МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ХЕРСОНСЬКИЙ НАЦІОНАЛЬНИЙ ТЕХНІЧНИЙ УНІВЕРСИТЕТ

СТРАТЕГІЇ, МОДЕЛІ ТА ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ В СИСТЕМАХ УПРАВЛІННЯ

Колективна монографія
за загальною редакцією

кандидата технічних наук, доцента

Райко Галини Олександрівни

Херсон, 2019

УДК 330.111.66:005.8
С-36

Рекомендовано до друку
Вченою Радою Херсонського національного технічного університету
(протокол №7 від 05.07.2019)

Рецензенти:

Фісун М.Т. д.т.н., професор, завідувач кафедри інженерії програмного забезпечення Чорноморського національного університету ім. Петра Могили

Бараненко Р.В. к.т.н., доцент, професор кафедри професійних та спеціальних дисциплін Херсонського факультету Одеського державного університету внутрішніх справ Міністерства внутрішніх справ України

Авторський колектив: Ходаков В.Є., Соколов А.Є., Веселовська Г.В., Барташевська Ю.М., Сапрон А.В., Райко Г.О., Чебукін Ю.В., Сидорук М.В., Сидорук В.В., Данилець Є.В., Козел В.М., Цивільський Ф.М., Дроздова Є.А., Хапов Д.В., Соколова О.В., Димова Г.О., Димов В.С., Лєпа Є.В., Письменний І.В., Конох І.С., Григорова А.А., Карамушка М.В.

С-36 **Стратегії, моделі та інформаційні технології в системах управління** : колективна монографія / За загальною редакцією Райко Г.О. – Херсон: Книжкове видавництво ФОП Вишемирський В.С., 2019. – 151 с.

ISBN 978-617-7573-35-6

Колективна монографія присвячена застосуванню інформатичних технологій в економіці, освіті та управлінні проектами.

Колективна монографія розрахована на фахівців у галузі економіки, інформаційних технологій, фінансів, банківництва, державного управління, науковців, викладачів, аспірантів, магістрів та студентів.

Матеріали монографії представлено у авторській редакції.

ISBN 978-617-7573-35-6

Наукове видання

СТРАТЕГІЇ, МОДЕЛІ ТА ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ В СИСТЕМАХ УПРАВЛІННЯ

Колективна монографія

ISBN 978-617-7573-35-6

Комп'ютерна верстка: к.т.н., доцент Хапов Д.В., к.т.н., доцент Сидорук М.В.
Відповідальний за випуск: к.т.н., доцент Райко Г.О.
Дизайн обкладинки: к.т.н., доцент Данилець Є.В.

Підписано до друку 03.09.2018. Формат 60х 84/16.
Папір офсетний. Наклад 30 примірників.
Гарнітура Times New Roman. Друк ризографія.
Ум. друк. арк. 17,22. Обл.-вид. арк. 18,52.
Замовлення № 912.

Книжкове видавництво ФОП Вишемирський В.С.
Свідоцтво про внесення до Державного реєстру
суб'єктів видавничої справи серія ХС № 48 від 14.04.2005 р.
видано Управлінням у справах преси та інформації
73000, Україна, м. Херсон, вул. Соборна, 2,
тел. (050) 514-67-88, (050) 133-10-13,
e-mail: printvvs@gmail.com, vish_sveta@rambler.ru

ЗМІСТ

THE CONCEPTS IMPROVING IN CONTROL METHODS OF COMPLEX COMPUTERIZED INFORMATION SYSTEMS AND TECHNOLOGIES FOR THE TRAINING BASED ON THE FEATURES RESEARCH IN THE INTELLECTUAL CAPITAL FACTOR

Khodakov V.Ye.
Dr. Sc., Professor, Honored Worker of Science and Technology of Ukraine, Professor of Information Technologies Department
Kherson National Technical University

Sokolov A.Ye.
Ph.D., Associate Professor of Information Technologies Department
Kherson National Technical University

Veselovskaya G.V.
Ph.D., Associate Professor of Information Technologies Department
Kherson National Technical University

The general view of the problem statement, and its connections with important scientific and practical tasks. The world is in a state on implementation of active conversion processes for industrial development stage of the society subsequent to the post-industrial stage of its evolution.

In this period of development for the global social phenomena and international processes of economic character, the overwhelming importance for increasing of the economic efficiency on countries and regions began to have the following spheres of the human activity: scientific and technical activities (theoretical studies, and, not least, practical research); educational activities (training, refresher training, retraining, etc.); the provision of services (both the general population and enterprises, organizations, institutions) [1-4].

Economic efficiency is also determined by an availability, a possibility of use, a tendency to further development and continuous production in a new capacity the following components: staff with a high professional qualifications corresponding to the advanced position in development of scientific and technical progress; employees with a high level of general cultural, spiritual, and physical development; high moral personal characteristics of employees, based on generally accepted social, spiritual, and cultural values; employees with advanced information and communication characteristics and skills; staff with good organizational qualities that contribute to the collaboration; new (newly created, updated, improved, integrated, etc.) knowledge; advanced technologies (especially computer, network, information, etc.); optimal methods in the organizational and technical control based on the account of the complexity property, in one way or another is inherent in most of the existing in

real systems (in particular, manifested in high dynamism of changes for these systems, and their surrounding external environment) [1-14].

Notions such as methods (concepts, approaches, algorithms, models, and tools) designed to knowledge process (generation, acquisition, modification, accumulation, preservation, transfer, organization of protection and security), and the person himself as a highly organized person and a professional worker have come to the forefront [3-5, 8, 13-14].

In this case, it is advisable to highlight the following interrelated and interdependent aspects: the individual intellectual potential of a person (not only as his personified property, but also as a part of the intellectual potentials for local societies, as well as the global society as a whole); personalized information space of a person isolated from the general information space [1-14].

Also in the first plan is the concept of human capital, which is considered mainly as an intellectual capital (potential), which may be inherent in the following research objects:

– a specific human personality as a symbiosis of moral and ethical, cultural and esthetic, psychological, communication, organizational, professional, physical and a number of other properties and qualities;

– a local human societies (territorial, ethnic, cultural, spiritual, etc.); the global society of people (when considering the human society as such as a whole) [1, 9, 15-17, 19].

A special, extremely important and active role for the formation of the intellectual (human) capital (potential) of the highest quality is played by the education sector (at various levels and forms of general and vocational education, training, retraining, advanced training, retraining of personnel, etc.) [1-4].

It is significant that the end products of the educational sphere should meet the criteria of actual requests and operational needs in the modern labor market [1-4].

In turn, these requests and needs are focused not only and not so much on the momentary socio-economic characteristics and needs of individual specific regions.

At the forefront, they are aimed at a fairly long-term prospect of the global world development, as well as at the relevant market trends of professions, specialties and specializations.

At the moment, one of the fundamental prerequisites for the quality products obtaining in the educational technological processes is the active integrated (multifunctional) application of the following modern tools:

– a modern computer and organizational equipment, portable mobile devices;

– a various complexes of computer networks (global and local, cable and wireless);

– an integrated adaptive information and communication technologies operating on the specified technical base [2, 4-14].

In the general case, we are talking about the optimization of the methods and tools for the application of progressive computerized information systems and technologies in the processes of modern learning [8].

Relevant and insufficiently developed at the moment are many research aspects in a close relationship between of the optimization issues in the problems solving on

the intellectual (human) capital developing, the efficiency increasing of the processes and improving the results of the computerized information systems and training technologies use.

The above determines the relevance and the practical value for the topic of the modern computerized information systems and training technologies improving, considered as a complex systems, as well as methods for control them, as part of the study in the characteristics of the intellectual capital factor.

The analysis of the recent researches and publications on the issue under consideration. An increasing number of scientists conducting research, both in the field of theory and in the practical field, consider intellectual (human) capital as the most valuable asset and most important resource of modern post-industrial society [1-3, 15-19].

Moreover, intellectual (human) capital seems to be much more valuable and promising for further growth than natural or accumulated (physical) wealth [15-19].

In developed countries, it is human capital, regarded as an intellectual factor that enhances the intensity of development for the following pre-determining components of the economic success: theoretical and applied science; scientific and technological progress (STP); economics of production and non-production spheres in human activity [1-3, 15-19].

As an organic consequence of the foregoing, the interest of society in comprehensive and high-quality general and professional education, as the primary basis for the acquisition of intellectual capital, substantially increases [1-3, 15-19].

Also, in this regard, the active and multifaceted use in the education field of modern advanced computerized network information systems and technologies with the aim of ultimately obtaining intellectual capital of the highest possible quality while ensuring maximum comfort, ergonomics and cost-effectiveness of learning processes is becoming increasingly relevant [2-14].

For objective reasons, the general theory of the intellectual (human) capital was created and formed, first of all, by foreign scientists who actually received a fairly large reserve of fundamental scientific research and development ([15-17] and a number of other fundamental works).

The volume in research and development of domestic scientists in the theory of the intellectual (human) capital is still rather small.

The noted feature takes place in the contrast to the solid achievements of experts in information technology, sociology, psychology, pedagogy and a number of other branches of knowledge.

At the same time, it is extremely interesting to research and analyze the results in the indicated achievements of the domestic science at the present stage, taking into account the proposed new approaches.

Numerous and many-sided applied aspects of the intellectual (human) capital theory are organically included in the general course of the above reasoning. Including those aspects that are related to the education issues, as well as to modern computerized information systems and technologies for educational processes supporting [1-14].

For conducting and analyzing the relationships between the methodology of intellectual capital, on the one hand, and the improvement of computerized information educational systems, technologies, objects and processes, on the other hand, sources are indicative [1-19].

Based on the analysis of the recent studies and publications, the issues of improving for information systems and technologies in computerized learning, as well as methods for control them, based on the research of the intellectual capital factor characteristics, have not received a systematic study and elaboration at the moment, thus requiring further scientific research.

The allocation of unresolved parts of the general problem, the solution of which is devoted to research. The general problem posed concerns rather global subject areas related to the research of the modern aspects in intellectual (human) capital, information systems and technologies, computer systems and networks, computerized training, complex systems and methods for managing complex systems.

At the intersection of these subject areas, there are insufficiently researched and systematized local problems that can be summarized as the task of finding ways to improve for complex computerized information systems and technologies of training, as well as methods for control them, based on the research of the intellectual capital factor characteristics.

Formation of research objectives (task setting). The initial goal of the research is the conceptualization for the role and place of intellectual (human) capital in national wealth and the characteristics of its mutual influence on the development of the modern educational sphere, taking into account the processes of computerization and informatization that are actively taking place in it.

The main research task is to analyze the characteristics of the mutual influence on the processes and results of the formation for the factors associated with intellectual capital, taking into account the activity of its interaction and mutual influence with respect to the educational environment based on modern promising computerized information systems and technologies for teaching, training and educational process control.

The main final research goal is the concepts formation for the control methods improving of the complex computerized information systems and technologies in training based on the research of the characteristics for the intellectual capital factor.

The statement of the main research material with justification of the results. In accordance with the concept proposed by academic scientists and practitioners of the World Bank, the following essential components represent the national wealth:

– a natural capital;

– an accumulated (physical) capital;

– the human capital, that is, the quality of a human resource, in particular and mainly, that constitute the intellectual capital [9-12, 18-19].

The role of a fundamental resource in the general structuring of the national wealth for countries and regions around the world is played by human (intellectual) capital.

The data of the World Bank and the United Nations Organization "Development Program" indicate that in the structure of the national wealth for the world as a whole the following relationship can be traced:

– a natural resources reach 20%;

– an accumulated wealth is 16%;

– the human capital occupies a significant share of 64% [9-12, 18-19].

For individual countries that are highly developed in socio-economic terms, such as France and Switzerland, the share of the intellectual (human) capital in the structure of national wealth is extremely high and approaches 80%.

In general, human capital in almost all countries of the world exceeds half of the accumulated national wealth.

A high proportion of the human capital, above all, speaks in favor of a significant level in countries development. In the structure of the national wealth of Ukraine, the share of the human capital in the total volume, as a rule, is at least 50%, which is quite a lot.

Human capital is one of the youngest components of national wealth.

The emergence of the human capital theory is associated with an expanded interpretation of the national wealth concept. This theory was proposed in the early 60s of the 19th century by scientists T. Schulz, M. Friedman, G. Becker [15-18].

Under human capital is understood in aggregate the acquired knowledge, skills, dispositions and abilities of a person, which contribute to the active growth of his productive forces [15-18].

Human capital is also constituted by existing and newly acquired human knowledge, habits, motivations and energy, which can be used for a certain rather long period of a time for the purpose of goods and services production.

Human capital is a form of capital because it is a source of future income, satisfying needs, or both.

Human capital is human because it constitutes a certain part of a person as an individual.

Nowadays, the qualitative and quantitative productive characteristics of employees are recognized as a special form of capital on the basis of the fact that they require significant resources (time, material costs) for development, and like the physical capital, creates a higher person income.

The concept of capital formation from physical assets alone has been replaced by a more complete idea that a capital is any physical or human asset that is capable of generating the future income stream.

The components of the human capital cost are considered to be the costs of the following activities:

– an education, which takes place with the separation from the main production activities;

– a vocational training carried out directly in the production process;

– a medical service;

– the giving birth to children and caring for them.

Of considerable interest are researches in the effectiveness of higher education.

The degree of the education effectiveness highlights the level of the investments profitability in the human education, which, in turn, is calculated by comparing the benefits and costs of education.

Countries with the highest levels of human capital development are Finland, Norway, Switzerland, Canada, Japan, Sweden, Denmark, Netherlands, New Zealand, and Belgium.

Ukraine belongs to a group of countries with a fairly high level of human capital, having decent places and indices in the ratings.

A rather high place in the rating is mainly due to indicators related to the distribution of education (especially primary, secondary, extracurricular and higher).

A significant role in the growth of the above indicators is played by the acceleration of education improvement processes using progressive computerized information systems and technologies.

Human capital has an extremely positive impact on the economic development of countries.

Currently, a number of countries and international rating agencies formulate certain ratings that allow evaluating the economic, industrial or other activities of countries, regions, etc.

In today's world, human capital is assuming an ever-greater importance.

The level of development efficiency for economies of countries and regions is to a large extent determined by the state of the human capital as their most important resource, which is:

– the main driving force of the social and economic development;

– the basis for creating the economy of the knowledge, innovations, and global information technology.

As already mentioned, the methodological foundation and basic directions for the theory of the "human capital" were formulated by such scientists as G. Becker, W. Bowen, E. Jenison, T. Schulz and several others [15-18].

By the end of the 20th century, the theory of the human capital was recognized by the appointment of the Nobel Prize to Theodor Schulz and Gary Becker.

After A. Smith and K. Marx, for the first time in science, an understanding was formed that the driving force of economic growth and development was primarily represented by people, not machines.

In the historical period of the turbulent scientific and technological revolution and intensive transformations in the structure of productive forces, the worker himself became the main factor in economic growth.

The effectiveness of the basic resources use has increasingly become dependent on how much employees are morally and financially interested in achieving of the high final results of their activities.

The foundation for the modern theory of the human capital is the economic approach to the human behavior, taking into account the following properties [1-3, 15-19].

Human capital is: the main value of modern society; fundamental factor for economic growth.

The formation of the human capital requires significant costs, both directly from the individual and from the society as a whole.

The human capital has the ability to accumulate.

In the process of the life cycle, the human capital not only acquires the knowledge, but also, to a certain extent, gradually loses their novelty and relevance, respectively, having substantially worn out.

Since the knowledge of the individual becomes obsolete over time, then, in the process of being, the value of the human capital changes.

Investing in the human capital gives a higher return.

Moreover, these investments are characterized by a rather long period.

From the physical capital, human capital differs significantly in the terms of the liquidity.

The carrier of the human capital is a living human person from whom the specified capital is inseparable.

It is characteristic of the human capital that the direct income received by a person is controlled by him, regardless of the investment source.

The fact and the nature of the human capital functioning primarily depend solely on a person's decision, on his will.

The degree of the return on the human capital use functionally depends on the following individual qualities and properties of a person:

– a circle of interests as a whole;

– the material and moral interest;

– the worldview and outlook;

– the level of culture, spirituality and morality.

Thus, the human capital is a person's initially available or subsequently acquired luggage (stock) of certain qualities that are used or can be potentially used by an individual to generate income, such as: abilities; knowledge; skills; life and professional experience; physical and mental health.

That is, the human capital is not just a combination of the knowledge and abilities that a person possesses.

The concept of the human capital also includes:

– a possibility for the appropriate use of the acquired stock of the knowledge and skills in one or another sphere of social activity, which contributes to the growth of the labor productivity and the development of production;

– an increase in the income of the employer and the employee, contributing to the employee's interest, which, accordingly, makes further investment in the human capital appropriate;

– a high level of the motivation.

In addition, human capital as a concept contains the following predetermining components:

– a highly qualified labor force;

– an integrated set of knowledge, qualifications, practical skills and innovational abilities for each of the employees in the enterprise and the collective as a whole;

– a system of the universal and professional values;

– a culture of the organization and implementation of the labor activity;

– a highly moral business philosophy.

The human capital can be researched at the following hierarchically subordinate levels: macro-level; nationally; regional; industry; enterprises; individual employee.

At the macroeconomic level, the human capital includes the contribution of the territorial-organizational units (such as regions and countries) to the level of the education, professional training and competence, health and other related factors.

This level consists of the human capital aggregate for the entire population of a region, country, etc.

The main factors of the macro-environment include the following: scientific and technical; economic; political; natural; demographic; cultural environment factors.

The factors of the national level that influence to the formation and development of human capital include:

– levels of the economic development for states;

– features of the historical stage in the economic development;

– features of the current economic policy.

The development of the human capital, of course, leads to the development of the economy.

Moreover, the development is considered as a type of movement in nature and society, logically associated with the transition from one quality of the state to another, from old to new.

Under the development in a general form, they most often understand:

– an increasing the complexity of objects, processes, relationships, interdependencies, methods, tools, technologies, complexes and systems in general;

– an improving the fitness for internal and external conditions, the environment as a whole;

– an increase in the scale of occurring or suspected phenomena;

– a quality improvement;

– a quantitative growth;

– a social progress.

The development of the human capital has the following main features:

– it is a complex function for controlling of the human potential as a complex system [8];

– suggests that, in the process of the development, direct investments in a person-worker should be realized, aimed at a significant increase in its potential competitiveness in the labor market.

We can say that the development of the human potential, in essence, is:

– the formation of a radically new, much more perfect generation of workers;

– an increase in new, modern professional qualities of individual workers.

Also, the development of the human potential can be considered as the formation of the required number of workers with the necessary qualities (appropriate level of the education, qualification, specialization, etc.).

Thus, the development of the intellectual (human) potential implies not only the formation of a new workers generation, but also the growth of new professional qualities in them.

For the above development, resources are required.

In [19] a theoretical model on the distribution of resources for the development of a system, an object (on the example of socio-economic systems) of the following form is proposed:

$$\text{argtolParF}\ [f_1(\alpha, D); f_2((1-\alpha), D)] \rightarrow \alpha^*,$$

where D is the free resources of the system;

α is a coefficient that determines the proportion (proportion) for the distribution of free system resources;

$f_1(\cdot)$, $f_2(\cdot)$ are functions that display the effectiveness of the development and functioning of the system, respectively;

$F[\cdot]$ is the functional that displays the generalized efficiency of the system;

argtolParF is a record that matches to the search of a satisfactory (tolerant) solution from a variety of solutions that are Pareto optimal.

Unfortunately, this theoretical model does not allow solving practically the majority of development problems.

The cornerstone for the sustainable development of the intellectual (human) potential as a system is the formula of the resource (energy) balance for an open system in the following form [18-20]:

$$\Delta E = \Delta E_S - E_D - E_M - E_P - E_T, \quad (1)$$

where ΔE is the change in the internal energy of the system;

ΔE_S is the change in the supply of the free energy for the system;

E_D is the energy dissipated by the system into the environment;

E_M is the energy that the system directs to the implementation of metabolic functions;

E_P is the energy consumed by the system to the maintain of the required level for homeostasis, that is, to the functions implement for the negative feedback mechanism;

E_T is the energy directed by the system to achieve the transformation of the level for homeostasis, that is, to the implementation of the functions for the positive feedback mechanism.

Provided that $\Delta E = 0$, we have the following features:

– the system (object) operates in a stable, equilibrium mode;

– the receipt (replenishment) of the system free energy is completely spent on the order maintaining in the system, that is, on the entropy reducing.

When $\Delta E > 0$, we obtain the following:

– the free energy is accumulated in the system;

– excess of the free energy can be realized by transforming the level of the homeostasis in the direction of its change, considered as the development.

When $\Delta E < 0$, it is characteristic that:

– there is not enough free energy to maintain the level of the homeostasis;

– the entropy rises.

In this case: the level of the homeostasis is reduced; the system goes into an unstable state.

From the model (1) it follows [18-20] that:

$$\Delta W = Wq - Wp - Wm - Ws, \quad (3)$$

where ΔW is the free resources;

Wq is the resources-revenues from the external environment (income);

Wp is the resources-costs transferred to the external environment;

Wm is the consumption resources (ensure the functioning of the system, that is, metabolism);

Ws is the stabilization resources that provide parry of risks as random external disturbances.

For the object under the consideration, which is a human resource, as a generalized resource, it is possible to consider:

– financial flows;

– integrations of various specific types of resources.

To implement the development in accordance with the goal, the system spends a different amount of different resources types from a variety of resources W [18-20].

When the less resources the system spends on the implementation of the development, the more effective it will be.

The amount of resources available to the system for the development control of the human capital during the planning period $W(T)$ is [18-20]:

$$W(T) = W\phi(T) + Wp(T),$$

where $W\phi(T)$ is the functioning resources;

$Wp(T)$ is the development resources.

The system can acquire resources for the development in the following possible ways:

– to receive from the outside, from higher-level control systems;

– to accumulate on the planning period, during the process of its regular functioning.

The functioning of the system in the planning period can be conditionally considered (taken) as a quasi-equilibrium state.

As a result of the development, a sequential transition from the one quasi-equilibrium state of the system to another is carried out.

Therefore, conditionally the state of the system in the development process can be approximated by a piecewise constant function.

Thus, the system requires the existence of the following two subsystems (loops) for control: to control the functioning of the system; to control the development of the system.

To analyze the sustainability of the system development, it is necessary to proceed to the analysis on the planning interval [18-20]:

$$\int_0^T \Delta W(t)\,dt = \int_0^T Wq\,dt - \int_0^T Wp\,dt - \int_0^T Wm\,dt - \int_0^T Ws\,dt. \quad (3)$$

In the first characteristic case, when $\Delta W\ (T) > 0$, certain resources for the development of the system are available.

In the second typical case, when $\Delta W(T) \leq 0$, the resources and, accordingly, the possibilities for the development of the system are completely absent. In this case, the following options are possible for subsequent analysis.

For $\Delta W\ (T) = 0$, we have: the state of the human resource is stable; there is completely no possibility for development.

For $\Delta W(T) < 0$, we obtain the following: there is an unstable state; there are no development opportunities either.

The following aspects may act as factors and components contributing to the development of the intellectual potential:

– a development of the educational system;

– an encouraging of employees who continue or plan to continue their education, the formation of their desire to increase the level of knowledge and competencies, the creation of the necessary conditions for this;

– an intensification in the introduction of progressive computerized information systems and technologies into educational processes.

All of the above contributes to the growth and development of the intellectual capital, which is the basis for the formation of highly professional personnel with the innovative thinking.

The features noted above together constitute a necessary condition for the sustainable economic, social, cultural and natural development of both an individual enterprise and the state as a whole.

Intellectual (human) potential is the main wealth of any state, and its maintenance is necessary in order to:

– a control for the economic, social, cultural and spiritual (moral) development of the country;

– a forming of a positive image in foreign relations with other states.

The analysis and research in the field of socio-economic processes show that in the modern society the human potential is the most important factor in the reproduction of the national wealth.

To assess the socio-economic situation of countries, the human potential development index is used.

This index is one of the indicators for the national economy competitiveness, along with the following important indicators:

– the global competitiveness index;

– the innovation development index;

– the gross domestic product per capita and others [9-12, 18-19].

The human development index is an integrated indicator calculated annually for the following purposes:

– making comparisons between different countries;

– measuring the level of living standards, literacy, education and longevity as the main characteristics of the intellectual (human) potential of the researched territory, region.

It is a standard tool for a general comparison of the level for living standards in different countries and regions.

This index is published as part of the "Development Program" from the United Nations Organization in annual reports on the human capital development [9-12, 18-19].

The main components-indicators that determine the development index for the human capital include the following: an expected duration of the human life; a level of the education; the real gross domestic product [9-12, 18-19].

They reflect such main qualities as: a human knowledge; the skills, competencies, specializations and qualifications of the people; a healthy human life; a comfort and ecology of human life; the decent standard of the living for a person as a whole.

As a result of the study, we can formulate a number of the following conclusions and conceptual approaches.

Intellectual potential and human resources are decisive for achieving the competitive advantages of the economy.

In the developed countries of the world, investments in the intellectual potential are the main factor of the economic growth and increasing the competitiveness of the national economy.

The determining condition in this case is the accumulation and preservation of the intellectual potential, including people encouraging to improving their lifelong skills through lifelong training.

This is due to the fact that for economic growth in the country, along with investments in the physical capital, investments in the education, health and culture are necessary as the main components of the intellectual potential.

Further development of the methodology for the effective practical application of advanced computerized information systems and technologies in the educational field is a powerful catalyst for the formation of the modern intellectual capital and its further powerful positive impact in this area.

The general problem in finding reserves to improve the efficiency of complex computerized information systems and technologies for training, as well as their control methods, based on research in theoretical and applied features for the concept of the intellectual capital in development dynamics, leads to the formulation of a number of topical local problems, among which it is advisable, first of all turn, consider the following questions below.

In modern teaching and learning technologies, the most important for the most effective return on the existing and further productive formation of a new (improved) intellectual potential are methods and means for the independently mastering of the new information in instrumental environments and under the control of computerized information training systems that are implemented remotely based on technologies of the distance learning systems.

In these systems, the requirements and possibilities for the using of the multimedia technologies with a high content of static and dynamic graphics (graphic control elements; raster, vector and fractal, two-dimensional and three-dimensional illustrations; photos; video; animation and morphing), combined with hypermedia and interactivity are extremely high.

It should be noted that multimedia content is one of those key and most intensive factors, which in the modern world community and at the current level of the development for the scientific and technological progress, computer tools, network technologies, informatization and virtualization processes is not only potentially very influential in both the processes of education, as well as the processes of formation and development of the human capital, considered in their close relationship and interaction, but in the real practice also has a powerful positive impact on these processes.

First of all, the high activity and effectiveness of the multimedia content impact on the formation of the intellectual capital and its inverse impact on the education system is due to the widespread distribution, accessibility and popularity of the global computer network Internet, of numerous and varied Web sites.

As a result, it is relevant to create the most optimal (productive, ergonomic, economical, and user-adaptive) methods, tools, models, and information technologies for computerized information systems and technologies of training, and also for methods of the control them as complex systems under conditions of increased intensity in applications, increased volumes in the storage and presentation, accelerated update dynamics, increased requirements to the multimedia content security.

The solution to the problem on the more effective mechanisms obtaining for the optimal information interaction ensuring in the process on users consuming of information resources for large-scale and dynamically developing subject areas associated with computerized information systems and technologies of training, and also with adaptive control methods for them as complex systems, is becoming more and more in demand in theory and practice.

Arising at the junction of two global, mutually influencing and interdependent areas of the research (subject areas), which are the intellectual potential (capital) and computerized information systems and technologies of training, the problem of improving both the systems and technologies themselves, and the methods of control them as complex systems, requires application more powerful mathematical apparatus.

As a result of the increased complexity in the researched class systems and their control methods, a need arises for models based on the theory of the synergetic control and the methodology of the artificial intelligence.

The conclusions and recommendations. A conceptual analysis for the role and place of the intellectual capital in the national wealth is made, carried out in the interconnection with the research on the influence of factors caused by the intellectual potential on the education system. As a result for the analysis in the characteristics of the intellectual capital factor, as a logical consequence and catalyst of educational processes, the concepts of further relevant research and development in the field of the control methods improving for complex computerized information systems and technologies of teaching are formed. The practical value of the work results is the possibility of the further formalizing for the formed concepts and putting them into the functioning practice for the management systems on the sustainable

development of the intellectual potential in the field of complex computerized information systems and technologies for training.

References.

1. Valero A., Van Reenen J. The economic impact of universities. Evidence from across the globe (No. w22501). USA: National Bureau of Economic Research, 2016. 320 p.

2. Higher education in the digital age. Moving academia online / eds.: A. Zorn, J. Haywood, J. Glachant. Cheltenham, UK, Northampton, MA, USA: EEE Publishing, 2018. 170 p.

3. Butenko V. H. Rol vyshchoi tekhnichnoi osvity u formuvanni hromadianskykh tsinnostei maibutnikh fakhivtsiv. *Pedahohichna nauka: istoriia, teoriia, praktyka, tendentsii rozvytku* [Elektronyyi zhurnal]. 2010. Vyp. 2.

4. Joshi A., Meza J., Costa S. et. al. The role of information and communication technology in community outreach, academic and research collaboration, and education and support services (IT-CARES). *Perspective in helth information management (online research journal)*. 2013. Volume 10 (Fall). 15 p.

5. Xing W., Fei G. Exploring the relationship between online discourse and commitment in Twitter professional learning communities. *Computers & Education*. 2018. № 126. P. 388-398.

6. Willcox K. E., Sarma S., Lippel P. H. Online education: a catalyst for higher education reforms. Massachusetts Institute of Technology online education policy initiative Final Report. Cambridge: MIT, 2016. 56 p.

7. Buinytska O. P. Informatsiini tekhnolohii ta tekhnichni zasoby navchannia. Kyiv: Tsentr navchalnoi literatury, 2017. 240 s.

8. Khodakov V. Ye., Sokolov A. Ye., Veselovskaya G. V. Models of training procedures. *Radio Electronics, Computer Science, Control*. 2018. № 4 (47). P. 51-60. doi: 10.15588/1607-3274-2018-4-5.

9. Measuring the information society report 2018 / eds.: Sanou B (International Telecommunication Union). Geneva, Switzerland: ITU Publications, 2018. Volume 1. 204 p.

10. *Trends and advances in information systems and technologies*: proceedings of the 2018 World conference on information systems and technologies WorldCIST`18 (Naples, Italy, 27-29 March 2018) / Eds.: A. Rocha, H. Adeli, L. P. Reis, S. Costanzo. Naples, Italy: Springers International Publishing, 2018.Volume 3 (347). 406 p.

11. Information technology strategy 2018-21: annual report of progress planned GB.331-PFA-5-2018 / Eds.: Information and technology management department, Inernetional labour office. Geneva, Switzerland: INFOTEC, ILO, 2017. 26 p.

12. *Enterprise information systems: proceedings of the 20-th International conference ICEIS 2018* (Funchal, Madeira, Portugal, 21-24 March 2018) / Eds.: S. Hammoudi, M. Smialek, O. Camp, J. Filipe. Madeira, Portugal: SciTePress, Science Technology Publications, Lda, 2018. Volume 1. 440 p.

13. Saidani N. Towards a better comprehension of adaptation to information and communication technologies: a multi-level approach: PhD dissertation. Georgia State University, USA, 2016. 220 p.

14. Antonenko V. M., Mamchenko S. D., Rohushyna Yu. V. Suchasni informatsiini systemy i tekhnolohii: upravlinnia znanniamy: navchalnyi posibnyk . Irpin: Natsionalnyi universytet DPS Ukrainy, 2016. 212 s.
15. Schultz T.W. Investing in People. California: University of California Press, 1981. 173 p.
16. Becker G. Human Capital. New York, London, 1975. 216 c.
17. Boiven H.R. Investment in Learning. San Francisco, 1978. 362 p.
18. Hodakov V. E., Sokolova N. A. Prirodno-klimaticheskie faktoryi i sotsialno-ekonomicheskie sistemyi. Herson: Izdatelstvo HGMA, 2016. 604 s.
19. Zabrodskiy V. A. Razvitie krupnomasshtabnyih ekonomiko-proizvodstvennyih sistem: monografiya. Harkov: Biznes-Inform, 2000. 72 s.
20. Sokolova N. A. Metodyi i modeli sistemyi upravleniya ustoychivyim razvitiem ob'ektov hozyaystvennoy deyatelnosti: Avtoreferat doktorskoy dissertatsii. Harkov, 2007. 46 s.