital. On the contrary, if the difference is negative, the market negatively evaluates the information capital of the firm, and such a firm can be sold on the market only at a loss.

Within the framework of this theory, the importance of the human factor as the main economic link is changing. This is primarily due to radical changes in the role of man in production. In the industrial economy, traditional technology aims to minimize human intervention in production processes. As the transition to the information society increases the importance of personal characteristics of the individual: analytical skills, information receptivity, sociability, ability to learn. New forms of human activity appear, which are insufficiently studied at the current stage. Dynamically formed human capital, which, above all, is expressed in constantly updated knowledge and skills. Continuing education and training is becoming a necessary condition for the modern economy.

Information economics requires a qualitatively new scientific approach, as in the current situation, the existing classical and neoclassical paradigms of economic theory are not able to describe many economic relations.

First of all, it is necessary to study the socio-economic aspects of the information revolution, which is already forming a fundamentally new pluralistic paradigm based on information and information flows.

The following features are characteristic of the information society: changes in lifestyle, redistribution of priorities in the system of human values, the growing importance of intellectual development of the individual in relation to material values; the basis of production and consumption becomes an intellectual product (knowledge), which leads to an increase in the share of mental labor; increase in creativity, both among employers and the population, the demand for knowledge is growing; material and technological base of information of society, will be various kinds of systems, based on computer technology and computer networks, information technology, telecommunications.

For the information economy, where the main productive factors are human capital and information resources, the standard law of diminishing returns does not apply with increasing scale of production and time of application. The law of diminishing returns is characteristic of normal physical capital, labor, and natural resources. That is, for extensive growth factors. Information products, increasing their quality and scale of use, demonstrate increasing profitability in the long run and with increasing scale of production. The essence of this effect is that information or information resource is the essence of knowledge. And the deeper, deeper and better accumulated knowledge. And, accordingly, the better the knowledge and experience of employees, the higher the return on them, the higher their productivity and cost of production. Moreover, this process is nonlinear. With the growth of knowledge and, consequently, human capital and information resources, there is an effect of outpacing the growth of GDP and other benefits that determine the quality of life of society. Therefore, the processes of globalization provide great opportunities for exploiting the effect of scale and profitability of corporations that produce competitive information products. The basis of the information sector of the economy is effective and modern education, with an emphasis on the study of the basics of computer science, information systems and computer technology. Therefore, the founders of modern information theory and introduced the term "information education" along with the term "information society", which means the use of educational information technology. This approach in the education system allows to identify and prepare talented and talented students in secondary schools with their further specialization in basic science, applied science, information technology, innovation and venture business. The modern economy is multisectoral. It includes the traditional industrial economy sector, the traditional post-industrial sector, the innovation economy sector, the information economy sector, the venture business and other clusters and the new technology sector.

The foundation that ensures the systematic functioning of all sectors of the economy and the state as a whole is the information sector. The main priorities for the development of the information economy include: development of information and communication infrastructure; human capital development; improvement and development of legal regulation; information economy development processes; creation and development of

a favorable environment for development information market; e-business development; improvement of regional and local government ICT-based self-government; ensuring information security of the country.

In general, the processes of globalization of the economy, strong synergetic effects in all areas of intellectual activity consolidate a leading position in the world economy, geopolitics, global information flows, technological and intellectual development of the largest developed countries.

Summing up, we draw the following conclusion, which will be confirmed in detail and considered in the paper. Information potential or information resource will work effectively only if the country, region, firm or organization has accumulated sufficient human capital of high quality. And created and effectively operates a favorable environment for its implementation as a productive factor. In other words, the information resource is a necessary but not sufficient factor in the implementation of an effective innovation economy based on knowledge and their intellectual media – high-level professionals who can implement ideas into new innovative products and effectively create and use competitive technologies.

In our opinion, the modern economy should be more precisely defined as the economy of human capital, which is a necessary and sufficient factor and condition for creating a post-industrial economy or innovation economy based on knowledge, intellectual labor and high technology and, above all, information technology.

9. Conceptual principles of the enterprise management process information support

The change of ideas and technologies is happening at an extremely fast pace at the present stage of the information society formation. Economic and informational tendencies in the development of society are partially implemented at the macro level, stimulating the development of socio-economic processes and systems. Driving changes in the interaction of market mechanisms, which occur under the influence of the information systems and computer technologies development, lead to a shift in emphasis in the resource support used in technological processes. Accordingly, the information resources and technology-intensive technologies occupy the dominant positions in the economy, which ensures the dynamic development

of market-based system-forming elements and their interactions, as well as the theory and practice of management.

The formation of the information economy puts forward new requirements for the conditions of enterprises functioning as complex macroeconomic systems, which, in turn, leads to an increase in the socio-economic significance of information. Information flows occupy a dominant position in comparison with financial and material, giving rise to new problems and tasks. In order to maintain the appropriate level of the enterprise image in the market, it is necessary to improve management of the assortment policy, quality customer service, personnel, pricing, security, and optimization of interaction with business partners. As a result, there is a problem of improving the quality of information use, the solution of which is based on the assessment of the possibilities of modern information systems using.

It is also necessary to take into account that the choice of an automated control system at each production enterprise is determined by its needs, depending on the technology of production, volumes of its production, sales and assortment, as well as the size of logistics and qualifications of employees. For this purpose, the potential of the development of an information system is an important object of study. In accordance with its level, requirements are created for the creation of the information system, which are its determining parameters at the stage of development, implementation and use.

Rapid advances of informational systems and technologies are one of the present time important characteristics appearing critical for improvement of market mechanisms, commercial organizations interaction on both domestic and foreign markets. Their influence on different social and economic spheres functioning is investigated in numerous scientific studies. V. Heiets [10], R. Zakharchenko [18], H. Tytorenko [35], and many others focus the attention on informational systems and technologies penetrating into economic processes of different enterprises and branches, formation of new information and knowledge markets as manufacturing factors in addition to the traditional raw materials market, as well as gradual integration of informational constituent into the market system.

I. Lytovchenko [28], I. Polishchuk [42], W. Henson [38], point out that computer networks and satellite communication improvement contribute to economy branches and manufacturing companies' quickness,

communication, hence increasing their competitiveness. The scientists highlight driving changes in market environment mechanisms interaction taking place under informational and computer technologies development as long as the Internet let informational environment of many countries and regions be united thus accelerating informational exchange and modern technologies introduction into manufacturing processes, education and scientific research, among other aiming at enterprises' intellectual capital enhancing. As a result time and material resources spent on joint projects of commercial organizations, purchasing and sailing of products, goods, and services are shortening thus lowering their prime cost and favouring the pricing system improvement.

Fundamental research of the development of informational society and its influence on market interaction by M. Castells is considered to be very important [23; 24]. The scientist distinguishes the reverse interaction between these two global processes and focuses on competitiveness being in its turn a mighty motive power for informational technologies and informational space development, demanding state support, fundamental scientific and legislative basis creation and institutions system formation. Y. Vershyhora and A. Nievierov focus on universally recognized and well-grounded statement that competition is a tool for technical progress and innovative development because as a result of strengthening competitive struggle the enterprises with higher technical level and more than average productivity eventually gain additional income. At the same time technically and organizationally backward enterprises on the other hand loosing partly the separate value of manufactured goods lead to actual losses [4, p. 29]. Besides, technical equipment of manufacturing processes, their automation and computerization shorten manufacturing, procurement and trip cost; they let the constant search for lowering production costs and raising production quality, introducing modern mechanisms of works and services pricing formation. This creates conditions for raising environmental compatibility, taking into account demand, long-term interaction with companies' partners both at domestic and global markets.

Undoubtedly, under such conditions international exchanges, production, goods and services at the global market essentially influence the development of each country's economy, strengthening interconnection and interdependence of separate countries and regions. A powerful exchange of

cultural values take place as long as informational systems favour social and economic systems development possessing qualitatively higher social and economic standards.

The main subjects of market economy are industrial enterprises. Reconstruction of management systems and industrial and economic systems based on modern scientific-and-technological advance achievements are important for each enterprise development as a competent participant of market relations. Thus, manufacturing and economic activity management methods, its informational provision, and organizational structure formation principles need further improvement. Under such conditions the use of informational systems is the basic process of flexibility and efficiency increase of company management system providing formation of theoretical, methodological, and practical unity of getting, systematization, summarizing, and use of information procedures [6; 7].

Capacity of necessary information is defined by management level and importance of management decision but achieving goal is possible only if there is opportunity to work with systematized information containing objective, precise data about necessary manufacturing processes. All the information of the enterprise belongs to a separate resource type, the informational resources. Informational resources are the basis for company activity informational provision. Informational resources formation, their storage and use represent a logical process demanding permanent regulating and systematization.

Informational resources usage efficiency lets any economic system raise its development level. The president of US National Academy of Sciences F. Handler also focused attention on informational resources importance for economy development: «Our economy is based not on natural resources, but on intellect and use of scientific knowledge» [8]. While defining state wealth resources T. Stownier distinguished the following way of new technologies using recycled materials as resources. Also the scientist emphasized the important strategic significance of informational resources: «in a post-industrial society national informational resources are the main economic value and its most potential wealth source» [34].

The value of informational resources for company management let us define their peculiarities becoming apparent in the process of their formation and use (Figure 8).

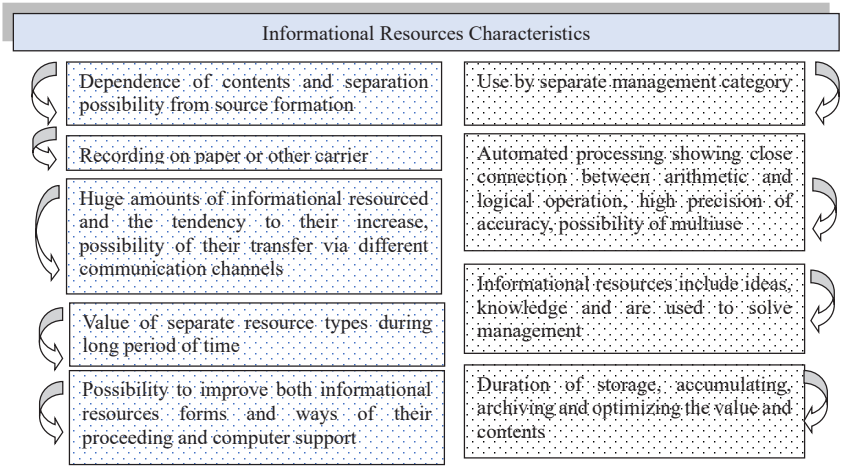

Figure 8. Peculiarities of informational resources

Demand of management personnel for information and informational services results in that information processing technology is directed at using the wide range of computer equipment along with communication facilities. Informational and computer technologies created on their basis make it possible to accumulate, to store and to process information as well as bring computer technics and corresponding software as near as possible to manager's workplace. Computer technologies introduction provide the possibility for massive information intellectual processing and creating enterprise's knowledge basis significantly quickening management decisions making.

Informational and computer technologies use in certain enterprise management process includes defining quantity, sequence and character of management process operations and also selecting corresponding ways, methods and technical means which eventually favours enterprise's activity efficiency.

Modern informational and computer technologies of manufacturing enterprise management provide for managing supplies, production, sales, personnel, financial flows, automation of all accounting and maintaining tax, managerial and financial records. In fulfilling definite management tasks informational system ensures well-timed access to informational

resources, efficient coordination of internal activity and quick distribution of management decisions, set tasks implementation control, use of previous data stored in data bases, making changes in data bases according to manufacturing process research results, rapid current and previous data processing, possibility of multi-version planned targets forecast, management quality and efficiency raise.

However many manufacturing enterprises show low informational systems implementation rate that is explained by many reasons. For example, nowadays there is a problem of objective information absence as to specific computer technologies because developers describe only advantages of their software, saying nothing about problems in its functioning. Conventional criteria of computer informational technologies comparing are their functional capabilities scope, rapid setting according to enterprise functioning conditions, and necessity of additional investments, technical support and software costs. Though in the process of computer technologies implementation there arise many questions not covered by conventional efficiency criteria.

While creating enterprise management system based on modern informational systems characterized in table 1 it must be taken into consideration that such reorganization demands definite – sometimes substantial – changes in management processes in general. That is why this system implementation needs system concept including variety of work planning and their implementation control, but in the result enterprise gets certain advantages (Table 3). Nowadays implementation of informational and communicative technologies is an important function of informational system. Communication provides for information exchange between structural units and single employees. Informational and communicative technology may be defined as purposeful aggregate of methods, processes, communications, networks and hard/software means united into clearly defined technological sequence providing for gathering, storing, processing and transferring information aimed at enterprise efficiency raise. An important peculiarity of communication is stability, reliability sufficient for functioning, possibility of improvement and development, and subordination to management system needs.

Functions of informational management system define its structure, which includes the following procedures as collecting and registration of

Table 3

Main characteristics of modern informational technologies

Methodology	Main characteristics	Results
Fundamentally new information processing means	Integration into management technology	New communication, information processing, formation and use of informational resources technology
Complete technological systems	Integration of specialists and managers functions	New technology of informational resources and certain information quality processing results formation and transfer
Purposeful creation, transfer, storing and representing of information	Taking into account rules of social environment, user's individual abilities and knowledge	New technology in management decisions making

data, preparing information arrays, processing, accumulation and storing of data, forming final information results, transferring data from sources to processing place, and transferring results to information consumers for management decisions to be made. Collecting and registration of information is made differently in various economic objects.

The most complex procedure is that of automated management processes at industrial enterprises and firms where collecting and registration of initial information reflecting manufacturing and financial activity of an object takes place. Particular importance is devoted to authenticity, completeness and timeliness of initial information. As a rule collecting information is followed by its writing onto material object (a document, machine-readable medium), its input into hard/software complex. Writing down into primary documents is done basically by hand, that is why collecting and registration procedures remain the most labour-intensive, and the document flow is still of current importance. That is why special attention in automated management system should be paid to the use of information collecting and registration technical means, combining operations of information measuring, registration, accumulating and transferring through data channels, and input into informational system to form necessary documents or accumulate data in the system.

Development of manufacturing enterprises automated management informational systems raises accessibility of informational data and resources, lowers expenditures on realization of deals between enterprises and their suppliers as to optimal decisions making, provides for maximum efficiency of manufacturing processes and raising market capitalization, simplifies procedures of entering international markets at lower costs.

Accordingly each enterprise has management hierarchy divided into parts in compliance with management levels and management decisions making competence. The higher a hierarchical level is, the bigger the volume and complexity of fulfilled functions, responsibility, ways of strategic decisions realization and access to information, informational resources, as well as different knowledge formation mechanism. At the same time requirements for the qualification level and independence in management are rising. Different methods and modes of necessary information getting may be used to provide for qualitative features of information including meeting the needs of users, timeliness of gathering and preciseness of information processing.

Enterprise management technology has an important status in information processing and using. It is connected with management personnel fulfilling different functions and work, though in general it is subjected to tasks set for the enterprise's leaders.

Lowering activity cost and economical use of resource base are important under complex conditions of domestic enterprises economic management. So the task of management process optimization becomes permanent for industrial enterprise management technology excluding such kinds of activity and operation, which lower enterprise efficiency. Analytical materials let us conclude that nowadays revival of industrial enterprises after the world economic crisis is possible mainly due to anthropocentric consciousness of society, intellectual activity development, raising manufacturing technology level, and modern informational and telecommunication technology spread.

In this connection, it is important to form such type of new management thinking oriented at progressive analytical and innovational activity. Developing management technology at definite enterprise means defining quantity, sequence and character of operations constituting management process, developing and choosing corresponding methods, techniques and technical means, defining optimal conditions for the management

decisions making. Clear functioning of industrial enterprise management process demands this process division into separate consecutive operations, the efficient organization of which demands corresponding combination of operations taking into account duties and abilities of executors. Every single operation should be connected with the previous and the following ones of a given management process cycle.

Our logically presented management process let us conclude that management technology is directly connected with operations algorithmization process within one or another managing system functions at an enterprise in general irrespective of management level. Fulfilling this condition confirms that almost all management process areas can be formalized, that is why technical side has a special place in management technology nowadays. As a rule, management technique includes material means (business/office equipment, communication facilities, computer techniques etc.) which help to reduce labour-intensiveness of management work, shorten their completion terms and raise decisions quality. Mental powers of a single individual have certain inclinations, peculiarities, reserves and their limitations, but the use of modern computers operative and long-term memory widens specialists' brainpower for deciding management problems and grounded choice of optimal management decisions.

Thus, modern management technologies can be realized only based on up-to-date informational technologies. Management process automation, available constantly updating software, and global informational networks substantially change all areas of enterprise manufacturing and economic activity from production to consumption.

Hence, enterprise management technologies development is a continuous improvement of management system main characteristics to achieve enterprise management targets based on changing external and internal functioning conditions. It means management system and all its elements gaining new qualitative characteristic different from previous ones, which let it, work more efficiently.

Qualitative changes are difficult to estimate and enterprise personnel can accept the development result not immediately. At the same time, only qualitative changes finally characterize management technologies development process taking into account its quantitative parameter dynamics.

During the last decades, dominant management practice has changed. Emphasis has moved from reaching enterprise economic efficiency to providing decisions quality, flexibility, and validity and creating organizational knowledge. Tendencies in management activity development define enterprise behavior direction in the spheres of scientific research and developments aimed at potential formation sufficient for taking into account environmental changes and achieving long-term goals, as well as efficient competitive strategy realization. At the same time management system development tendency should be not only coordinated with enterprise development strategy but also at definite times (such as depression and crisis) it should become basic. Management system consists of different subsystems and elements, but irrespective of classification, each element possesses its own potential. Enterprise potential consists of and depends on all its subsystems activities potential.

Generally, enterprise potential is availability and maximum applicability of all resources (possibilities) of an enterprise. Enterprise potential traditionally means aggregate of activities or factors defining its power, sources, capability, means, and other production resources that can be used in economic activity. Enterprise potential defines both its activity results and economic growth, and further development resources. Enterprise total potential consists of separate constituents such as labour, economic, organizational, scientific and technical, manufacturing, entrepreneurial, financial potential etc.

Scientific works use different indicator system to make comparative evaluation of different enterprises and economy in general potential development. Such indicators are an aggregate of the most important object or system characteristics providing for formal description of their main parameters, choice of system optimal variants functioning at different times, and foreseeing the best ways of its future development.

Nowadays there is a number of scientific works investigating different aspects of enterprise potential. Many of them focus on potential evaluation problem, its use and increase, they point at differences in defining the notion of potential, its essence, structure and correlation with other categories.

As a result of sources analysis we may conclude that in general potential means sources, possibilities, means, and reserves that can be used to

fulfill any task, reach set goals, or as capabilities of its resources, abilities, and competences system to create value for interested parties. Thus understanding potential is directly connected to resources and abilities. Complex, dynamic, integrated, interlocked and synergetic aggregate of all available enterprise resources and possibilities including their prospective growth used to achieve tactical and strategic enterprise development goals and providing for its constant development is defined as enterprise economic potential [36, p. 12].

All the enterprise resources form its potential basis. However, leading resource and a main factor of economic development nowadays is information as stated above. It forms competitive advantages both for single enterprises and for each country in general.

Modern computer and informational technologies and information software are of great help. Their potential abilities and enterprise new potential raise of informational complex as well as considerable acceleration of production process lead to raising market competitiveness. Thus, economic potential becomes informational and, taking into account information constituent, it seems reasonable to study enterprise informational and economic potential.

Enterprise informational and economic potential we understand as possibility of its producing capacity realization using information (statements, reports, knowledge, information goods and services) to achieve goals, making production and economic decisions in economical society. Though, informational technologies and informational systems introduction in enterprise activity needs separating single enterprise potential constituent – informational potential, including methods and means of informational system building and already used information systems, their components employed by an enterprise in reaching set goals and which demand continuous development.

As stated earlier, enterprise management system functioning basis and well-grounded management decision making is quality information, informational resources, formed by enterprise informational system. Correspondingly, management potential receives informational characteristics and taking into account informational constituent it is reasonable to study enterprise informational, management potential. Management informational potential thus means aggregate of knowledge,

information, informational resources, experience, management personnel intellectual and organizational abilities, used by an enterprise to strengthen its competitiveness and stable development.

Certain scientists study enterprise social informational potential and ecological informational potential as parts of informational potential. Enterprise informational social potential includes manufacturing possibilities and use of knowledge, information and informational resources to fulfill enterprise social sphere tasks. Enterprise ecological informational potential comprises manufacturing possibilities and use of information, knowledge, and informational resources to solve enterprise ecological problems.

Thus, enterprise economic potential can be studied as separate system, consisting of a number of subsystems. In its turn informational potential is a subsystem of economic potential and at the same time it can be studied as separate system including constituents reflecting interconnection and integration of enterprise economic potential subsystems (constituents) and provide for creating potential for enterprise management informational system development.

The notion of potential encompasses several aspects such as using potential for task fulfillment, and for achieving set goals; belonging to a subject of potential; sources of potential formation; conditions of potential development and realization.

Thus, enterprise economic potential state can be characterized by the following factors and figures: production resources volume and quantity, number of industrial and production personnel, structure of productive fixed assets, volume of current assets and inventories, financial resources and intangible assets, using patents, licenses, technologies, information, personnel abilities and professional activity in all production areas and at all management levels; enterprise financial state, level of current solvency and liquidity; internal and external debt; level of scientific and innovational activity, ability to change functioning technology; informational provision of marketing, production and financial activity, quality of used information, its substantiation and probability levels etc.

Existing approaches to enterprise informational potential estimation concern either generalized financial and economic estimates that is value expression or technical point of view, that is in terms of stability, technical reliability, scaling, adapting and so on.

Hence, enterprise information potential estimation should take into account both technical and economic factors of enterprise informational systems use.

The essence of the information economy is manifested in the new stage of society development, which is characterized by rapid pace of scientific and technological progress and the strengthening of the role of information in the successful functioning of socio-economic systems. It provides the implementation of modern management technologies based on the latest information systems. Automation of the management process, available software that is constantly updated, global information networks radically change all levels of production and economic activity of enterprises from production to consumption. Nowadays, new information technologies and complex systems are becoming more and more important for domestic enterprises, which help to accurately and promptly solve problems from preparation of production to sales of products, and provide integration of management functions.

We systematized information characteristics inherent in the enterprise management system: creation of information support for the formation of the goals of the enterprise, their implementation; its successful functioning and development; development of methods for the formation and use of information resources; information interaction between elements of the control system and information exchange between the enterprise management system and the environment; systematization of information flows and information resources within the system, accumulation of knowledge; intensive information exchange leads to the mutual diffusion of ideas, concepts and methods of management, increasing the potential of enterprise development; intellectualization of the work of management personnel; development of own approaches at each enterprise in relation to information evaluation, potential of development of the information system of the enterprise and the corresponding formation of the information system of flexible (mobile) character.

The modern level of the society informatization and the economy knowledge formation determines the use of the latest technical, technological and software tools in various information systems of economic objects.

The objective reality of last decade's domestic economics transformations reveals complicated social development disproportions,

reduction in scientific and technical research and industrial production, lack of highly-qualified specialists, and exhaustion of national wealth. That is why the problem of new economic development paradigm proves particularly important for Ukraine. Such a paradigm should be based on industrial enterprises' competitive recovery, speeding up the scientific-and-technological advance, and widening the use of scientific knowledge. All the above given conditions not only define the qualitatively new development level of the social and economic processes, but also promote their adaptability to new challenges and international cooperation.

One must take into consideration the fact that existing national production structure corresponds with the operational market model. At the same time it is not able to generate the macroeconomic system innovative approach. As a result Ukraine's economic and geopolitical safety risks continue to increase. So the main factor of national economic development strategic directions implementation is its reconstruction with raising cooperation priority of governmental, scientific and business institutions and clustering processes. It should also be aimed at high-technological, intellectual, informational, and science intensive production with quality products highly demanded in the global market. Despite the difficult economic and political situation in Ukraine the high-technological economic sectors find their own way of transformation into basic branches able of having significant positive effect on steady economic rise in all national economy spheres. It is possible due to quick intellectual achievements implementation in the form of advanced breakthrough technologies. In this connection there is a conclusion that high-technology branches will define Ukraine's future position in the world economy. At the moment there is the lack of scientific estimation results as to this economy development direction's invigorative significance demanding additional system research to create efficient restructuring mechanisms of national economy and develop its high-technological branches. Industrialization of state's industrial complex stipulates for new cooperation forms between enterprises and research institutions to be created among which a cluster form of social and economic relations organization deserves special attention. Economy's clustering means an industrial complex created on the basis of concentrating manufacturing elements, economic and financial interests, scientific and educational, and other parts of social and economic system. It is vital that there is no

confrontation between big companies and small and medium business within a cluster approach. On the contrary large-scale projects, industrial and social programs are intensified within clusters. Moreover clusters stimulate both depressed regions recovery and loss-making enterprises financial invigoration.

International experience proves clustering to provide world standards of industrial economic development due to creating inter-branch cluster systems with industrial relations and new technology, uniting tens or hundreds of big, middle and small enterprises. One branch competitive advantages favour adjacent branches' competitive advantages within one cluster thus promoting common high-technology system formation. The modern world society is anthropogenic and it can develop only owing to everyday technical novation combining knowledge and scientific research. Anthropogenic world community develops and introduces a considerable amount of technologies of different complexity degree.

High technology refers to technical methods and modes complex, developed in research system to be introduced in all human activity spheres ensuring efficient and ecological production and consumption of high quality. In conditions of modern scientific and technological achievements they include information technology, nanotechnology, biotechnology, laser technology, and space technology etc.

High technologies create advantages for industrial, financial, and social and economic systems as they ensure traditional technology improvement, new type of social and economic relations formation both in country and abroad and positive influence on optimal ways of world problems to be solved in education, science, medicine, branch management, ecology etc. Thus high technology is able to meet the needs of progressive economy's innovation and technological development.

At the same time the rate and scope of high technology implementation depends on the level of development, possibilities and peculiarities of national innovation system functioning.

National high-technology market is just arising. Nowadays our country is able of developing new and promising technological directions having positive estimates in the international economic research ratings. Among them are information technologies, space technology, energy technology, and biotechnology. The main prerequisite of their development is authorities,

business and science cooperation to connect high-technology development and efficient economy structure creating, providing every economic agent's integration in regional, national or global economic system. Global experience proves high-technology clusters to be a powerful mechanism of scientific and technologic achievements implementation in the process of national economy development. Clustering is a way the business, capital, scientific and commercial infrastructure can achieve world standards.

There are certain peculiarities to be taken into consideration in the process of high-technology clustering in Ukraine. Among them are national policy further development tendencies in technology, science and innovation; human potential quality determined by national education system and qualified specialists' ability to take part in high technology development and implementation; legislation and national programs regulating and directing economic agent's innovation activity; mechanisms of innovation systems financing from governmental, investment and other financial resources.

10. Conclusion

Adaptation to complex dynamic changes in the market environment and the choice of an effective development strategy are urgent tasks of Ukrainian enterprises. This requires an active search for new approaches in building an enterprise management system. Under such conditions, new technologies for the formation of information support play a key role in improving the efficiency of enterprises and the growth of their intellectual capital. Our research is devoted to the construction of scientific and methodological approaches to improving the quality of the information management system of the enterprise based on the use of the latest technologies and knowledge.

The need to solve our problems is explained by the fact that at the present stage of development of science and technology, digitization of economic processes, cloud technologies and their implementation in enterprise management systems in various fields provide new tools for knowledge formation and management decisions. Such conditions radically change the system of managerial decision-making in the enterprise, which requires the search for new knowledge and the use of economic and mathematical methods and models. This will provide the company's management with new tools for effective organization of the management process and sound management decisions, growth of intellectual capital of the enterprise.

The study determined the sequence of formation and general structure of the enterprise management system based on the use of cloud technologies, which allowed to build a mathematical model to calculate the probability of error making, to make management decisions over time with a parallel method of operation of enterprise management system. The author's approach to the essence, components and assessment of the potential of the enterprise information management system development is highlighted. Current trends in the development of the high-tech market and the impact of high-tech clusters on the formation of innovation infrastructure and the country's competitiveness are analyzed.

The use of the obtained scientific and practical results is possible at enterprises with different forms of ownership, in different sectors of the economy. The value of the proposed scientific and methodological approaches is that they can be used without modification to perform appropriate calculations in such important areas as energy, engineering, financial services and more.

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