INTRODUCTION OF THE INTELLECTUAL CAPITAL MANAGEMENT MECHANISM AT MACHINE-BUILDING ENTERPRISES

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Abstract. *Intellectual capital plays a significant role in the activities of machine-building enterprises. The purpose of the article is to study the main approaches to the structure of intellectual capital at machine-building enterprises; The methodology of the conducted research involves the use of a complex scientific approach to the study of intellectual capital with the use of information systems for its management. The article examines the structure of intellectual capital, the main approaches to determining the structure of intellectual capital. The analysis of various intellectual capital management systems made it possible to propose such an intellectual capital management system of a machine-building enterprise, which is considered from the point of view of a combination of formalized elements, actions that are included in the management subsystem of structural internal and external (relational) capital and the human capital management subsystem. The introduction of cyber-physical systems into the practice of machine-building enterprises and their further integration into a single network is considered. Such unification is a key stage in the creation of industrial SMART enterprises within the framework of the fourth industrial revolution. Given that the management of intellectual capital is one of the elements of structural capital management, the formalization of the main elements and the data processing of these elements using appropriate mathematical models were investigated. With the help of analytical and simulation modeling, we came to the conclusion about the need for a scientific and practical approach to the implementation of the intellectual capital management mechanism at machine-building enterprises. It is proposed to modernize the operational decision-making algorithm based on the analysis of the dynamics of the main indicators of the financial state of the enterprise, as well as the components of intellectual capital, which may lead to the need to reconstruct modes and forms of work. of the entire enterprise. The organizational and information provision of the intellectual capital management mechanism of machine-building enterprises has been improved and expanded.*

Keywords: *intellectual capital, informatization, quantitative and qualitative indicators of intellectual capital, cyber-physical systems, structural capital, intellectual capital assessment, intellectual capital management mechanism.*

JEL Classification: M12, M14
Formulas: 14; fig.: 8; tabl.: 2; bibl.: 27

Introduction. With the global transition from industrial to intellectual economy, significant industrial changes are taking place. The modern era of innovation, in which advanced technologies are rapidly changing the direction and target sectors of the economy, is called Industry 4.0. In the process of these changes, a completely new type of control in industrial production is emerging, based on so-called Big Date and its analysis, full automation of production (cyber -physical systems), technologies of additional reality, Internet of Things (Internet of Things, IoT).

The special value in this process belongs to intellectual capital (IC) which essentially influences branch structure of the industry, quality, manufacturability, innovativeness of production and services, and also defines efficiency of functioning of the enterprises. Thus, the development of intellectual work and the degree of its participation in industrial processes become the most important factors determining the competitiveness of the country in the international market, its export potential and share in world production.

Literature review. In the structure of Ukrainian industry the machine-building is one of the main branches of national economy, reflects the level of scientific and technical condition and defense capabilities of the country. Specificity of activity of the machine-building enterprises, high level of knowledge intensity and complexity of their manufacture, the qualitative requirements shown to production of branch in the domestic and international markets, condition an urgency of demand for studying of a question of the intellectual capital of the machine-building enterprises and search of new modern methods of management of it. Besides, in spite of the increased attention which is given to scientific bases of management of intellectual capital of the industrial enterprises, in particular the enterprises of mechanical engineering, absence of unity in definition of its substantial structure, underlines the second component of an urgency of a theme of research - an urgency of the offer.

Many works of Ukrainian and foreign scientists are devoted to the conceptual provision on the essence, evaluation and management of intellectual capital of industrial enterprises, namely: G. Becker [1], E. Brooking [2], P. Drucker [3], S. Diatlov [4], L. Edvinsson [5], O. Kolomina [6], L. Fernström [7], V. Shkola [8], K. Yagelska [9] and others.

A great contribution to the development of the theme of management of industrial enterprises, including the intellectual capital of industrial enterprises have made the collectives of Ukrainian economic schools under the leadership of V. Porokhnya [10], A. Kendiukhov [11], A. Hilukha [12] and others, the results of scientific development of which were reflected in monographs and collections of scientific papers.

Despite the large number of studies on the management of intellectual capital of industrial enterprises, its structure and evaluation, some issues remain open in fragments. In particular, there is no unambiguous scientific approach to the interpretation of the content and formation of the structure of intellectual capital, up to the end the process of transition of management technologies to a new level of SMART enterprises is not studied, and also the system of express estimation of intellectual capital of industrial enterprises and express management of it in connection with such transition is not considered. The need for further research in this area led to the choice of the topic for our article.

Intellectual capital belongs to new forms of capital and acts as one of the main factors in the development of both the state economy as a whole and a single enterprise. This type of capital corresponds to a high degree of development, because it is characterized by new knowledge and high technologies.

Despite a large number of studies and scientific discussions, as well as by the very definition of intellectual capital, scientists did not agree on its structure, what elements are part of it and what is the difference between "intellectual capital" and traditional "intangible assets".

The heterogeneity of the structure of intellectual capital is connected with many approaches to the definition of this structure.

According to the classic concept, as noted by O.V.Popelo, it is still accepted to consider the concept proposed by L. Edvinsson in his book "Corporate Longitude", which was part of intellectual capital includes the following elements: "human capital, as the competences and experience of the company's employees who are lost from the departure of their employees, and structural capital, which belongs to the company as a whole, although it is the product of its employees' activity, including the value of relations with clients (client capital), the value of intellectual property products (ideas, patents, licenses, etc.) (innovative capital), as well as the value of the company's infrastructure (process capital)" [13, pp. 66-78; 17]. This division was based on property relations. This statement can be interpreted in such a way that human capital is embodied in the employees of the organization, and structural in the organization itself. L. Edvinsson paid more attention to structural capital, trying to combine in it both internal elements (organizational capital) and elements related to the external environment (client's capital).

The disadvantage of such a structure is not enough emphasis on human capital, as well as the fact that in such a definition of the structure of intellectual capital there is no explanation of how all these components interact, perceiving each of the elements of the structure as separate capital.

The co-author of this approach is M. Malone. The classic approach to defining the structure of intellectual capital proposed by them is shown in Figure 1. They considered the market property of Swedish insurance company Skandia, dividing it into financial capital and intellectual capital. Intellectual capital consists of two components: human and structural capital, which in turn is divided into consumer and organizational capital. The latter includes innovative and process capital.

Based on the structure of L. Edvinsson's intellectual capital, in 1989 C.E. Sweiby tried to eliminate the above disadvantages, and also suggested using a system of quantitative indicators to evaluate each component of intellectual capital. A.D.Bazylevych noted that K.E.Sweiby also identified the concept of intellectual capital with intangible assets and described such a structure in which he singled out individual competence (namely, education, experience, skills and abilities of employees of the company), internal (patents, information networks, processes and procedures of the organization) and external structure (links between enterprises that can be both customers and suppliers of necessary products) [13, p. 63]. According to other scientists, the proposed structure had to be improved.

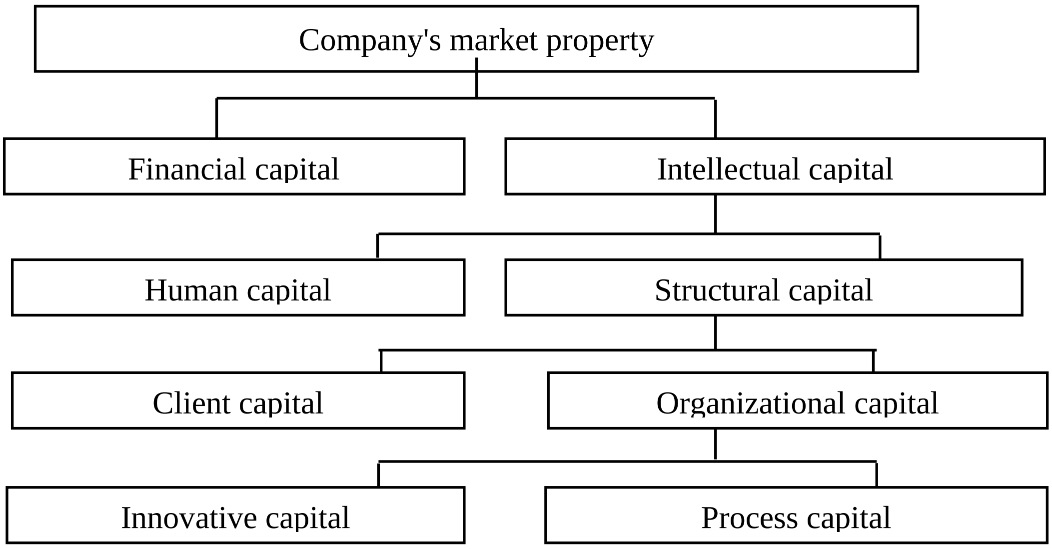

Figure 1. The structure of intellectual capital in the "Skandia Value Scheme" model by L. Edvinsson and M. Malone [5]

In further research, the structure of intellectual capital has been presented in three- and four-component models. And the three-component models mainly consider traditional components of intellectual capital: human, structural and client. And there is the interaction of these components. Another type of capital is usually added to the Four Component models - partnership capital. The authors also introduce the notion of structuring, i.e. the ability of capital to stay in the company even in case of loss of an employee or partner. Structural capital is considered the most structured, while client capital is considered the least structured [15-21].

Since 1990, T. Stewart's work has included the distribution of intellectual capital into human capital (the existing knowledge of workers and the ability to use it), structural capital (methods that enable the collection, storage and filtering of existing knowledge), and consumer capital (relations with the external environment that can be converted into money). He pointed out that it is necessary to balance between its components, as excessive development of individual components may not lead to productivity growth, but rather to a decrease in productivity [22].

Later on, X. St. Aunge also refined L.Edvinsson's approach left in the structural capital innovative and process capitals, and the client's one put next to human and structural capitals (fig. 2) [23].

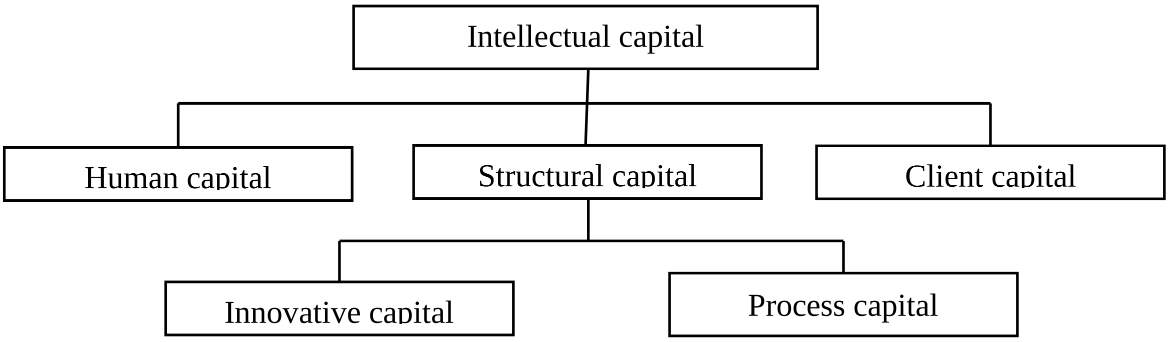

Figure 2. Structure of intellectual capital of H. Saint-Ange [23]

In E. Brookings' works, four components of intellectual capital are already distinguished and each of the structures is added with new components (Fig. 3).

In contrast to previous specialists, E. Brookings represents intellectual capital by various assets. If we consider capital in the economy, it should be noted that it is an indicator of production in the form of value, which can bring profit or loss.

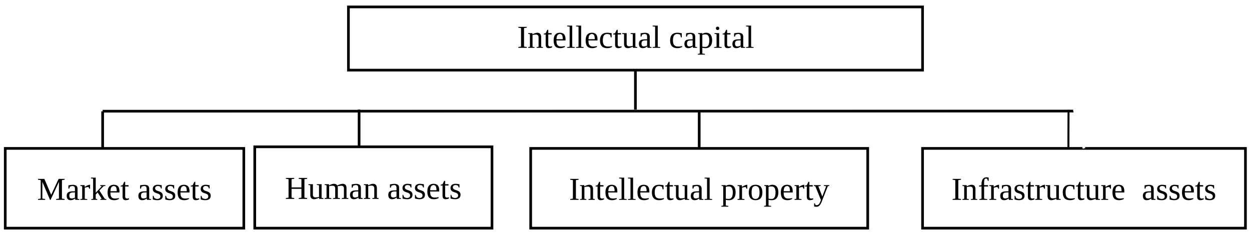

Figure 3. Structure of Intellectual Capital E. Brookings [3]

As far as assets are concerned, this is what the enterprise owns, so these two concepts can be equated in connection with "intelligence", because the previous interpretation makes economic sense, and the second one contains its accounting aspects.

Market assets are the potential provided by intangible assets associated with market transactions (brand names, purchase attachment, corporate name, order book, etc.).

Human assets are the aggregate of knowledge of employees of an enterprise, their creative abilities, managerial, leadership and entrepreneurial qualities, behavior in various situations.

Intellectual property as an asset is a tool to protect various corporate assets (know-how, patents, copyrights, trade and production secrets, etc.).

Infrastructure assets are technologies, methods and processes that make the work of an enterprise possible (corporate culture, risk assessment methods, financial structure, databases, etc.).

As already mentioned, the models of intellectual capital for different enterprises may vary, hence the number of its components and their name.

Thus I. Ruus, S. Pike and L. Fernstrom use "intellectual resources" instead of "intellectual capital" (Fig. 4). Resources can be interpreted as factors of production that lead to the provision of goods and services. "Client capital" has been replaced by the notion of "relational" resources, covers relations with suppliers and other partners in addition to relations with buyers, and intellectual capital has been considered as a part of a company's resource portfolio and presented the interaction of all its components in a tree structure [24].

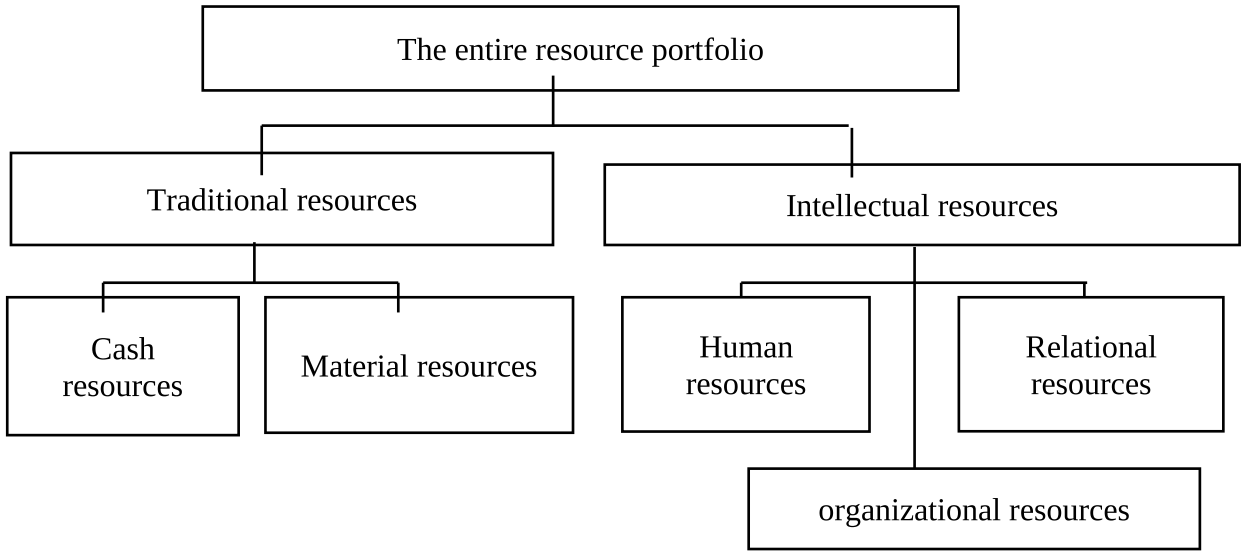

Figure 4. Structure of Intellectual Capital as a Component of Resource Portfolio
Sources: proposed by I. Ruus, S. Pike and L. Fernstrom [24]

Methodology. The machine-building industry is highly complex and knowledge-intensive. With the development of scientific and technical progress of mechanical engineering is becoming more and more technological and requires compliance with the realities of time, which is due to the increasing frequency of introduction of cyber-physical systems at the enterprises of the machine-building complex.

Development and introduction of such systems in practice of functioning of the machine-building enterprises and their subsequent association in a uniform network is a key stage of creation of industrial SMART-enterprises within the limits of the fourth industrial revolution. Such association can be reached by formalization of key parameters of each of the designated systems to provide possibility of transfer on a network of the corresponding data for the further processing and the analysis by other elements of system within the limits of SMART-enterprise.

Formalization of the main elements and processing of data of these elements is provided by using appropriate mathematical models. Intellectual capital management is one of such elements.

Industry 4.0's vision is to digitize all physical assets and integrate them into the digital ecosystem with partners (suppliers or customers) who are involved in the value chain. This industrial revolution is characterized by new digital technologies, namely: cloud services; mobile devices; augmented reality; Internet of things; geolocation, that is, location; advanced interfaces of interaction between an individual and a computer; authentication and detection of fraud; 3D-printing;

technologies within the framework of artificial intelligence; analysis of large data and advanced algorithms; personalization by client profile.

In connection with the aspiration of the enterprise to have advantages among competitors there is a necessity to computerize its activity, namely to automate the process of intellectual capital management. The scientific and practical approach to introduction of the intellectual capital management mechanism at machine-building enterprises is shown in Figure 5.

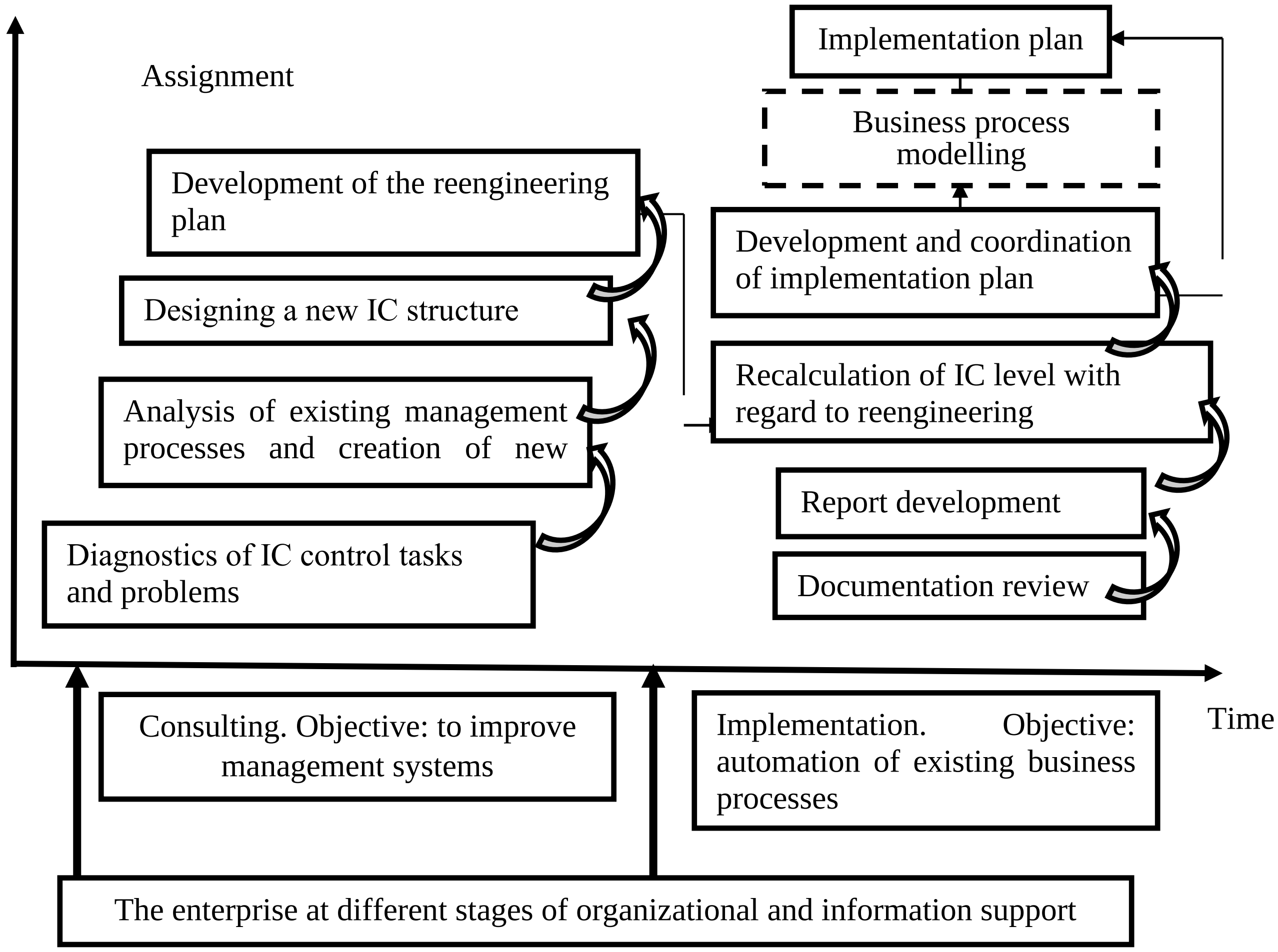

Figure 5. Scientific and practical approach to implementation of intellectual capital management mechanism at machine-building enterprises

The main task of quality management is that it must be done in real time, that is, it is necessary to modernize the algorithm of operational decision-making based on the analysis of the dynamics of the main indicators of the financial condition of the enterprise, as well as the components of intellectual capital, which may lead to the need to restructure modes and forms of operation of the entire enterprise.

The implementation of a full-scale information system for the automation of intellectual capital management at an enterprise is a rather time-consuming process that requires detailed planning.

At the initial stage of creating an information system it is desirable to have a reasonable goal and calculations of cost efficiency for automation. It is necessary to conduct simultaneously consulting works on improvement of management systems and automation of existing business processes. Consulting is explained as an activity on consulting of managers, managers on a wide range of issues in the field of financial, commercial, legal, technological, technical, expert activity, which turns out to be external specialists to solve this or that problem. The purpose of consulting is to provide assistance for management (management) in achieving the stated objectives. The main task of consulting is to analyze, justify the prospects of development and use of scientific, technical and organizational-economic solutions, taking into account the subject area and problems of the client.

In a competitive market environment, even strong and developed enterprises often experience difficulties that may be caused by both external and internal circumstances. Fluctuations in exchange rates and prices for raw materials, the emergence of new laws and regulations, changes in government policy in any area of the economy, as well as decisions made on the international arena can affect many business processes.

The situation of imbalance in the enterprise can be created by strained relations between employees and changes in management, partners and customers. When all these problems cannot be solved by the enterprise on its own, the way out of the situation is to turn to professional consultants.

There are the following types of consulting services, which are the most common:

- general management of evaluation activities, building the organizational structure, withdrawal of the enterprise from the crisis situation, it is possible to search for new partners;
- administration of document management, office management and control of other internal organizational aspects;
- financial management is control over taxation and financial reserves, cost reduction and profit increase;
- HR management HR consulting (assistance in personnel search and selection), formation of corporate culture, creation of incentive program, conducting trainings [28];
- market analysis market research and adaptation of the company to market standards (pricing adjustments, product upgrading);
- production acceleration of the company's production cycle and productivity increase, production automation, industrial engineering;
- information technology development, restoration and audit of the company's information systems;
- specialized services engineering, environmental, legal, information consulting, telecommunications consulting, electricity management consulting, public sector consulting.

In this case you can use the following services: general management - to improve the structural internal capital, personnel consulting - to improve human capital, market analysis to stabilize the structural external or relational capital, as well as information technology.

Management information technologies are used to manage a machine-building enterprise, to reduce transaction costs by collecting information, analyzing it, further negotiating and coordinating it, adjusting expenses on marketing and promotion of goods on the market.

The main purpose of information technologies in management processes of machine-building enterprise is formalization of business processes into the information system of the enterprise. Accordingly, employees of the enterprise (human capital) develop business processes in accordance with the objectives of the enterprise, choose the necessary software and hardware (structural internal capital), organize the implementation, operation and maintenance of information system of machine-building enterprise.

Accordingly, given the role of information technologies as general-purpose technologies, the formation of intellectual capital is possible only with simultaneous changes in organizational assets (business processes) and development of human assets in the field of information technologies.

The introduction of an information system of a machine-building enterprise is always accompanied by the process of adaptation of the enterprise to new working conditions. This process includes changes in both the technologies of business processes and the accumulation of knowledge by employees to work with them, which also has the appropriate motivation.

First of all, it concerns accumulation of employees' knowledge on work with management business processes of the enterprise, secondly - increase of employees' competence on support and operation of information system of machine-building enterprise.

If we do not get the effect from the operation of the enterprise information system, this is due to the lack of coordinated changes in human capital, structural internal and external (relational) capital and information technologies.

In a market economy it is not always intellectual capital that increases the value of enterprises. Many enterprises become bankrupt, in fact, assuming a negative value of intellectual capital, with a minus in the formula of the value of the enterprise. From the point of view of the exchange, this means that investors are not sure that the enterprise management system is capable of storing and increasing the existing value of the enterprise.

The final of the consulting work is the development of the plan of reengineering the enterprise (improvement of qualitative and quantitative factors of intellectual capital), is the impetus for recalculating the level of intellectual capital of the enterprise. From the point of view of the exchange, this means that investors are not sure that the enterprise management system is capable of storing and increasing the existing value of the enterprise.

Results. After that the detailed plan of introduction of the mechanism of increase of intellectual capital level is developed and coordinated. For a substantiation of efficiency of the offered introductions business processes by means of use of system dynamics are developed because components of the intellectual capital are subject to influence of casual factors. After that the decision on introduction of the intellectual capital management plan is made.

Use of models of system dynamics for management of intellectual capital of the machine-building enterprise has following advantages:

- possibility to use multipurpose criteria when constructing and investigating models;
- carrying out researches on the basis of the incomplete information;
- the simulation model is the most suitable for research of a dynamic situation when system and environment parameters change in time;
- research of the system's behavior by revealing cause-and-effect relations and interactions of feedback loops manifested in the peculiarities of its structural organization;
- good interpretation of system stream diagrams, gives the chance of carrying out of joint expert audits at discussion of problems, formation of mental model and working out of the coordinated decisions;
- the simulation model is a convenient tool for experimental reproduction of a large number of "what-if" scenarios;
- the technology of scenario study using a simulation model does not provide for active participation of the expert in the process of mental model formation and decision making.

The main method of research of organization of production systems management is the construction of various models and their analysis [25].

A model is a system, represented or materially realized system, which reflects an object of research and is able to replace it so that its study provides adequate information about the object's behavior.

Modeling is one of the ways to solve problems arising in the real world [25]. Modeling is used when experiments with real systems or their prototyping are impossible or too valuable. It covers reflection of the problem from real world to the world of models (abstraction process), analysis and optimization of the model, finding the solution and displaying the solution back to the real world.

A distinction is made between analytical and simulation modeling. In an analytical model, the output is functionally dependent on the input (parameter set) and, in this sense, it is static; such a model can be implemented in the form of spreadsheets. This requires the analyst to own only commonly used software such as Excel. Analytical solutions do not always exist, and existing solutions are not always easy to find. And then analysts use simulation modeling, which in contrast can be called dynamic.

The simulation model can be considered as a set of rules (differential equations, state maps, automatic machines, networks) that determine which state the system will move to in the future from the given current state. This is a process of "executing" the model, which guides it through (discrete or continuous) state changes in time. In general, for complex problems where time and dynamics are important, simulation modeling is a more powerful tool for analysis.

Such behavior is conditioned both by the size and complex structure of systems and by the large amount of information that is generated in such systems by the processes that take place. Such information in most cases cannot be adequately evaluated without the use of information analysis and information technologies. And it can be extremely necessary in the conditions of "unique choice", the mistakes of which in the modern world can cost very much.

The developed model for obtaining the forecast value will contain key steps:

1. Prediction of the model input parameters using the Monte Carlo method.
2. Prediction of the value of intellectual capital.
3. analysis of the simulation results obtained.

Statistical testing using the Monte Carlo method is the simplest simulation without any rules of conduct. Obtaining Monte Carlo samples is the basic principle of computer simulations of systems containing stochastic or probabilistic elements.

Application of Monte Carlo method allows to study very complex systems consisting of thousands or millions of elements, or very long intervals of model time (in this case modeling can be several seconds).

Monte Carlo calculations are based on a random selection of numbers from a given probability distribution. In practical calculations, these numbers are taken from tables or obtained through some operations, the results of which are pseudo-random numbers with the same properties as those obtained by random sampling.

Business process modeling will be carried out for PJSC "Novokramatorsky machine-building plant", where the level of intellectual capital was the highest.

Based on the calculation of intellectual capital proposed in Formula 1, variations in the distribution of the number of employees with higher education (X_2), advanced training of managers, specialists and employees (X_5), investment in personnel development (X_9), investment in enterprise development (X_{18}) are considered in more detail.

$$Y = 0{,}03766 + 1{,}1844 \cdot X_2 - 3{,}4133 \cdot X_5 + 1{,}8419 \cdot X_9 + 1{,}596 \cdot X_{18} \quad (1)$$

These indicators are subject to the influence of random factors. So, to predict these values, it is reasonable to use a simulation modeling method based on the assumption of independence and normal distribution of key variables.

To confirm independence of key variable distributions X_2, X_5, X_9, X_{18}, a correlation analysis is performed.

Average values are calculated for each parameter

$$\overline{x}_m = \frac{\sum_{i=1}^{n} x_{m,i}}{n}, \ \overline{x}_{m+1} = \frac{\sum_{i=1}^{n} x_{m+1,i}}{n}, \quad (2)$$

where m – is a parameter number.

Then the correlation coefficient for each pair of parameters is calculated directly:

$$r_{m,m+1} = \frac{\sum_{i=1}^{n}(x_{m,i} - \bar{x}_m)\cdot(x_{m+1,i} - \bar{x}_{m+1})}{\sqrt{\sum_{i=1}^{n}(x_{m,i} - \bar{x}_m)^2}\cdot\sqrt{\sum_{i=1}^{n}(x_{m+1,i} - \bar{x}_{m+1})^2}}. \quad (3)$$

By the properties of the correlation coefficient, if:

$0{,}9 < |r| \le 1$, - is a strong connection;

$0{,}6 < |r| \le 0{,}9$ – is a sufficient connection.

$0{,}3 < |r| \le 0{,}6$ – is a weak connection.

$|r| \le 0{,}3$ – no connection.

The adoption of a normal law of distribution of random variables does not contradict the generally accepted position on its practical application for economic calculations and can be used to determine the real law of distribution of input parameters of the simulation.

The algorithm consists, firstly, in determining the normal distribution density [26]:

$$\varphi(x; a, \sigma^2) = \frac{1}{\sqrt{2\pi}\cdot\sigma} e^{\frac{-(x-a)^2}{2\sigma^2}}. \quad (4)$$

Secondly, the function of distribution of a normal random value:

$$F(X; A, \sigma^2) = P\{\xi(a,\sigma^2)\langle x\} = \frac{1}{\sqrt{2\pi}\cdot\sigma}\int_{-\infty}^{x} e^{\frac{-(t-a)^2}{2\sigma^2}} dt, \quad (5)$$

where a and σ^2 – are the law parameters: average value and dispersion of a random value; $\xi(a,\sigma^2)$ – is a random variable.

To simplify the calculations, the normal distribution is brought to a standard form by the Laplace theorem:

$$Z = \frac{X-a}{\sigma}. \quad (6)$$

Then you select a random value Z and a value X. It is characteristic of the standard law that the mathematical value Z of the magnitude is equal to zero, and its average square deviation is one.

The density of the normalized value distribution Z and the normalized (standard) distribution function have the form:

$$\varphi(z) = \frac{1}{\sqrt{2\pi}} e^{\frac{-z^2}{2}} \quad (7)$$

$$F(z) = \int_{-\infty}^{\infty}\frac{1}{\sqrt{2\pi}} e^{\frac{-z^2}{2}} dz = 0{,}5 + \Phi(z), \quad (8)$$

where $\Phi(z)$ -is the Laplace function:

$$\Phi(z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-\frac{z^2}{2}} dz \,. \qquad (9)$$

Thus, the choice of a random value is reduced to obtaining a random value R' (from 0 to 1) and the value X is chosen as the formula (11):

$$X = F^{-1}(R'), \qquad (11)$$

where F^{-1} *- is a function, reverse function* F.

Then we get:

$$R' = 0{,}5 + \Phi(Z).$$

Where from

$$Z = \Phi^{-1}(R' - 0{,}5).$$

To finally get random values, expression 12 is used:

$$X = \sigma \cdot \Phi^{-1}(R' - 0{,}5) + a, \qquad (12)$$

where R' *- is a normally distributed random value.*

As a result of the simulation model application there are interval values of the number of employees with higher education, advanced training of managers, specialists and employees, investment in personnel development, investment in the development of the enterprise, on the basis of which the calculation of the intellectual capital itself is carried out.

At the next stage, the results of simulation modeling are analyzed [27].

According to the formula 13 is the average value of weighty indicators. Then the value of standard deviation, which shows how the values in the sample are distributed relative to the average:

$$\sigma_m = \sqrt{\frac{\sum_{i=1}^{n} (x_{m,i} - x_m)^2}{n}}. \qquad (13)$$

The next stage of the analysis to determine the value of the coefficient of variation, reflects what proportion of the average value of the parameter is its average spread:

$$\text{cov}_m = \frac{\bar{x}_m}{\sigma_m}. \qquad (14)$$

The results of the simulation analysis are given in Table 2.

Table 2. Results of analysis

Indexes	Number of employees with higher education	Professional development of managers, specialists and employees	Investing in personnel development	Investing in enterprise development	Intellectual capital
Average value	0,49	0,49	0,52	0,49	0,32
Standard deviation	0,29	0,28	0,29	0,28	1,13
Variation coefficient	0,59	0,57	0,56	0,57	3,50
Minimum	0,00	0,00	0,00	0,00	-2,31
Maximum	1,00	1,00	1,00	1,00	3,08
Number of cases where intellectual capital < 0					139

Within the framework of approbation of the proposed scientific provisions at CJSC "Novokramatorsky machine-building plant" the following results of intellectual capital were obtained (fig. 7).

Discussion. At application of the simulation model the interval values of the weighted quantitative indicators received at the correlation-regression analysis on which basis the further calculation of intellectual capital is carried out are found.

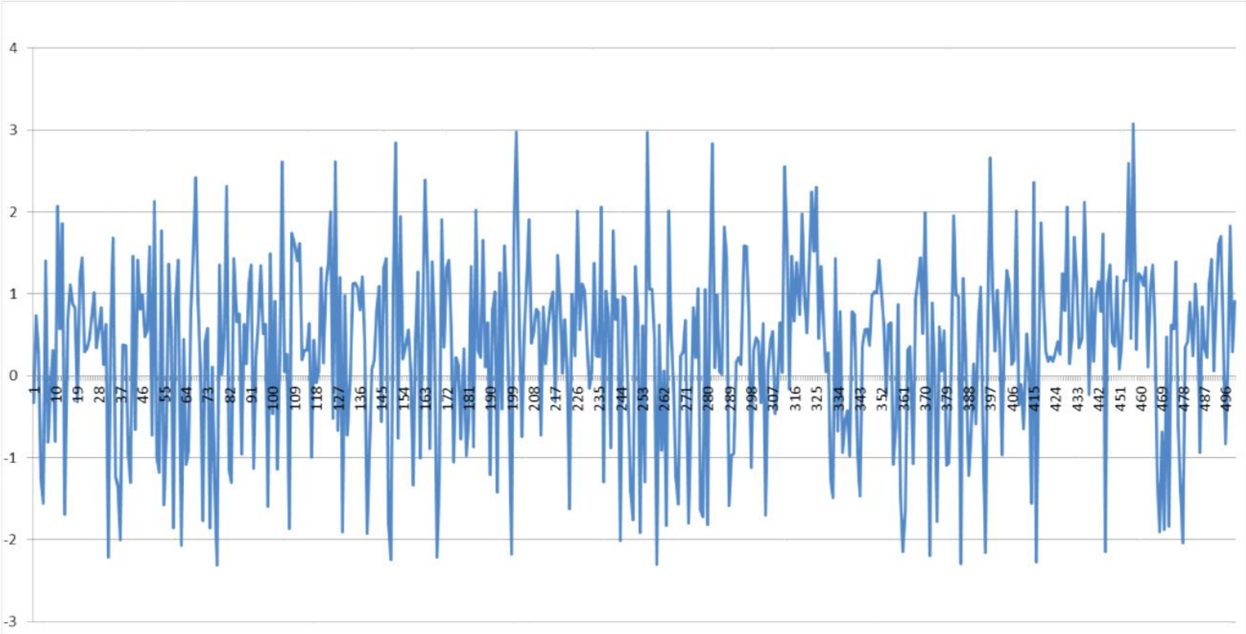

Figure 7. Modeling of intellectual capital value for CJSC "Novokramatorsky machine-building plant"

The next step is to analyze the results of simulation modeling.

The analysis of simulation results showed that the probability of obtaining a negative value of intellectual capital does not exceed 25%.

Since the intellectual capital of machine-building enterprise is accepted as one of the most important indicators of competitiveness of the enterprise, it is necessary to pay special attention to the positive value of intellectual capital (with the probability of about 76%).

Statistical analysis of the simulation results showed that the probability of obtaining intellectual capital in the interval from 0 to M (IK) is 15.8%, where M (IR) is the average value of intellectual capital.

The probability of getting the value of intellectual capital in the interval [M (IK) M (IR) + G] is 35.1%, and in the interval [M (IR) + G; max] - 25.0%, where G is the standard deviation and max is the maximum value of intellectual capital of an engineering enterprise.

Probabilities of hitting the value of intellectual capital in the specified intervals are shown in Figure 8.

The proposed mechanism can be used as a regulator of effective enterprise management. The calculations confirm that all indicators of intellectual capital are quantifiable, i.e. the selected levers, the obtained intellectual capital assessment and scientific and practical approach to the implementation of the intellectual capital management mechanism at machine-building enterprises can be applied in real time in the enterprise conditions.

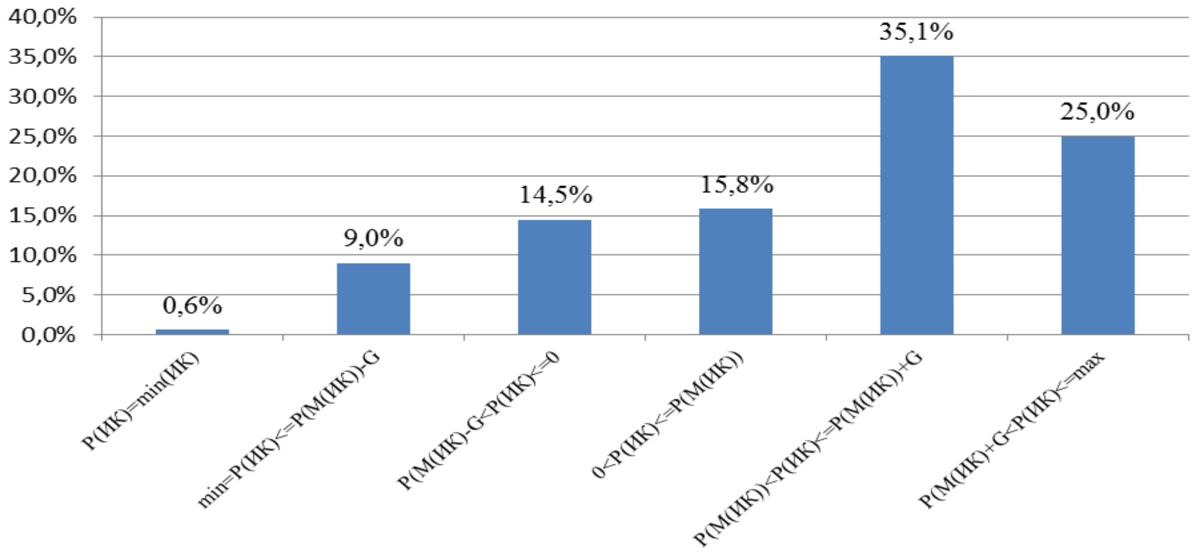

Figure 8. Distribution of intellectual capital across value ranges

Competitive advantages and financial well-being of enterprises will depend on how effectively the intellectual capital management process is implemented.

Conclusions. So, in the process of research the elements of management system of intellectual capital of machine-building enterprises were formalized and the mechanism of management of intellectual capital of machine-building enterprises was improved.

The improved mechanism of management of intellectual capital of the machine-building enterprise causes perception of intellectual capital as an integral value, which components are interconnected elements of intellectual capital, management of which requires an integrated approach. It includes subjects of management, goals and objectives, functions, principles and elements of management system, approach to assessment of management efficiency, which contributes to the implementation of measures to increase the level of intellectual capital and, on this basis, the efficiency of the entire machine-building enterprise.

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