

# Structure and Regularities of Development Information and Intellectual Capital Taking Into Account Acceleration of Digital Transformations in Conditions Information Society

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## Abstract

Article is devoted to a perspective of development of the information and intellectual capital during an era of digitalization of global space in a section of development of information society. The research objective consists in need of creation of effective mechanisms concerning ensuring formation, development and use of the information and intellectual capital in a condition of digital transformations as a basis of increase in competitive advantages of manufacturing enterprises of the country. It causes need and relevance further of rather scientific search in the field of development of adaptive theoretical and methodical approaches and practical recommendations which allow to organize effectively at manufacturing enterprises development of the information and intellectual capital in the conditions of difficult digital transformations. Digitalization of economy in the modern world becomes inevitable process which objectively influences all spheres of life of society and defines the direction of its development. Historical and empirical methods, a method of scientific abstraction, methods of analysis and synthesis, a method of system analysis are by methods of a research. The scientific novelty consists in development of complex and complete approach concerning ensuring transformation of the information and intellectual capital of manufacturing enterprises due to synthesis with digital technologies which use would allow to accelerate development of the enterprises of the sphere of production.

## Keywords

Intellectual capital, information, intelligence, information support, information systems, digital economy.

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## **1. Introduction**

The relevance of a research is proved by high extent of development of modern economy of Ukraine in a combination with the lasting transformation. In the course of informatization of economy the digital infrastructure at the different levels is formed, necessary systems which are improved through implementation of new technologies and association in a common information space are created. Current trends of digital transformation of manufacturing enterprise for the purpose of increase in its competitiveness assume active introduction in practice of digital technologies. Digital technologies become instruments of increase in effectiveness, performance and efficiency of productions due to increase in the output and/or reduction of the used resources. Digital transformation assumes change of a production system of the enterprise, its main, auxiliary processes which serve of technological quality control and the organization of work. According to the concept the Industry 4.0 [1], production processes, structuring and service have to be digitized and integrated on the basis of mutual penetration of information technologies and the industry. Implementation of artificial intelligence leads to emergence of intellectual information technologies which promotes change of organizational structure of the enterprise, reduction of staff and reorientation of staffing in pursuance of new functions. At the same time relevant there is a scientific and technical problem of definition of rational replacement of human resources with intellectual systems and realization of effective forms of the organization of work in the conditions of human-computer interaction in a common information space. The majority of the existing researches in this direction are conducted within development of collaborative industrial robots and integration of information resources. Success of the enterprise depends on effective use of modern digital technologies in the main directions of the activity. In process of information technology development the need for use of innovative methods of management and the organization of production increases. Universal distribution and implementation of digital technologies at the enterprises leads to changes in processes of making management decisions, planning, the organization of production of work. Digital transformation in narrow interpretation represents process of implementation of modern technologies in processes of the enterprise. Transformation is at the same time directed to improvement of the existing processes and to creation of competitive advantages due to change and creation of new technological processes in the enterprise. Use of digital transformation and new digital knowledge is a key factor of effective development of production. Transformation assumes changes of the main, the auxiliary and serving processes of the enterprise, a production system, technological quality control, operational planning of production activity, the organization of work of workers.

## **2. Modifications**

Insufficiently fully studied uneconomical methods of development of knowledge at manufacturing enterprises though they become decisive tools in digital economy. There are significant not examinations in structurization of these methods and search of ways of their optimization within the reproduced cycle from generation of the ideas to creation of

grocery innovations. It is also incomplete the questions connected with characteristic of methods of development of knowledge as specific non-material asset of the enterprise at the corresponding creative and labor qualities of the subject of management are considered.

Active participation in a research of the intellectual capital was taken by foreign scientists: N. Bontis [2], E. Bruking [3], L. Robinson [4], Y. Ruus [5], T. Stewart [6], R. Petty [7].

Problems of formation and estimation of the intellectual capital of the enterprises, the human capital, intellectualization of society and economy are lit in works of domestic scientists A. L. Skillies [8], O. V. Berveno [9], Yu. V. Gava [10], N. L. Gavkalova [11]. To a research of mechanisms of management of the intellectual capital of the enterprise the devoted D.'s works I. Zvirgidze [12], O. S. Litvinova [13], etc.

The considerable contribution to formations of the concept "intellectual capital" was made by fundamental works of such scientists as O.B. Butnik-Siversky [14], V.A. Willows [15], S. Vovkanich [16], T.V. Grinko [17] and others. However, analyzing interpretation of category "intellectual capital" it is necessary to state lack of unification in definition of this concept, important for any enterprise. At the same time, contrary to a significant amount of the scientific research devoted to problems of formation and assessment of the intellectual capital of the enterprises it should be noted that in the existing developments there is no uniform system approach to formation and assessment of the intellectual capital of the enterprises.

In modern conditions the information economy which relies on knowledge becomes the dominating paradigm of social and economic development. The emphasis on knowledge as an essential resource of the enterprise, significantly influenced organizational structure of management, promotes emergence of network economy, the virtual organizations which in this regard improving competitiveness of economic entities at any stage of life cycle and effective management of human resources, search of new forms and methods of its organization arises a key question. The situation in modern business is such that it is harder and harder to provide constantly increasing cost of labor and to reach not only performance of functions, and to stimulate activity of personnel which provide the notable growth of effectiveness. To information economy the necessary initiative worker who is worth to increase in the competence and to innovative activity, focused on the maximum achievement in work and who takes the responsibility not only for the destiny, but also for success of common cause. Today most competitor companies are technically equipped approximately equally, they use similar methods and methods of marketing and the organizations of production.

Rapid and large-scale changes which happen in the field of production technologies, infrastructure, forms of the organization and functioning of economy caused emergence and distribution of the concept "information economy". Thus, transition from resource-based and industrial economy to so-called "information economy" which is based on intellectual resources, the high and information technologies is the most important global trend in formation of modern society. The term "information economy" appeared at the beginning of the 80th years of the XX century, and it was used for the description of economy which in bigger a measure leaned on the sphere of provision of services, than on

the sphere of production of goods. On today the given concept was not used so often, rather faster, it became a harbinger of use of this term which we observe at the present stage. In 90 year the term "information economy" began to be used rather high-tech economy. Now the knowledge-intensive sectors of "information economy" play the defining role in economic development not only the advanced countries what growth of the annual address in the world market of high technologies and the knowledge-intensive products which several times exceeds the address of the market raw materials, including oil, oil products and gas testifies to.

In the conditions of fight for intangible assets the intellectual capital becomes resistant advantage of corporations of innovative type which competitiveness depends on creation of key competences.

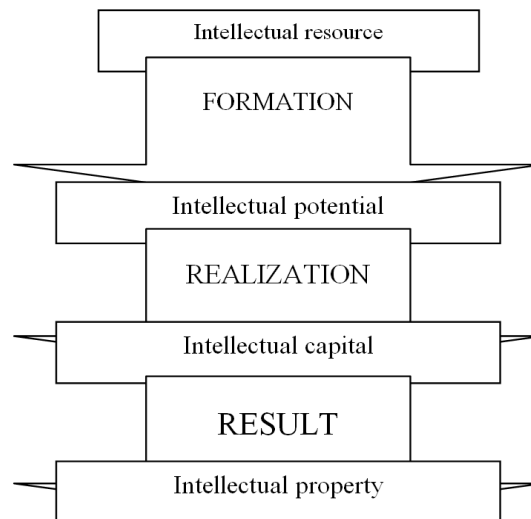
1. Any economic science or the direction choose any given aspect of the concept and, according to G. Saimon, begin to create the settlements [18] there. It is necessary to agree with M. Doronina's opinion that upon transition to post-industrial type of society there is obvious a limitation of use of approach to a capital research, as to it that is in physical shape because the competitiveness and market advantages of the modern enterprises a bigger measure are provided with use of resources which have the non-material nature (intellectual, information, organizational, social, etc.) [19].

2. The concept "intellectual capital" needs to be considered how specific rather genitive concept "capital". Therefore, the research of the intellectual capital, its essence and main economic categories which are with it in system relationship has to be guided by the core economic theory of the capital and her basic concept – the capital. The capital (capital is from armor. main) was always considered in the economic theory as one of the central and most important economic categories, an obligatory element of market economy. The capital is an economic cage of a complex social and economic market system, it decisive category [20]. It should be noted that the scientific thought still did not develop universal determination of category "capital" which would meet all needs of the theory and practice. The careful system, complex analysis of evolution of views of category "capital" made in the course of the research in concepts of different schools of sciences, changes of its contents, a role in process of an economic system and the review of development of the theory of the capital with the purpose to create the methodological principles of the concept of functioning of the intellectual capital as its compound on the basis of the classical and modern ideas of scientists-economists presented in work as I. V. Zhuravleva [21].

### **3. Main results**

The efficiency of use of intellectual potential is the highest, the enterprise owns the big intellectual capital. So, the intellectual potential gains properties of economic category only in the course of attraction to economic activity, that is in the course of transformation in the intellectual capital. We agree with opinion Y. S. Sytnyk [22] that the concept "intellectual resources", "intellectual potential", "intellectual capital" and "intellectual property" (Fig. 1) which are closely connected among themselves. The given ratio demonstrates that intellectual resources are the primary source and the defining factor of development of the

enterprise, and the intellectual property is result of formation of the intellectual capital. It is established that the intellectual potential is the key instrument of achievement of competitiveness of the enterprise, and is defined how set of human, organizational and information potentials.



**Figure 1:** A ratio between categories “intellectual resources”, “intellectual potential”, “intellectual capital” and “intellectual property” at the level of the enterprise (made by authors)

At analysis of the basic structural elements of the capital be what enterprise (the company, firm) as its main components it is possible to mark out the following forms of capital: material capital, human capital, structural capital, client capital. Under the material capital in this case it is offered to consider all set of tangible assets of the organization, including buildings, a construction, the equipment, etc.

To group of scientific and technical factors of functioning of the intellectual capital intensity of technologies, energy and financial resources, capital intensity of work, knowledge-intensive works, innovative activity, level of availability of computers, use of the Internet, etc. belong. Scientific and technical factors influence development of the intellectual capital through increase in productivity of work, improvement of the organization, improvement of quality of goods and services, change of vocational and industry structure occupied, presentation of increased requirements to the worker [21]. The quantity occupied with scientific research, developments in the European Union countries, represents on average 1.68% of employed population. The highest value of this indicator is observed in Iceland (3,3%), Finland (3,23%) and Denmark (2,94%).

Institutional factors define development of the intellectual capital by the adopted state laws and regulations which regulate: the relations of intellectual property, a condition of formation and use of labor – duration of working week and the size of the paid holiday (size of working hours), immigration streams, terms of training, a retirement age; measures which promote: to achievement of an optimum ratio between supply and demand of labor, to stimulation of territorial and branch and vocational mobility of personnel, ensuring necessary general education, vocational training of workers which answers the modern

scientific and technical level, structure and dynamics of production. Ukraine passed important stages on the way to integration into world economic space: On March 1, 1998 got force the Partnership and Cooperation Agreement with the European Union; The EU and the USA provided to Ukraine the status of the country with market economy; The U. S. Senate repealed Jackson's – Venika amendment concerning Ukraine; interstate agreements concerning assistance and mutual protection of investment are signed with 70 countries of the world; On May 16, 2008 Ukraine acquired the status of the member of the WTO. The agreement on association between Ukraine and the EU gives a positive signal for enhancing cooperation between Ukraine and the EU on all the directions and also in the innovative and intellectual sphere. But at the same time the imperfection of the legal framework of the country which interferes with wide circulation and use of products of intellectual activity and also their lawful use in case of protection allows to note syntheses of references [13]. So, the volume of the Ukrainian computer market in a year is 600 million US dollars, but its further development is interfered by the high level of piracy.

Belong to the most essential demographic factors of formation of the intellectual capital: population of the country (region), its gender and age structure, rates of natural increase of the population, average life expectancy, etc. The analysis of a demographic situation in regions of Ukraine for the last decade shows considerable deformations in development of the population: excess of mortality over birth rate, low level of life expectancy, emigration, "aging" population and growth of demographic tension. The number of economically active population of the country, region is the major extensive factor. Reduction of volumes of GDP which took place in the last 20 years led to reduction of total number of personnel at the enterprises.

Among the three most influential factors which determine the size of the intellectual capital priority there is level of the general and professional education. This conclusion divides most of scientists-economists [13, 23, 24, 25, 26]. In modern conditions the professionalism becomes the most important condition of optimum inclusion of the person in work, a factor of effective formation of the intellectual capital. Especially the value of education and vocational training during restructuring which is followed in Ukraine also cardinal social and economic changes increases.

Social demographic factors have the extensive nature of influence on the intellectual capital and appear on macro – and mesoeconomic levels. Transition to economy of innovative type which is carried out in Ukraine rendered and pointed numerous and deep disproportions in the sphere of work. Archaic is in Ukraine also a macroeconomic structure of employment. Production of goods remains the sphere of employment which prevails in our country unlike the majority of the developed countries. Statistical data confirm high employment rate in the industry and agriculture of Ukraine (honor 10 times more, than in the developed countries), sharp lag of the service industry which besides has structure, atypical for the developed countries. The available contradiction between the level of formation of the intellectual capital and needs of the modern market of work.

We agree with O.A. Grishnova's opinion that determination of its structure [10, 27] is one of the most debatable problems which arises during studying the intellectual capital. Despite the lack of uniform approach to determination of essence and structure of the intellectual capital, most of scientists agree on a thought which the intellectual capital is the system of the interconnected components which given rise by human intelligence and create prerequisites for increase in performance of work, competitiveness of the enterprise, cost efficiency of activity and financial firmness.

The human capital acts as the leading component of the intellectual capital. The

conceptual foundation of the theory of the human capital was laid in the second half the XX century by Theodor V. Shultz which are published in 1961 in work of "Investment into the human capital" [7] and also in works of G. Becker who proved efficiency of investments in the human capital and formulated economic approach to human behavior [28]. Gehry Becker considered the person in a context with the material capital used in production, and training was defined by it as a form of investments into the human capital. According to him, investments into the person also expenses on education of younger generation, health of workers and members of their families, information search, change of work and other investments which promote development of productive work of the worker, his cultural and intellectual growth [29] are included.

Generalizing results of a research of structure of the intellectual capital, it is possible to claim that practically all scientists allocate three the main components of the intellectual capital: human capital, structural capital and client (consumer) capital. At the same time, each researcher in own way locates allocation of elements and relationship between them.

The weak innovative activity and the spontaneous nature of structural and technological shifts mainly under the influence of a global environment cause lag of indicators of innovative development of the industry of Ukraine from world indicators, formation in the industry of inefficient technological structure. In technological structure of processing industry the share of products of high-tech areas in Insufficiency of volumes of production with high added value is compensated by way of increasing its import, deepening an import dependence of national economy. For the last 10 years the import share in the total amount of internal consumption of industrial output increased from 42,8% in 2010 up to 47,6% in 2020, machine-building products – from 77,7% to 94,9%, metallurgical – from 31,9% to 39,7%, food – from 13,6% to 21,6% [23].

Today later, how developed non-material component in social production how strong post-industrial trends, it is possible to judge development of the country.

The system of the following criteria is for this purpose used.

1. Social and economic criterion:

- if in the society of more than 50% the population is engaged in the service industry, the post-industrial phase of its development came;

- if in the society of more than 50% the population is engaged in the sphere of information and intellectual services, society becomes information.

In the world believes that changes in economy occur mainly after the specific weight of Internet users begins to exceed 10-15% the population of the country. According to this criterion, the USA entered the post-industrial period of the development in 1956-1960 (the State of California – "Silicon or Silicon Valley" – overcame this boundary in 1910). The beginning of new century of the USA was met by the following structure of employment: 75% – in the sphere of information and intellectual services, 25% – in production of goods that in the agricultural sector. Finland joined post-industrial society 20 years later than the USA. Ukraine, as well as the international community in general, by this criterion is at an industrial stage of development. The companies which ignore possibilities of "World wide web" will stop being competitive. The Internet is data on buyers, suppliers and potential workers, and 90% of information on them were collected within the last two years.

2. Technical criterion. The early phase of informatization of society comes at achievement of specific information armament which answers existence of a reliable long-distance telephone network. The final phase provides satisfaction by which information needs of each person in be what time and in be to what point of space. L. Robinson put

forward a formula “the civilization is information” [4]. The scientist to a formation e civilizations by criterion of amount of information made by them thus:

- level 0 – the information capacity of a brain separate the person – 107 bits;
- level 1 is oral communication in community, the village or the tribe – amount of the circulating information ~ 109 bits;
- level 2 is written culture; as means of awareness of society serves the Alexandria library which has 532,800 rolls which contain  $10^{11}$  bits of information;
- level 3 is book culture; there are hundreds of libraries, tens of thousands of books, newspapers, magazines which cumulative capacity is estimated at  $10^{17}$  bits are produced;
- level 4 is information society with electronic information processing with a capacity of  $10^{25}$  bits.

The discussion concerning a question of transition to information society is conducted since the beginning of the 1960th, still it as the scientific concept, has no uniform, standard and conventional definition.

Mark out only its main characteristics (Table 1):

- more than 50% the population are engaged in the sphere of information services;
- growth rates of the information sector of economy surpass rates of development of economy in general;
- wide use of information technologies and products of the information sector of economy in everyday life;
- creation uniform information space and availability to it all members of society;
- welfare of members of this society a bigger measure depends on their education, training becomes continuous process throughout everything life.

**Table 1**

Comparative characteristic industrial and information (new) economy (made by authors)

Parameters	Economy	
	Industrial	Information
Hierarchical levels	A lot	A lot
Division of labor	Wide	Insignificant
Position of workers	Interchangeability, dependence, humility	Involvement, loyalty, independence
Network	Insignificant	Wide
Working processes	Insignificant	Flexible, situational, organized for the period of performance to a project
Influence, power	Depends on hierarchical level	Depends on knowledge and abilities
Possibilities of Organizational	Insignificant	Wide
The most important purpose	On economy of the enterprise	Optimization of benefit
	Maximizing on own interest, the enterprise, collective	

Information infrastructure is formed at the expense of organizational structures and means of information exchange. Information infrastructure has to provide functioning and development uniform information a scope.

As a result of active theoretical researches of information as specific subject of economic science, the big categorically-conceptual framework which treats such concepts as



“information resources”, “information products”, “information technologies”, “information production”, “the information industry”, etc. was created. At the same time, within the economic theory these categories are insufficiently developed both in theoretical, and in practical aspect. There is no uniform interpretation of the specified concepts, there are no intrinsic characteristics which display their most powerful lines.

Computer and communication technologies will be the catalyst. Corporate networks and work when workers get simultaneous remote access to data array, promise the next and serious change of standards of employment. The usual labor relations with working week which lasts more than 30 hours and with constant employment in one company (which up to the 1990th years were norm) become less widespread. Intellectual technologies which use big corporations make available to shots large volumes of knowledge. The value of the computer is provided by two of its compound – software and hardware. The same, it seems, becomes the integral characteristic of the modern worker in the opinion of the employer.

Forecasting of expenses on personnel is key function of a control system of a personnel resource of the enterprise. At the same time methodological base of formation of this function is the theory of the alternative expenses expected (relevant) on the basis of the expected economic benefit in the future. Use of the multicriteria analysis will allow to define effective instruments of increase in efficiency of use of personnel as a priority resource of the enterprise (Table 2, Fig. 2-4).

**Table 2**

Input data for forecasting of expenses of a personnel resource of all enterprises of Ukraine by their sizes on the basis of statistical these 2013-2022

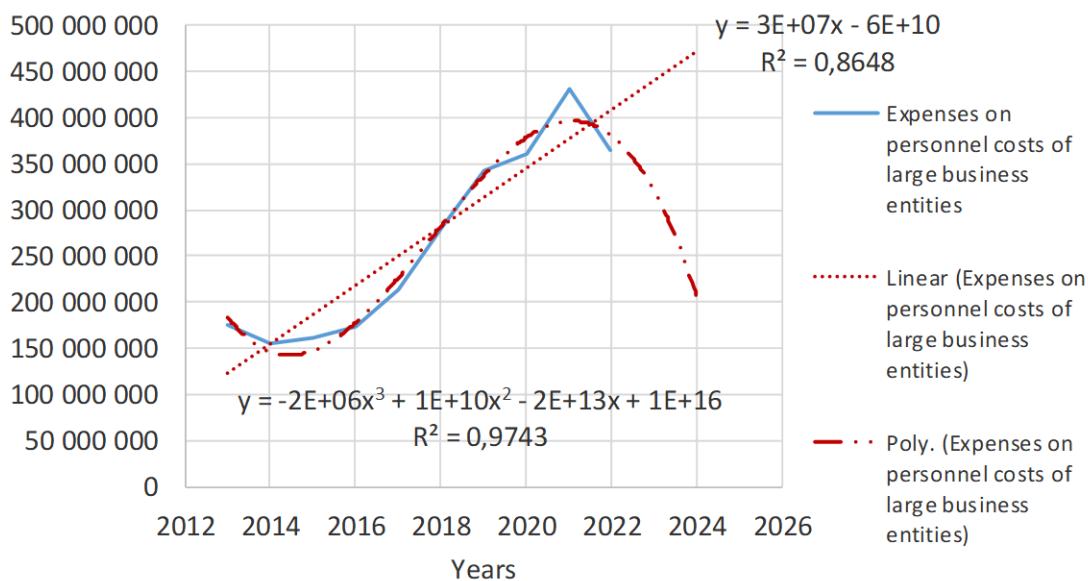
Years	Subjects of large business, thousand UAH	Subjects of medium-sized business, thousand UAH	Subjects of small business, thousand UAH
1	2	3	4
2013	175 677 772	143 542 937	81 576 048
2014	154 660 857	147 376 598	75 414 976
2015	161 847 033	168 829 612	80 585 700
2016	172 765 753	192 830 836	89 877 178
2017	212 897 900	257 196 607	124 778 216
2018	280 461 814	323 980 594	154 297 097
2019	341 807 499	412 934 804	177 635 986
2020	360 077 319	464 615 486	195 122 344
2021	431797529	553 782 857	215 170 979
2022	364 267 681	503 743 503	189 098 672
Forecast for linear model			
2023	420 000 000	576 000 000	225 000 000
2024	470 000 000	635 000 000	250000000
Forecast for polynomial model of the third order			
2023	327 000 000	490 000 000	150 000 000
2024	215 000 000	410 000 000	99 000 000

Note: created and calculated by the author (Official site of Public service of statistics of Ukraine)

In the course of the analysis of statistical data of number of busy workers at all enterprises of Ukraine for 2013-2022, monotonous trends of change of a trend for the analyzed time period, in particular, in a section of the enterprises for their sizes were revealed. So, from the above-stated table 2 we see that on a linear trend the steady tendency to increase in total number of workers at large, medium-sized and small enterprises of Ukraine is observed, however the general tendency to increase in number of workers at medium-sized enterprises of the country proceeding from an indicator of costs of personnel is watched a polynomial trend of the third order we Choose the forecast for polynomial model of the third order as we consider it more reliable.

In the course of the research of statistical data of number of busy workers at the enterprises of the industry of Ukraine for 2013-2022, monotonous trends of change of a trend for the analyzed time period, in particular, in a section of the enterprises for their sizes were revealed. Let's consider dynamics of an indicator of costs of personnel of the enterprises of the industry of subjects of large, medium-sized and small business in Ukraine for 2013-2022 and we will define dependence of this indicator on time factor by means of creation of one-factorial functions.

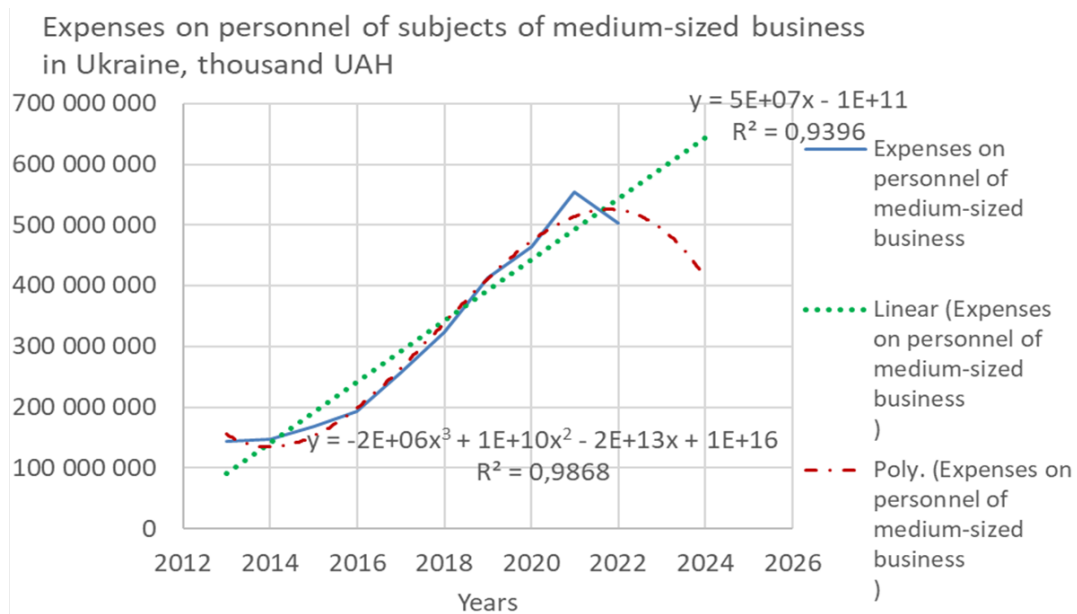
Expenses on personnel costs of large business entities in Ukraine, thousand UAH



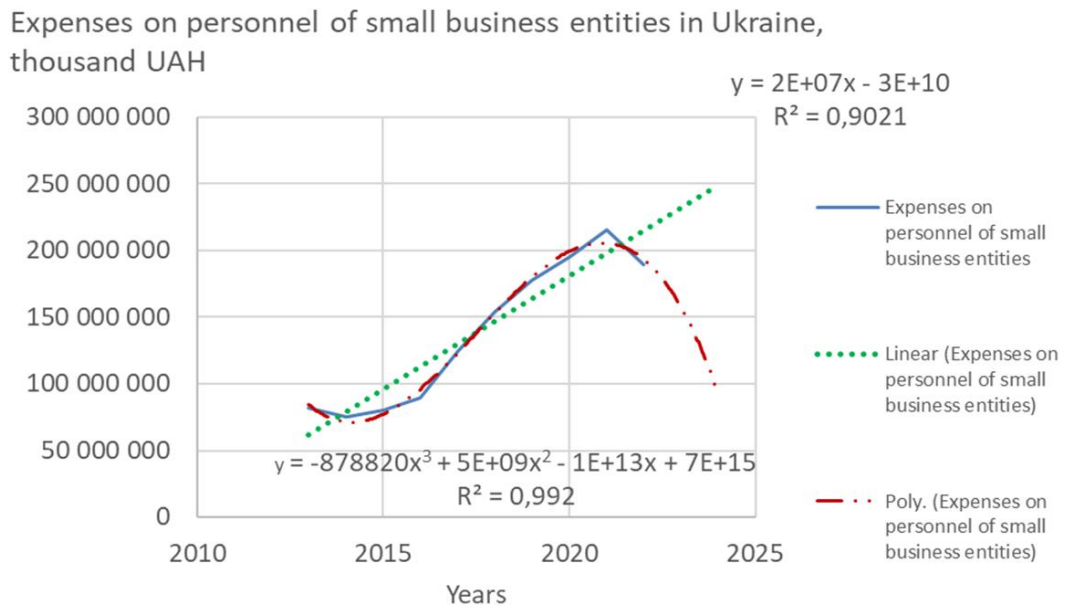
**Figure 2:** Expenses on personnel of subjects of large business in Ukraine on the basis of statistical these 2013-2022, thousand UAH

In the course of the analysis of statistical data, monotonous trends of a configuration of a trend for the considered time period, including in a section of all companies of the country by their sizes were revealed. Yes, the general steady tendency to reduction of number of workers at the domestic enterprises of the industry is observed. In particular, the analysis

of number of workers in a section of the enterprises for their sizes, confirms the descending dynamics at large enterprises of mechanical engineering and certain fluctuations in dynamics of an indicator of number of workers at medium-sized and small enterprises of mechanical engineering.



**Figure 3:** Expenses on personnel of subjects of medium-sized business in Ukraine on the basis of statistical these 2013-2022, thousand UAH



**Figure 4:** Expenses on personnel of small business entities in Ukraine on the basis of statistical these 2013-2022, thousand UAH

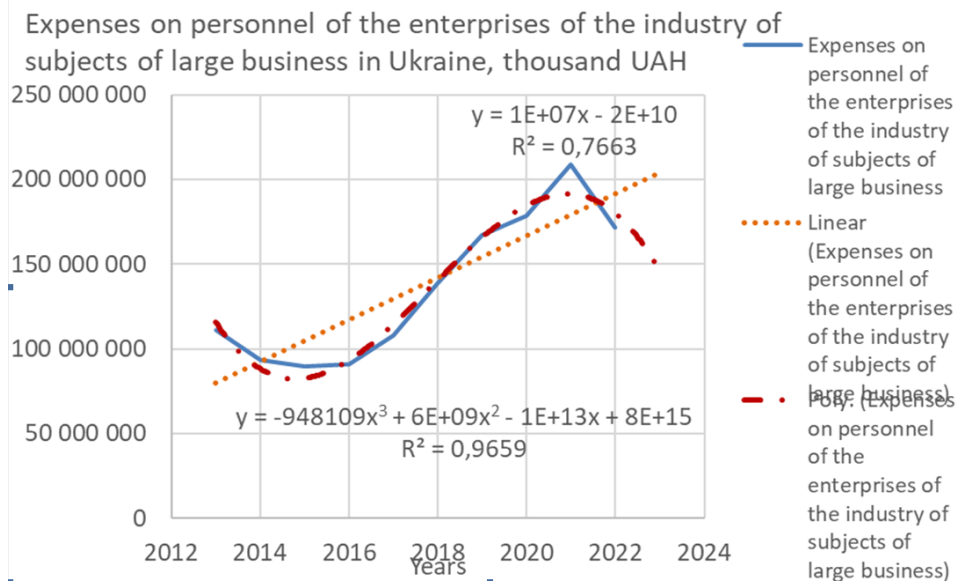
So, from above the submitted table 3 we see that on a linear trend the steady tendency to increase in total number of workers of the industry at large, medium-sized enterprises and sharp reduction of total number of workers of the industry at small enterprises of Ukraine is observed. On a polynomial trend of the third order the general tendency to increase in number of workers at medium-sized enterprises of the country and some reduction of total number of workers of the industry at large and small enterprises proceeding from an indicator of expenses on personnel is traced. We consider the forecast for polynomial model of the third order more probable.

Costs on personnel in comparison with the working model will significantly be reduced, and the companies will get access to army of experts in all corners of the world who crave to take part in realization of any given project and who can be connected or sidelined as required.

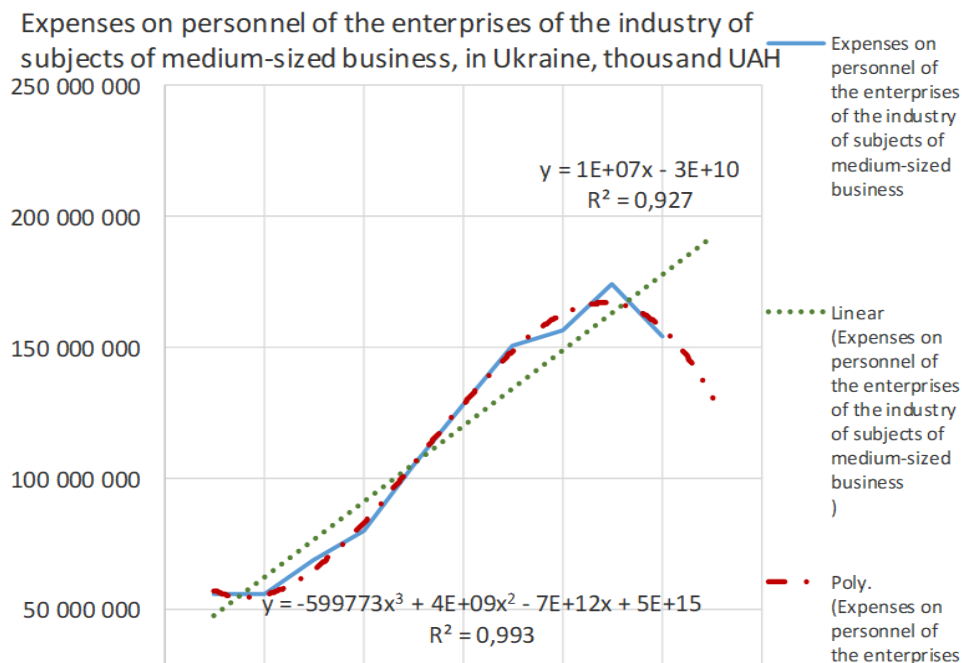
**Table 3**

Input data for forecasting in 2023-2024 of expenses of a personnel resource of the enterprises of the industry in Ukraine by their sizes on the basis of statistical these 2013-2022

Years	Subjects of large business, thousand UAH	Subjects of medium-sized business, thousand UAH	Subjects of small business, thousand UAH
2013	110 863 803	56 163 738	11 944 350
2014	93 563 802	56 152 519	10 841 354
2015	90 003 773	68 914 514	12 529 301
2016	90 931 748	79 813 469	13 761 854
2017	107 869 479	105 092 422	20 552 401
2018	138 883 735	128 160 742	25 603 178
2019	167 045 823	151 042 093	27 206 220
2020	178 383 306	156 885 056	320 098 302
2021	208 567 125	174 400 186	36 604 010
2022	171 677 441	154 537 811	31 590 482
Forecast for linear model			
2023	200 567 125	181 160 742	38 579 301
2024	215 883 735	203 042 093	42 961 854
Forecast for polynomial model of the third order			
2023	105 092 422	135 883 735	27 883 735
2024	81 813 469	50 045 823	18 045 823



**Figure 4:** Expenses on personnel of the enterprises of the industry of subjects of large business in Ukraine on the basis of statistical these 2013-2022, thousand UAH



**Figure 5:** Expenses on personnel of the enterprises of the industry of subjects of medium-sized business in Ukraine on the basis of statistical these 2013-2022, thousand UAH

Thus, the non-material capital in the conditions of new economy decides the following forms:

- intellectual property – it is legally protected knowledge, is capable to bring an excess profit on a contract basis of patents, license agreements, etc. The property right to an asset,

but an asset not in itself – notable or imperceptible – is a subject of estimation of cost, including, intellectual property;

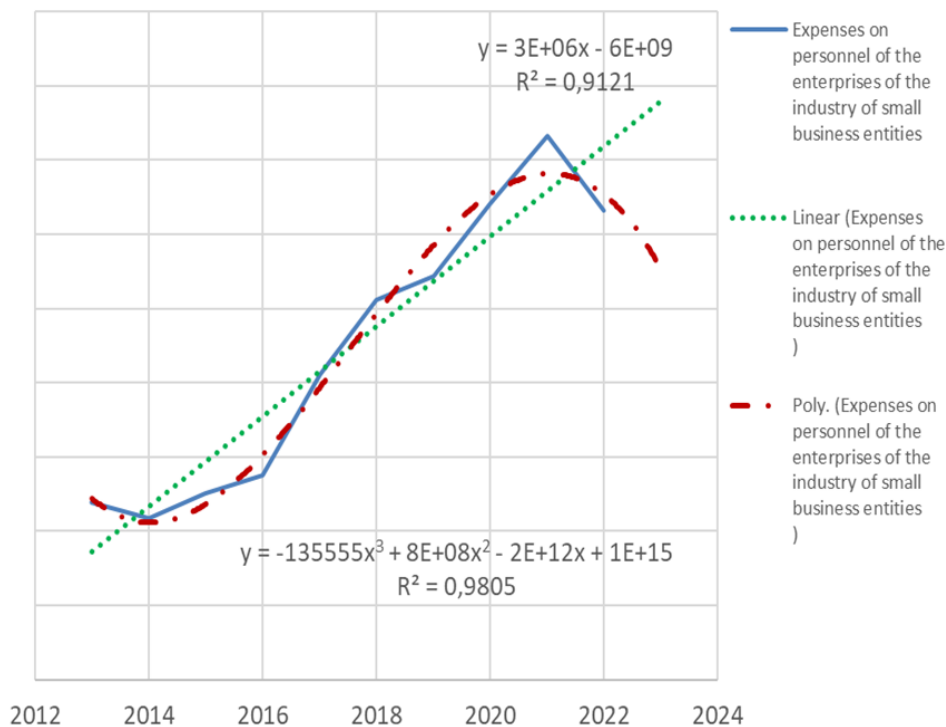
- transformation of a system of business contacts of producers, suppliers and customers to the interdependent system of flexible alliances or so-called networks. Alliances increase value and reduce costs on interaction of the companies among themselves and with the end user;

- transformation of reputation to a brand. Brands reduce costs on interaction due to confidence of clients as the acquired goods. The owner of a brand can earn, in turn, an excess profit due to decrease in expenses on acquisition, service and keeping of the client or at the expense of the high prices;

- to talent of workers who are the major non-material capital. He creates intellectual property, flexible alliances and brands. The capital should be invested only in those whose talent and professional skill are:

- own (in other words, nobody will make their work better);
- strategic (they create added value – what buyers pay money for).

Expenses on personnel of the enterprises of the industry of small business entities in Ukraine, thousand UAH



**Figure 6:** Expenses on personnel of the enterprises of the industry of small business entities in Ukraine on the basis of statistical these 2013-2022, thousand UAH

In modern conditions the decisive influence on process of production and its results reveals such factor of production as the intellectual and information capital. This economic resource acts as the most important element of value creation of a public product today. Process of use of the intellectual and information capital represents represents net capital formation which demands attraction of real investment resources. In the course of investment into intellectual and information assets the production capacity of information

society which provides as a result of net capital gain as improvement of production capabilities of separate economic entities, and growth of macroeconomic parameters is formed.

Even within the same discipline there is a variety of target vectors of analysis, distinction of theoretical and methodical approaches which does not allow to offer absolute and uniform determination of essence of the concepts “information” and “knowledge”. So, the famous expert in the field of management of knowledge and innovative economy professor Bontis marks out in structure of information created by society “knowledge obvious” (codified or standardized) and “implicit knowledge” which cannot be described in connection with the created its classification or clearness of formulations. At the same time, Bontis emphasizes that it “irrespective of, has knowledge obvious or implicit character, it can be equally used in a production process and can be equally significant for the purposes of its efficiency, providing clear or implicit competitive advantage of any given company which cannot be solved, even being in it” [2].

As organizational form of formation of the intellectual and information capital in public reproduced process the enterprise (organization) acts. Analyzing what cost of business it be possible to allocate three main to structure which generate cost: tangible assets (ware component); financial assets (monetary and financial component); intellectual assets (imperceptible component). So, in structure of intellectual and information capital at the most general approach it is advisable to allocate following the most important component to a part:

- information product – information and knowledge which are recorded on material carriers, and those which can be transferred in process of direct communication between people (dialogues, interpretations, etc.) as even nonverbal information can become a source of increase in positive effect;

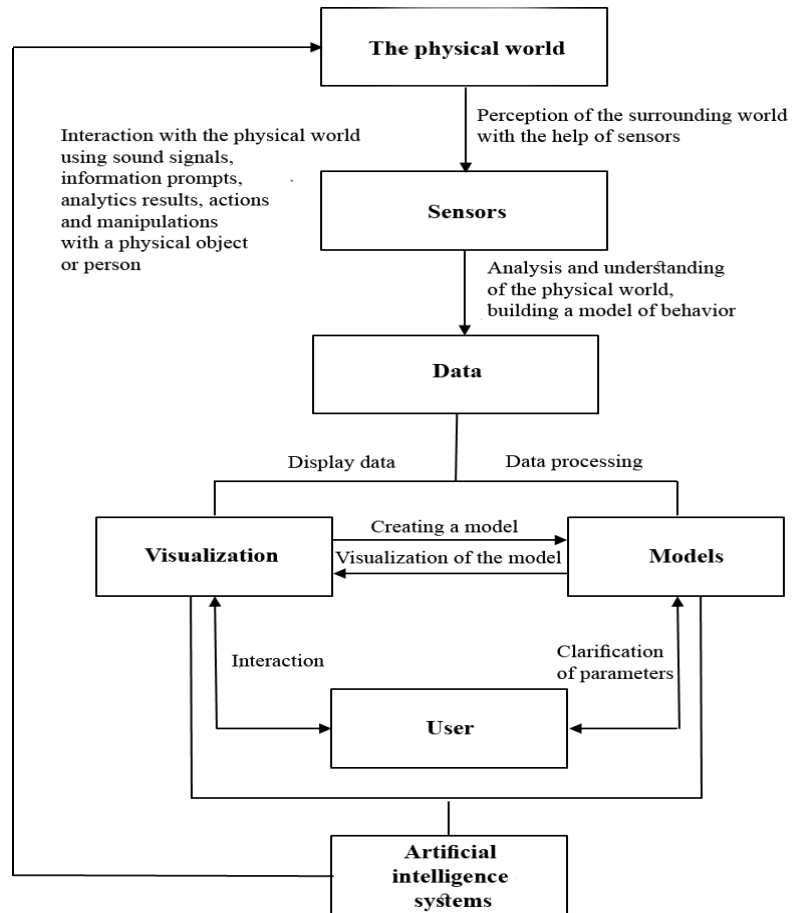
- means and technologies of storage, replication, dissemination of information (equipment of printing houses, publishing houses, libraries, archives, institutions of mail, telegraph, modern media, to the Internet, satellites, etc.);

- technologies which provide process of production and realization in the markets of not informative benefits and services;

- a source and the developer of information (that is the actual and potential producers of intellectual and information product) – people who act as the isolated individuals, or as occupied at various enterprises, institutions and the organizations of information infrastructure. In structure of intellectual and information capital, a source that the developer of information is a fundamental, basic ingredient.

In our opinion, the concept of the information and intellectual capital something is wider, than the concept “intellectual capital” which is already used in scientific literature as process of capitalization of intellectual assets which are fixed by intellectual property right and personal qualities of the person to their creation, but also in total “knowledge” streams and information what can be capitalized, that is saved up for productive activity during which income in a type of profit of a rent is formed.. The considered economic category “informational and intellectual capital”, differs also and from the concept “information resources” as formation of a specific factor of production which is really involved in economic process on purpose receiving profit, unlike the available production potential which basis is represented by information resources displays processes.

The systems of artificial intelligence allow to add and expand human opportunities. In production the artificial intelligence needs to interact with the physical world constantly. The principle functioning is presented in Fig. 7.



**Figure 7:** Principles of functioning of artificial intelligence with the physical world (made by authors)

Perception of the physical world artificial intelligence happens on the help of different sensors and sensors. This process is followed by the analysis, understanding and data acquisition. On the basis of the obtained data the model is under construction and there is a visualization of data. At the same time the sequence of creation of model and visualization can be different. In case of a lack of data possible direct interaction with the user or specification of parameters.

After a stage of perception and understanding of the physical world is based behavior model of artificial intelligence. By means of different sound signals, information messages, actions and manipulations to different objects, systems or personnel there is an influence on the surrounding physical world.

This interaction constant and cyclic within production of the enterprise, assumes emergence uniform information space of the enterprise. Digital transformation of the enterprise assumes that the systems of artificial intelligence become elements of production and has on attention active interaction with personnel. With development of technologies the production at the enterprise changed. At first operations were completely manual, further the mechanized means gradually took root, later mechanisms were automated.



Near the existing operations, appear, operations are connected with digital technologies. The artificial intelligence at interaction with the equipment, a subject of work and if necessary personnel carries out operations of production instead of the person.

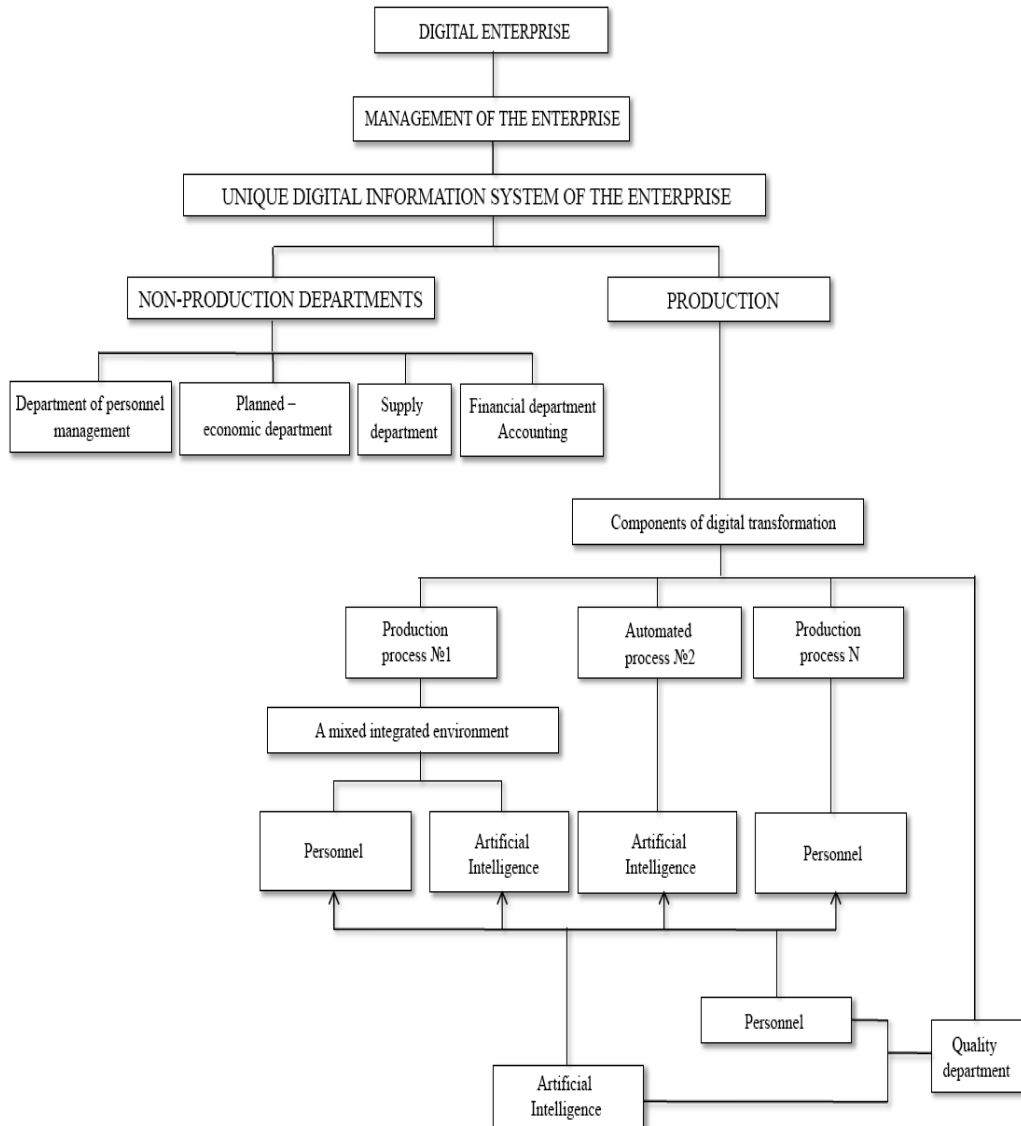
For the rational organization of human-computer interaction it is necessary to consider the existing features of the person and artificial intelligence and on their basis to divide spheres where each of performers is more effective. Us certain main differences of functioning of artificial intelligence and personnel in the mixed integrated information environment of the enterprise which it is displayed in tab. 4.

**Table 4**

The main differences of artificial intelligence and personnel at to processing of tasks (made by authors)

Criterion	Artificial intelligence	Personnel
Time	Modal time	Real time
Communications, supply with arguments, facts	The set initial operation algorithm, standard procedures	Professional competence of the operator
Focus	Firm and certain	Flexibility that changes under the influence of interest, a possibility of several parallel focuses
Context	Does not influence focus	Influences change of focus
Clearness of the purposes	Accurate formalized statements of the task	Poorly formalized or can be absent
Feedback	Without delay (in the presence of specifications)	The timeliness is not guaranteed
Speed of processing of tasks	Stable, without interruptions and with maximum capacity	Increases and falls depending on a psychophysical state, breaks are necessary
Switching to new type of solvable tasks	It is strictly determined by an algorithm, reorganization of algorithms and testing of introduction is necessary	Flexible, variable, the context influences, perhaps, at the same time in several focuses at the corresponding competences
Control	Regular, with a possibility of estimation and standard feedback of the repeated, monotonous tasks from processing of large volume	Influence of a human factor on frequency and fact of estimation (effects of fatigue, sympathy or antipathy, subjectivity, possible inadequacy)
Advantages	High speed of data processing, transparency of actions, constant performance level, work in extreme conditions	The solution of the unique and poorly formalized tasks, with high uncertainty which demand creative approach
Restriction	Lack of ability to solve the unique and poorly formalized problems, adaptation to subject domain, control under concrete process	Low speed of data processing, "human factor"

The developed model of the digital enterprise which can be presented in the form of the structure presented in fig. 8 was us.



**Figure 8:** Example of structure of the digital enterprise (made by authors)

The structure of the digital enterprise shows that as a basic element of production not only the personnel, but also artificial intelligence act. Personnel and artificial intelligence are in continuous interaction within one production, being in the mixed integrated information environment. At the same time, there are completely automated productions which are supported by intellectual technologies. There are also such structural elements where as the decision which is made and controls a link over personnel, the artificial intelligence acts.

Such organization of production activity is specific only to the digital enterprise and demands special methods and models. Digital transformation of a production system of the enterprise assumes continuous interaction of personnel and the systems of artificial

intelligence when performing production operations. It forms creation mixed integrated environments at the enterprise.

#### **4. Conclusion**

In article it is opened conditions of development of the information and intellectual capital during an era of digitalization of global space in a section of development of information society. Need of creation of effective mechanisms concerning ensuring formation, development and use of the information and intellectual capital in a condition of digital transformations as a basis increase in competitive advantages of manufacturing enterprises of the country is investigated. Digitalization of economy in the modern world becomes inevitable process which objectively influences all spheres of life of society and defines the direction of its development. Complex and complete approach concerning ensuring transformation of the information and intellectual capital of manufacturing enterprises due to synthesis with digital technologies which use would allow to accelerate development of the enterprises of the sphere of production, market economy of the country and its acceleration concerning occurrence to the developed global space is developed. Analysis of intellectualization of management of innovative activity which allows to draw a conclusion that at the Ukrainian enterprises prerequisites to formation and development of a control system of the information and intellectual capital of the organization which becomes the most important integration mechanism of creation of the complex productive and economic system based on modern resources and information and communication technologies are created is carried out. The essence, features and types of the intellectual capital of modern manufacturing enterprise are found out. Possibilities of development of the intellectual capital of manufacturing enterprises in which key there is their transformed human capital in combination with digitalization processes as powerful sources of improving competitiveness of the domestic enterprises are also studied. It is defined that creative and labor energy of the intellectual worker and the system of creative latest knowledge is the human capital which in total with the structural and consumer capital and is the intellectual capital which in a final form provides reproduction of economic innovations of all forms and types on different hierarchies and levels of management both state, and enterprise. Generally that the problem of development and strengthening of competitiveness of the intellectual capital due to synthesis with digital knowledge, tools, habits and abilities will promote improvement of quality of the intellectual capital and is a compound and integral part of a problem of improving competitiveness of the enterprises of the industry of the country. The matrix of a research of methods of management of knowledge in modern information economy is specified and is concretized, the features of management of corporate knowledge caused by system and integration approach to the contents and development of the human capital of the modern industrial enterprise in digital space are revealed. By results of forecasting of subjects of big, medium-sized and small business it is established the best polynomial lines of a trend with the corresponding coefficients of approximation 0.9743, 0.9868, 0.992 which are quite close to 1 that gives the chance to trust results of forecasting. By results of forecasting of subjects big, average and small business is established the best polynomial lines of a trend with the corresponding coefficients of approximation 0.9659, 0.993, 0.9805 which are also quite close to 1 that gives the chance to trust results of forecasting. We observe the descending dynamics of an indicator of number of workers at the big enterprises of mechanical engineering and

certain fluctuations in dynamics of this indicator at medium-sized and small enterprises of mechanical engineering. Such situation is connected with the war in Ukraine as most the enterprises, big behind the size, especially in the combat zone and in temporarily occupied territories, are destroyed by bombing, damaged or just do not work. We have hope for the fast end of war and improvement of indicators of number of staff in the industry. The conducted research is proved by the high level of development of modern developed economy in a combination with increasing digitalization. In the course of informatization of economy the digital infrastructure at the different levels is formed, necessary systems which are improved through implementation of new technologies and association in a common information space are created. On the basis of analysis of works of leading experts the main features and a contradiction in work with personnel of manufacturing enterprises are revealed and the circle of tasks which experts will need to solve in the field of a research of the intellectual capital is defined. Own vision of work with personnel in the conditions of information economy is formulated, coming out from stages of its formation and those threats (risks) which can arise in the course of work with personnel.

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