

*This paper explores peculiarities in the formation and development of intelligent entrepreneurship as a new social phenomenon of national economies and the imperatives of its manifestation in the economic environment. The relationship between intelligent, informational, and innovative activities that shape the environment of modern entrepreneurship has been established. A new understanding of the essence of “intelligent entrepreneurship” and “talent management” categories has been proposed. The value of human capital, the realization of intelligent capabilities of the individual is recognized as the basic value of intelligent entrepreneurship. It has been proven that in modern conditions the most promising for national economies is the transition to open innovation models. It is noted that the development and effective use of intelligent potential are due to the need to increase the efficiency of innovation, science, and education systems, which ensures the economic growth of the national economy. The structure of intelligent potential of entrepreneurship under the conditions of digital transformation of the economy has been built. Original views on the essence and significance of the talent management system are presented. It is noted that intelligent entrepreneurship requires a holistic approach. The classification of communities of intelligent practitioners has been devised. The system of management of advanced reproduction of the latest knowledge of business entities has been formed. The directions of digital transformation of intelligent entrepreneurship have been outlined. A system-integrated methodological approach to determining the Index of digital transformation of business entities has been devised. The study results build on the theoretical and practical aspects of intelligent entrepreneurship, contribute to the effective use and development of the intelligent potential of entrepreneurial organizations and their network associations*

**Keywords:** digital economy, intelligent entrepreneurship, knowledge management, intelligent commerce, digital transformation

Received date 08.10.2021

Accepted date 18.11.2021

Published date 28.12.2021

**How to Cite:** Ostrovska, H., Tsikh, H., Strutynska, I., Kinash, I., Pietukhova, O., Golovnya, O., Shehynska, N. (2021).

Building an effective model of intelligent entrepreneurship development in digital economy. *Eastern-European Journal of Enterprise Technologies*, 6 (13 (114)), 49–59. doi: <https://doi.org/10.15587/1729-4061.2021.244916>

UDC 331.102.344

DOI: 10.15587/1729-4061.2021.244916

# BUILDING AN EFFECTIVE MODEL OF INTELLIGENT ENTREPRENEURSHIP DEVELOPMENT IN DIGITAL ECONOMY

**Halyna Ostrovska**

*Corresponding author*

PhD, Associate Professor

Department of Management of Innovation Activity and Service Industries\*

E-mail: h.ostrovska@gmail.com

**Halyna Tsikh**

PhD, Associate Professor, Dean

Department of Economics and Finance\*

**Iryna Strutynska**

Doctor of Economic Sciences, Professor, Associate Professor

Department of Computer Science\*

**Iryna Kinash**

Doctor of Economic Sciences, Professor

Department of Management and Administration

Ivano-Frankivsk National Technical University of Oil and Gas

Karpatska str., 15, Ivano-Frankivsk, Ukraine, 76019

**Olha Pietukhova**

Doctor of Economic Sciences, Associate Professor, Head of Department

Department of Marketing

National University of Food Technologies

Volodymyrska str., 68, Kyiv, Ukraine, 01601

**Olena Golovnya**

Doctor of Economic Sciences, Associate Professor

Department International Management, Hotel and

Restaurant Business and Tourism

Vynnytsia National Agrarian University

Soniachna str., 3, Vynnytsia, Ukraine, 21008

**Natalia Shehynska**

PhD, Associate Professor, Head of Department

Department of Management and Social Security

University of Banking

Sichovykh Striltsiv str., 11, Lviv, Ukraine, 79007

\*Ternopil Ivan Puluj National Technical University

Ruska str., 56, Ternopil, Ukraine, 46001

## 1. Introduction

Under the conditions of the digital economy, the innovative development of economic systems is predetermined by two parallel and interrelated phenomena – globalization (open macroeconomic systems) and the transformation of models of the innovation process. “Globalization 4.0 and

the technological innovations underlying it lead the world to a new era of development – cyberphysical systems and talents – an era that has no historical precedent in scale, speed, and depth of change” [1].

The dominants of intelligent evolution of the modern economy by vectors of high-tech services and high-tech technologies marked the formation of such a phenomenon

of modern economy as intelligent entrepreneurship [2]. It implies the synthesis of intelligent and entrepreneurial activity, accompanied by the interaction of subjects of continuous reproduction of intelligent resources of the economy and society and business entities. We, experts are unanimous that the transformation of these processes is hindered by psychological inertia and, in general, the understanding of entrepreneurship formed during the development of industrial society. In this context, the main problem of modern entrepreneurship is the unformed creative innovative thinking, the absence of new theories, concepts, methods, and mechanisms for capitalizing the potential of knowledge, modernization of the institutional infrastructure of entrepreneurship, etc.

The research related to this issue is relevant since it ensures the implementation of the results on the formation of an effective model for the development of intelligent entrepreneurship under the conditions of the digital economy. These circumstances necessitate the review of literary data and problem statement.

---

## 2. Literature review and problem statement

---

Comprehension of the phenomenon of entrepreneurship evolves “from the concept of entrepreneurship to intelligent entrepreneurship inherent in modern trends, among which the basic ones are the innovative direction of socio-economic processes and the dynamic development of informatization of all aspects of human activity” [3].

In this context, alternative approaches of world schools have been formed to solve the problem of intelligent entrepreneurship. First, the Kozminsky University of Warsaw, where the UNESCO Department of Intelligent Entrepreneurship was established in 1998. The focus of research published in the Series Knowledge Café for Intelligent Entrepreneurship by the Warsaw school is an entrepreneur who is already engaged in business.

There, intelligent entrepreneurship is associated with a special type of entrepreneurship carried out by intelligent entrepreneurs. They create socially oriented innovative products, guided not only by economic benefits but also by the goals of self-realization and spiritual and moral guidelines [4]. Another center for the study of intelligent entrepreneurship is the University of Texas in Austin. The Texas school puts a scientist, an academic figure in the spotlight, believing that academic institutions are better able to develop critical thinking, while possessing knowledge and tools. In particular, study [5] states that this entrepreneurship is the production of the latest knowledge, the organization and management of advanced reproduction of knowledge, the embodiment of their specific life benefits for summarizing the mechanisms of cooperation and interaction of economic agents. At the same time, entrepreneurship is a driver for mastering the world, as well as the process of cultural innovation. Intelligent entrepreneurs cooperate and solve problems in a variety of social areas: corporate, non-profit, state, and educational. In this context, cooperation between universities and the public expands access to the “intelligent assets” of universities. The Swedish school demonstrates an approach based on the development and effective use of the intelligent potential of entrepreneurship as the wealth of the nation. In this direction, human potential in combination with structural capital should contribute to the future

growth of intelligent entrepreneurship. Based on comprehensive analysis and comprehension of global socio-economic processes of the 1990s, the concept of intelligent entrepreneurship was formed that “integrates intelligence, entrepreneurship, and university (academic) education” [6].

In order to further study this concept, the Technology and Entrepreneurship Center at Harvard, TECH, with the support of Zebra Technologies Corporation, held a symposium “Innovations 2016: Intelligent Enterprise” [7]. Attention was paid to the fact that the concept of an intelligent enterprise allows companies to implement advanced technologies and connection solutions that meet the requirements of the modern digital world. In this context, analysts from Zebra Technologies Corporation, who compile the annual report “Intelligent Enterprise Index” [8], determine how specific companies have approached the status of an “intelligent enterprise”. To assess the degree of compliance of the “corporate intelligence” of a particular company with the status of “Intelligent Enterprise”, 11 criteria were used, including the strategy of implementation of the Internet of Things, adaptation of employees, data management, and intelligent analysis.

Worth attention is research [9] that advances the concept of digital entrepreneurship. It proposes an interpretive base consisting of components such as the justification for the adoption of digital technologies (why), digital activities (what), digital actors (who), and a digital organization (how). However, while that phenomenon was analyzed for academic entrepreneurship, the questions about the impact of digital technologies on intelligent entrepreneurship remain open.

In [10], the notion on integrating modern entrepreneurship with innovation dominates. At the same time, innovation is considered a way of expressing entrepreneurship. There is also evidence that the concept is the basis for the formation of social roles and activities that make it possible for business entities to develop. Based on critical analysis, it has been proven that the economy is a space where people can collaborate, generate ideas, and compete in intelligent reflection. Intelligent entrepreneurship is understood as an attitude towards global expansion of the knowledge boundary. However, the cited paper is exclusively theoretical in nature, there are no recommendations of the authors about the practical platform.

Using meta-analysis, the authors of [11] investigate the extent to which general mental abilities (cognitive intelligence) and emotional intelligence affect entrepreneurship success. Based on sociological research methods, it was found that both cognitive and emotional intelligence have a significant impact on the effectiveness of entrepreneurship but the value of emotional intelligence is twice as high. In this context, such an important element of intelligent entrepreneurship as spiritual consciousness remained unattended, which limits the coverage of the object of research.

The issues related to intelligent enterprise development in the context of capitalization of knowledge potential are crystallized in work [12]. The focus is smart specialization, which involves the intensification of relations between business, science, and the public area. The need to go beyond economic and mathematical tools in the study of economic development in favor of complexity and multidisciplinary has been proven. The authors found that variability of the influence of science on economic growth establishes an understanding of the ambiguity and nonlinearity of this process. Accordingly, it requires constant empirical checks

of existing dependences and the search for new factors of influence depending on the stage of civilization movement at which different countries of the world are.

It is necessary to agree with the statement of the authors of study [13] that in the process of intelligent and innovative activities of enterprises, outsourcing makes it possible to concentrate all available resources on achieving commercial goals. At the same time, the economic evaluation of outsourcing services is extremely important for the effective activity of entrepreneurship. In this context, the methodology developed by the authors to synthesize indicators of economic efficiency, reproducing the advantages obtained through outsourcing, deserves attention.

The doctrine of intelligent commercialization serves as a reliable foundation for the formation of a model of high-tech and competitive entrepreneurship, the progress of which is closely related to the production of intelligent product as an expression of human talent. However, it is not yet united by a single methodology, theoretical construct, its socio-economic aspects are not distinguished.

The formation of a holistic concept of intelligent entrepreneurship requires the development of a new “functional-content” approach that would harmoniously combine aspects of mental activity and practice-oriented activities of a person with intelligent competence.

Intelligent competence is understood as a fundamental skill that determines the degree of industry-related knowledge by a subject. At the same time, it is characterized by a special type of organization of subject-specific knowledge and effective decision-making strategies using non-standard methods that are produced by an irrational component of thinking.

---

### 3. The study materials and methods

---

The purpose of this research is to build an effective model for the development of intelligent entrepreneurship in the digital economy. This will contribute to the achievement of economic, social, managerial, capitalization, and image efficiency of entrepreneurship and the dominance of the role of human in the modern economy as an intelligent factor in economic growth.

To accomplish the aim, the following tasks have been set:

- to substantiate the feasibility of transition of national economies to open innovation models;
- to build the structure of the intelligent potential of modern entrepreneurship;
- to explore the peculiarities of intelligent entrepreneurship in terms of its meaningful content as a form of realization of intelligent potential;
- to build a system of management of advanced reproduction of the latest knowledge of business entities;
- to outline the directions of digital transformation of intelligent entrepreneurship;
- to devise a system-integrated methodological approach to determining the Index of digital transformation of business entities.

---

### 4. The study materials and methods

---

In order to justify the feasibility of transition of national economies to models of open innovations, to develop a management system for the advanced reproduction of the latest

knowledge of business entities, such research methods as abstraction, specification, and generalization of theoretical provisions were used. To analyze alternative approaches of world schools to solve the problem of intelligent entrepreneurship, a historical method has been used. To build a methodological approach to the evaluation of the Index of digital transformation of business entities, the method of economic and mathematical modeling was used. The tabular research method was used to visually display the results of the study. In the context of the formation of a holistic concept of intelligent entrepreneurship, a functional-content approach has been developed.

Intelligent entrepreneurship has a much wider and deeper meaning than strict methods of scientific knowledge of socio-economic reality. Advanced reproduction of the latest knowledge under modern conditions can not only be the result of the use of research tools, rigidly deterministic by the requirements of a certain methodology and scientific paradigms. The increasing complexity and contradiction of socio-economic reality objectively causes the need for increasingly private improvisations, intuitive solutions, estimation, and comprehension of “weak signals” as markers from other fields of knowledge.

---

## 5. The study results in the context of the intensification of intelligent entrepreneurship

---

### 5.1. Economic justification for the feasibility of transition of national economies to open innovation models

The global spread of knowledge, technology, information, intelligent resources, the growth of the significance of open interactions and qualitatively new effects (the “butterfly effect”) lead to changes in the very nature of competition and forms of intelligent business. Our theoretical and applied research has made it possible to conclude that under modern conditions for national economies the most promising is the transition to models of open innovation. These intelligent models relate to the development, implementation, and use of the results of scientific, technical and innovative activities in the process of open innovative interaction. At the same time, the stability of innovative interactions directly depends on the diffusion of innovations. In recent years, open innovative models have become an integral part of innovative strategies of a number of countries and business models of companies. In these models, the issues of management of inter-industry clusters, local innovation networks, the system of trilateral cooperation between science, business, and the state are of particular relevance. The problems of effective use of intelligent potential, development of the intelligent property market and institutional support of innovation activity are also worthy of attention. In accordance with the rules for the formation of an open innovation system, the management of innovative development is based on such principles as:

- recognition of innovation as a key competitive advantage;
- susceptibility to innovations of society, science, state, and business;
- the use of the model of open innovative interaction; development of innovations based on innovative target programs;
- creation of institutional and infrastructure conditions to ensure the transition of innovative processes from the previous stage to the next stage;
- coordination of the development of an innovative subsystem with socio-economic systems;

- ensuring the transformation of intelligent potential into intelligent capital as the most important factor that generates knowledge and ensures innovative development;
- achievement of synergism due to the fact that the manager's influence on innovative development will be generated from the inside, not from the outside, and will correspond to the internal trends of self-development of the system.

The transition to open innovation shifts the focus to the fastest development and implementation of innovations in order to obtain competitive advantages of high order. In turn, it depends not so much on the accumulated knowledge but on the ability and capability to create, update, and transform them into an innovative benefit. The obstacle to the implementation of the open innovation model in the national system is weak institutional support for innovation activities. This slows down the transition to a new technological way and does not make it possible to effectively use technological windows of opportunities in order to accelerate innovative development.

Knowledge-based services and technologies revolutionize the economy. However, the degree to which entrepreneurship can be successful depends on the competencies of people and their operational capabilities, such as structure and systems. To achieve exceptional success, it is necessary to use intelligent capabilities and competitive information about the environment.

### 5. 2. Building the structure of the intelligent potential of modern entrepreneurship

The panorama of scientific research suggests that intelligent potential as a driving force based on knowledge and science is the basis for the effective development of entrepreneurship in the digital economy. Intelligent potential is an integrating indicator of internal sources, opportunities, means of rational solution of social, political, ideological, cultural, scientific and technical problems, including socially valuable knowledge of the entire population, country, region, community. With the help of intelligent potential, preconditions for creating new knowledge are being prepared, the practical use of which contributes to the progress of society in general and its structural elements in particular [14]. For a deeper analysis of the intelligent potential of entrepreneurship under the conditions of the digital economy, its infrastructure is built (Fig. 1).

Taking into consideration the above mentioned components of intelligent potential will allow business entities to manage business processes more efficiently, to form key vectors of growth and directions of strategic business development.

We believe that the possibilities of ensuring a high-quality level of intelligent potential of business entities are in the area of implementation of talent management programs. Talent management is seen as a targeted influence on employees in order to

increase their self-esteem, professional dexterity, innovation, and creativity in the process of using personal intelligent potential. Thus, "innovative opportunities do not come on a hurricane wave – they are brought by a light breath of the breeze" [15]. In the current environment, increased talent gap is the biggest challenge for business entities. Thus, in 2020, the most significant shortage of workers with a high level of intelligent potential was observed in the United States, and is projected to reach 14 million persons. At the same time, in Japan, the shortage of talent is confirmed by 86 % of entrepreneurs, in neighboring Poland – 51 % [16]. In our opinion, the implementation of talent management programs for business entities should include the identification (detection) of talents using various methods; monitoring and quality assessment (monitoring of talent dynamics); development (based on training, self-education, self-improvement, workplace changes, etc.).

In general, the development and effective use of intelligent potential in the era of knowledge contributes to increasing the efficiency of existing systems of innovation, science, and education in the country, ensuring the economic growth of the national economy in general. Intelligent entrepreneurship is a favorable environment for the effective use and realization of intelligent potential.

| Infrastructure of intelligent potential of entrepreneurship                                      |  |   |   |  |
|--|--|---|---|--|
| Organizational structures of intelligent capacity development management                         |  |   | A system that promotes the process of digital transformation of business entities |  |
| Entrepreneurship training System   | Potential in the field of scientific research and engineering development              |   |   | Development of crowd-technologies (crowdsourcing, crowd-recruiting, crowd working)                                 |
| Training system for network tools for the capitalization of intelligent potential and innovation | Research institutes  | The core of intelligent potential                 | System of technical and engineering education                                     | Innovation parks; clusters; business incubators; system of support for entrepreneurship development                |
| Training system on intellectual property protection  | Innovative system of training scientific personnel in the field of creative industries | Level of education and development of individuals | The system of acquiring skills and knowledge                                      | Institutional mechanisms for regulating intelligent, innovative, and informational activities of business entities |
|  |  | Continuous learning                               |   |  |
|  |  | Creativity  |   |  |
|  |  | Generation of new knowledge                       |   |  |
| Development of information and communication structure   | Information literacy   | R&D potential                                     | ICT Education and vocational training system                                      |  |
|  |  | Patent activity                                   |   |  |
|  |  |   |   |  |
| Constituent elements of intelligent potential in interaction between areas of influence          |  |   |   |  |
| Financial and economic   | Investment and innovation  | Scientific and technical                          | Logistics and marketing   | Export-import  |

Fig. 1. Infrastructure of intelligent potential of entrepreneurship in the digital economy

Table 1

**5. 3. Intelligent entrepreneurship as a form of intelligent potential implementation**

The transition of the economy in the era of knowledge fundamentally changes traditional approaches and models related to the development of modern entrepreneurship, which is confirmed by the need to make entrepreneurship smart. This is due to the fact that the main economic products of entrepreneurial activity are intelligent product and high-tech product while entrepreneurs themselves become smart people like us, thereby marking the development of an intelligent type of entrepreneurship.

The main features of intelligent entrepreneurship are as follows:

- combination of training with the main production activities and remuneration;
- highly developed motivational area of humans; the availability of innovative system thinking;
- obtaining, disseminating knowledge, skills, experience in an educational or professional environment;
- clear codified taxonomy of collective knowledge in order to increase their effectiveness;
- transformation of knowledge into specific actions and decisions with the assistance of communicative and mental abilities caused by creativity and technologies of their realization;
- effective use and practical realization of intelligent potential of the individual and/or team;
- implementation of venture projects aimed at creating and commercializing innovations, developing new sectors (industries) of the country’s (region’s) economy;
- integration with a self-taught organization;
- development of intelligent culture, in particular knowledge culture;
- maintaining a balance between chaos and order, that is, fundamental organizational dichotomy.

Innovations require a clever, balanced combination of structuredness and creativity, which probably supports the concept of “chaordic”[17]. At the same time, entrepreneurship is responsible for promoting an intelligent product to global markets, guided not only by economic achievements but also by the goals of self-realization and moral benchmarks.

Intelligent entrepreneurship combines rational intelligence, emotional intelligence, and spiritual intelligence. Under these conditions, intelligent entrepreneurship requires a holistic approach. Therefore, organizational synapses are needed, which are created by learning opportunities or experience. The basis of rational and emotional intelligence is spiritual consciousness, or the coefficient of spiritual synapses (synapse quotient – SQ). Within the holistic approach, it is advisable to use the technology “intelligent map” [17].

The concept of intelligent entrepreneurship implements the idea of combining the physical and digital worlds for the sake of innovation, increasing the efficiency and growth rate of the global economy. Working together, specialists organize intelligent societies (communities of practitioners, coalitions of the elite), as a result of which the generation of knowledge is carried out through an effective synergy mechanism. This makes it possible to remove not only obstacles to the implementation of specific intelligent potentials of individual individuals but also resource constraints in the production of the latest knowledge [2]. The classification of communities of intelligent practitioners is given in Table 1.

Classification of communities of practitioners

| Attribute               | Types of communities of intelligent practitioners  |
|-------------------------|--|
| By form of organization | - self-organized ones;<br>- initiated by management  |
| By time of existence    | - short-term;<br>- existing for many years   |
| By community size       | - with a small number of community members;<br>- numerous (extended)   |
| By target orientation   | - created to achieve a certain short-term goal;<br>- multifunctional   |
| By space of existence   | - intra-organizational (unite employees of one organization);<br>- inter-organizational (uniting employees of several different organizations, such as network communities, “virtual communities”) |

Thus, the new paradigm of entrepreneurship is based on the following principles [18]:

- social responsibility;
- network construction of entrepreneurial environment;
- partnerships of non-profit and non-profit organizations, startups for the exchange of knowledge, technologies, and the formation of a single institutional environment of social development;
- interaction of large businesses with medium and small, new forms of economic integration;
- the union of social, innovative, and market benchmarks of activity.

The first intelligent enterprises appeared in the oil business (Royal Dutch/Shell), cement production (Mexican firm Cementos Mexicanos), financial services (Swedish Scandia), retail (English firm Burmah Petroleum Fuels Ltd). The concept of an intelligent enterprise has no industry specificity and is a universal model of the organization of the future.

**5. 4. Formation of a management system for the advanced reproduction of the latest knowledge of intelligent entrepreneurship**

Intelligent entrepreneurship is understood as an open interaction of its subjects in the process of managing advanced reproduction of knowledge under the conditions of highly developed intelligent culture. At the same time, intelligent culture is a system of relations that arise between participants in intelligent, innovative, and information activities.

The system of management of advanced reproduction of the latest knowledge of intelligent entrepreneurship is shown in Fig. 2.

In Fig. 2, intelligent entrepreneurship is considered as a system of innovations in the field of advanced reproduction of intelligent values. Knowledge management is a form of intelligent entrepreneurship, conscious purposeful influence on the process of reproduction of new organizational knowledge. In this context, the knowledge management system should be based on a cultural-value approach. Therefore, knowledge management is a concept of strategic management focused on the development and effective use of intelligent potential based on management methods and new information technologies to ensure fundamentally new competitive advantages [19].

The components of the mechanism of acquiring intelligent knowledge are interrelated and provide a synergistic result in the form of creating the latest knowledge within the discursive creative-energy space. The area of special attention is the synergistic effectiveness of socio-economic

intra-firm interactions as a function of the intensity of discursive transactions. This intensity is provided by a network of creative groups, network project subgroups, and a network form of functioning of business entities, where any forms of expression of administration and internal bureaucracy lead to the destruction of the space of developing exchange-communication.

Accordingly, the introduction of innovative models of open knowledge and innovation, commercialization in science require the creation of platforms for knowledge exchange – innovative markets. A necessary component of the structure of the specified market is crowdsourcing, the purpose of which is to use the latent intelligent potential of society to gain new knowledge or open innovation. The introduction of crowdsourcing elements makes it possible to accelerate innovative development and adapt the product (informational or material) to the needs of consumers at the design stage.

The basic principles of smart platforms include the following:

- joining efforts in the most significant areas of stakeholders for commercialization (science and education – business and production);
- creation of professional and expert communities;
- formation of innovative culture;
- distinguishing benchmarks for the formation of new interdisciplinary fields of knowledge;
- innovative (proactive) training in the field of creative industries.

It should be noted that in modern conditions, an objective and official understanding of the development of innovative markets, in particular digital ones, is not sufficiently explored. In this context, it is necessary to intensify innovative forms of entrepreneurial activity, the basis of which is social capital and IT technologies (crowdfunding, coworking, sharing platforms and e-commerce, etc.).

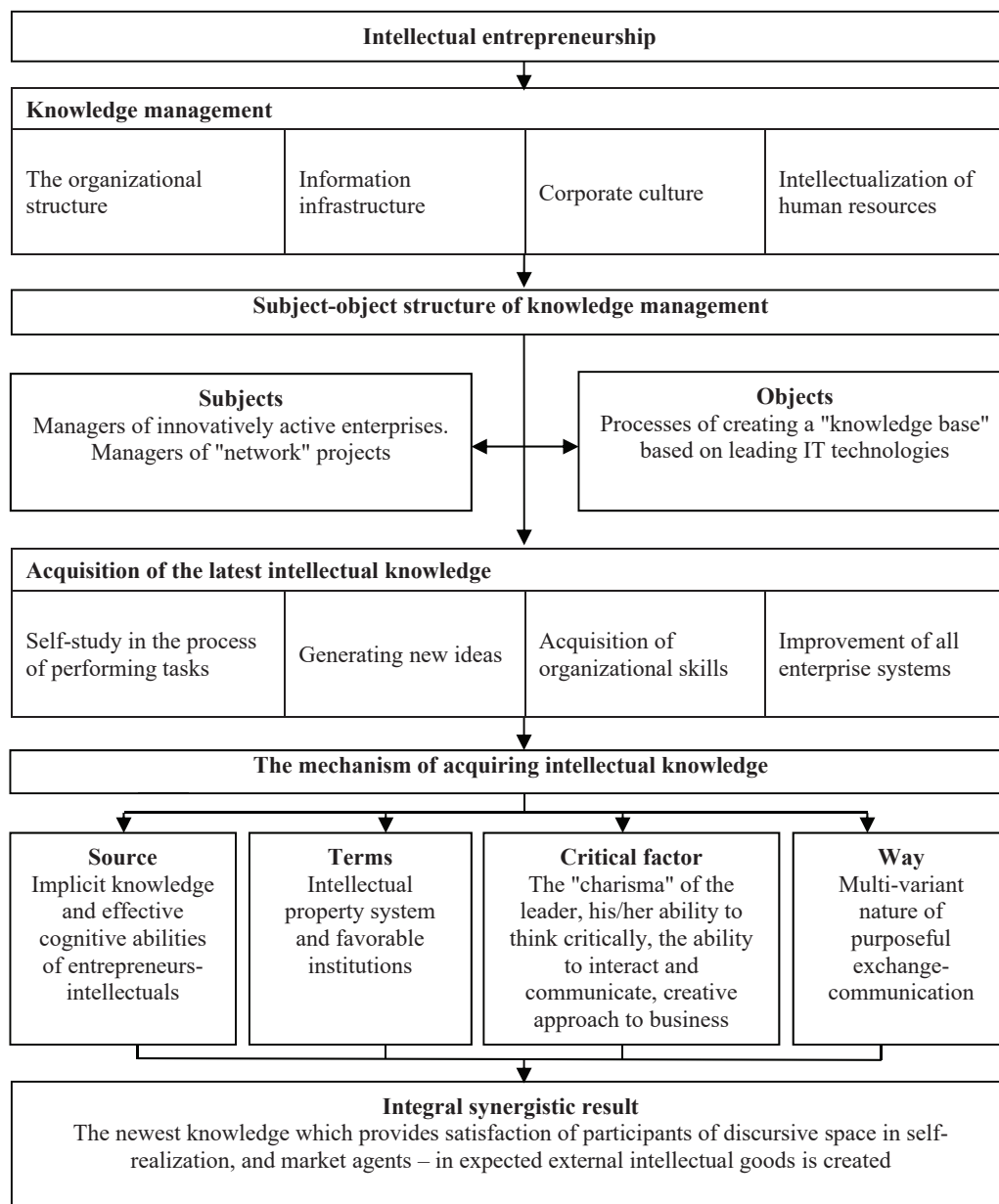


Fig. 2. The system of management of advanced reproduction of the latest knowledge of intelligent entrepreneurship

### 5.5. Digital transformation of entrepreneurship

Digital transformation of entrepreneurship will take place through the introduction of digital technologies through powerful centralized and distributed computing resources (super- and quantum computers; cloud and edge computing; software based on artificial intelligence systems that involves machine learning; next-generation network resources that combine Big Data using neural networking principles; development and implementation of software and hardware systems. In the field of network infrastructure, the basis for the development of public infocommunication networks should be networks with a synchronous digital hierarchy (SDH), which will serve as the basis for the further implementation and expansion of the use of inter-machine interaction technologies (M2M) and the Internet of Things (IoT).

The process of digitalization of business entities should be built by introducing control systems based on the concept of the Internet of Things, high-speed data processing, the creation of industrial robots, 3D printing technologies, full digital integration of engineering and design work on the value chain. At the same time, the emphasis should be on the development of comprehensive program and strategic documents on the digital transformation of business entities similar to the concepts “Industry 4.0” (Germany), “Internet+” (PRC), on a large-scale transition to new technologies, including the change of existing business models. High-tech production should develop in the most popular areas of creation of a component base of microelectronics for all types of activities. For the successful digitalization of business entities, standardization of technological processes, modernization of equipment, introduction of intelligent control systems for production operations and business processes, creation of competence centers for the distribution of digital technologies are required. Digitalization of traditional activities involves the introduction of quickly re-equipped automated production lines and processing centers. Production equipment must be adapted to the use of CALS technologies, ERP systems, SCM systems (supply chain management), MES systems (production systems management). Thus, the main directions of digital transformation of entrepreneurship are interaction with customers, optimization of operational processes, and change of business model.

### 5.6. Practical verification of the system-integrated methodical approach to calculating the Index of digital transformation of business structures “HIT”

Lack of open information sources, platforms, services for the digital transformation of business entities, hinders the processes of innovation implementation and entering the international economic arena. In this context, “digital” competence (or “digital” literacy) is recognized by the European Union as one of the eight key competencies for professional activities and making the most of your life [20]. On the scale of the state, improving the formation of digital competencies in all areas of functioning is a source of increasing the level of competitiveness of the country, because access to information, digital interaction and intensity of use and improvement of information and communication technologies are the basic elements of almost all global competitiveness indexes. These problems predetermine the need to develop a methodological approach, which involves determining the Index of digital transformation of business entities based on relevant indicators.

The creation and approval of the national methodology for determining the index of digital transformation of businesses will make it possible to assess the level of digital maturity of business entities and take into consideration all the factors (indicators) that need to be integrated to increase the potential of business. At the same time, to track the impact of relevant technologies on the development of business and the information society in general, which will further be an impetus for researching the impact of information technology on the country’s economy.

To determine the generalized Digital Transformation Index, formula (1) was built based on the consolidated structural indicators (indicators) of the digital transformation of business entities:

$$HIT = Summ_H \cdot \omega_H + Summ_I \cdot \omega_I + Summ_T \cdot \omega_T, \quad (1)$$

where “HIT” is an index of digital transformation of a business;  $Summ_H$  – a consolidated indicator of the state of digital literacy of the human capital of the enterprise;  $Summ_I$  – a consolidated indicator of the state of functioning of digital instruments integrated into the business processes of the enterprise;  $Summ_T$  – a consolidated indicator of the state of operation of the digital infrastructure of the enterprise;  $\omega_H$  is the weight coefficient of indicator  $H$ ;  $\omega_I$  is the weight coefficient of indicator  $I$ ;  $\omega_T$  is the weight coefficient of indicator  $T$ .

$$\omega_H + \omega_I + \omega_T = 1. \quad (2)$$

Taking into consideration formula (2), in our case, the weight of the  $H$  indicator will be 0.3 ( $\omega_H = 0.3$ ), since “digital” literacy (or “digital” competence) is recognized by the European Union as one of the eight key competencies for life and professional activity. The weight coefficient of indicator  $I$  will be 0.5 ( $\omega_I = 0.5$ ). It is the use and implementation of certain groups of digital tools in the structure of business processes of the enterprise that transform the existing business model and act as an imperative of innovative development of the business entity. The weight factor of the  $T$  indicator is 0.2 ( $\omega_T = 0.2$ ).

The level of human literacy in the assets of the human capital of the enterprise is determined by the formula:

$$Summ_H = \sum_{i=1}^{m_H} n_i^{(H)} \cdot k_i^{(H)}, \quad (3)$$

where  $n_i^{(H)}$  is an indicator of the level of digital literacy of the human capital of an enterprise;  $k_i^{(H)}$  is the weight coefficient of indicator  $n_i^{(H)}$ ;  $m_H$  is the number of expert opinions.

The main reason for distinguishing this component in the calculation of the Digital Transformation Index is that the digital maturity of the enterprise, namely, the digital transformation of the business goes far beyond digital tools (technologies). The weight factor of the  $H$  indicator is 0.3 because the process of digital transformation will not be able to take place without the participation of human capital, namely the integration of knowledge, talent, culture, and organizational structure with the “digital” environment.

The consolidated indicator of the state of functioning of digital tools integrated into the business processes of the enterprise takes the following form:

$$Summ_I = \sum_{i=1}^{m_I} n_i^{(I)} \cdot k_i^{(I)}, \quad (4)$$

where  $n_i^{(I)}$  is an indicator of the level of functioning of digital instruments at an enterprise;  $k_i^{(I)}$  is the weight coefficient of indicator  $n_i^{(I)}$ ;  $m_I$  is the number of digital tools.

At the same time, the consolidated indicator of the state of operation of the digital infrastructure of the enterprise will be calculated as follows:

$$Summ_T = \sum_{i=1}^{m_T} n_i^{(T)} \cdot k_i^{(T)}, \tag{5}$$

where  $n_i^{(T)}$  is an indicator of the level of functioning of the digital infrastructure at an enterprise;  $k_i^{(T)}$  is the weight coefficient of indicator  $n_i^{(T)}$ ;  $m_T$  is the number of elements of the digital infrastructure.

The annual assessment of the Digital Transformation Index of Entrepreneurship would serve as a tool for monitoring and evaluating the effectiveness of doing business in the digital economy. At the same time, it would contribute to the formation of priority economic, legal, and regulatory measures (reforms) to improve the introduction of digital technologies in the activities of business entities in Ukraine and their integration into the global digital economy.

A fragment of the calculations carried out based on all indicators of the Index of Digital Transformation of Business Structures is given in Table 2.

Based on the results obtained, we can state that the level of digital literacy and maturity of business entities must be increased. Most respondents have a level of digital transformation below average. In this context, immediate changes in governance are needed, significant work on the implementation of available digital technologies and tools, as well as the improvement of digital literacy of human capital. These changes will make it possible to acquire unique competitive advantages and win new market segments [21].

The total consolidated indicator, as well as the level of the Digital Transformation Index by the respondents and the corresponding indicators, is given in Table 3.

Fragment of aggregated data based on indicators «H», «I», «T»

| Respondent No. | The value of indicator «H» | The value of indicator «I» | The value of indicator «T» | The value of $H_n I_n T_n$ |
|----------------|----------------------------|----------------------------|----------------------------|----------------------------|
| 1              | 0.4                        | 0.225                      | 0.5                        | $H_3 I_4 T_3$              |
| 2              | 0.6                        | 0.276                      | 0.75                       | $H_2 I_4 T_2$              |
| 3              | 0.6                        | 0.174                      | 0.75                       | $H_2 I_5 T_2$              |
| ...            | ...                        | ...                        | ...                        | ...                        |
| <i>n</i>       | 0.6                        | 0.669                      | 0.665                      | $H_5 I_3 T_2$              |

Note: calculated and structured on the basis of this study

Table 2

tion and communication environment of the enterprise;

2) formation of creative thinking due to continuous learning and self-improvement of individuals;

3) significant increase in the synergic effect due to interaction of participants of discursive space for self-realization and increase of knowledge;

4) the use of crowd-technologies in entrepreneurship as modern management tools in the context of open innovations;

5) the need to have a certain level of digital literacy;

6) uneven distribution of the intelligent potential of the economy between its agents;

7) strengthening interaction in science and innovation (innovative coopera-

The value of the Digital Transformation Index by the respondents

| Level              | $H_n$ | $H$  | $I_n$ | $I$   | $T_n$ | $T$   |
|--------------------|-------|--|-------|---|-------|---|
| Very high (0.81–1) | $H_1$ | (26)   | $I_1$ | –   | $T_1$ | (4; 6; 21; 7; 12; 16; 19; 20; 22; 24; 27; 8; 26; 32; 33 9 ) |
| High (0.61–0.8)    | $H_2$ | (25; 27; 33; 3; 2)                           | $I_2$ | (25; 26)  | $T_2$ | (2; 3; 10; 13; 18; 28; 29; 31; 34)                          |
| Medium (0.41–0.6)  | $H_3$ | (15; 24; 28; 4; 1; 7)                        | $I_3$ | (7; 24; 27; 34)   | $T_3$ | (5; 1; 14; 15; 25)  |
| Low (0.21–0.4)     | $H_4$ | (8; 9; 10; 13; 14; 21; 29; 30; 31; 32; 5; 6) | $I_4$ | (1; 2; 4; 8; 9; 10; 13; 14; 15; 19; 20; 22; 28; 31; 33; 21) | $T_4$ | (11; 30)  |
| Very low (0–0.2)   | $H_5$ | (11; 12; 16; 17; 18; 19; 20; 22; 23; 34)     | $I_5$ | (3; 5; 6; 11; 12; 16; 17; 18; 23; 29; 30; 32)               | $T_5$ | (8; 17; 23)   |

Note: calculated and structured on the basis of this study

Table 3

## 6. Discussion of study results on the intensification of intelligent entrepreneurship

In modern conditions, institutional features of an open innovative economy and current trends in the global innovation market are not fully taken into consideration. The open innovation model will smooth out negative trends in the innovation market, such as the increase in the cost of research and development work, the reduction of the life cycle of goods, and the mobility of human capital. As regards the transfer of knowledge and open innovations, it is proposed to introduce an open innovation policy at the national level. At the same time, to update the regulatory framework in the field of innovation activity, which would strengthen the chain of “education – science – innovation – economy”. To effectively interact with education, science, business, and civil society, to form a culture of open innovation, as well as to introduce a system for monitoring knowledge transfer and open innovation. The use of the open innovation interaction model makes it possible to create and maintain sustainable channels of penetration of innovations into the real economy in the digital economy. This will contribute to the effective use of technological windows of opportunities in order to accelerate innovative development.

The formation and development of the digital economic system brings new characteristics to the category of intelligent potential. In this context, a new vision has been formed regarding the purpose of the intelligent potential of entrepreneurship, its socio-humanistic responsibility, opportunities for balanced development and implementation. The difference between the proposed structure of the intelligent potential of entrepreneurship and the existing one is to include components that play a crucial role at the present stage of the development of the digital economy. Under these conditions, the structure of the intelligent potential of entrepreneurship acquires a number of creative features:



tion), the essence of which is to create a single “end-to-end” system for the main components of the innovation cycle.

The proposed measures can be used in the context of increasing the effectiveness of managing the intelligent potential of entrepreneurship in order to increase economic added value through an increase in organizational knowledge.

Intelligent entrepreneurship is understood as an open interaction of its subjects in the process of managing advanced reproduction of knowledge under the conditions of highly developed intelligent culture. Intelligent entrepreneurs generate organizational knowledge using the synergy mechanism, which makes it possible to avoid obstacles in the process of realizing the intelligent potential of individual individuals, eliminating restrictions in the creation of new knowledge, and thus achieving a socio-economic effect. This process takes place within the framework of a common interaction that crosses intra- and inter-organization levels and boundaries. Raising the level of organizational knowledge contributes to the development of economic thinking based on a competent understanding of the processes of the socio-economic area, forms economic consciousness, changes the value field, expands the adaptive, integrating, creative, and innovative capabilities of individuals. For representatives of intelligent communities, a universal means that makes it possible to maximize the influx and value of knowledge is a network.

It is appropriate to form a management system for the advanced reproduction of the latest knowledge of intelligent entrepreneurship. Implementation of the concept of knowledge management at an enterprise provides for a series of advantages. First, efficient use and high value of the intelligent potential of the enterprise. Second, improving the relationship of practitioners due to active exchange of information, cooperation of ideas in the process of innovation activity. Third, improving cooperation and partnerships with the assistance of information from consumers through feedback channels. The introduction of innovative models of open knowledge and innovation requires the creation of platforms for knowledge exchange – innovative markets. This becomes possible due to the intensification of innovative forms of entrepreneurial activity, the basis of which is social capital and IT technologies (crowdfunding, coworking, sharing platforms, and e-commerce, etc.).

The main directions of digital transformation of entrepreneurship are interaction with customers, optimization of operational processes, and change of business model. Information technologies allow business entities to flexibly change their business model, ensure innovative development, and integrate competitive positions into the world market. In the era of rapid development of information and communication technologies and innovations, the processes of digitalization of existing business processes, which are the relevant “growth points” of business, are of great importance. At the same time, the transition from the simple use of IT to business transformation must be carried out through the integration of activity in the field of digital technologies and creative leadership. This is what is called “digital maturity”. Enterprises on this basis vary significantly, and those that are more mature in terms of digital technologies outperform their competitors in business.

Lack of open information sources, platforms, services for the digital transformation of business entities, inhibits the processes of innovation implementation and entry into the international economic arena [20]. These problems led to the need to develop a methodological approach, which involves determining the Index of digital transformation of business entities based on relevant indicators. A system-integrated

approach has been developed, which is characterized by the features of the complex *HIT* system, involves distinguishing the following groups of indicators: informative (for further in-depth data analysis); digital literacy of human capital (skills and competencies of employees – “*H*”); digital tools (groups of tools in terms of business processes of the enterprise – “*I*”); digital infrastructure (hardware, technological support – “*T*”), each of which contains its own system of sub indicators with appropriate weight coefficients. Based on the results obtained, we can indicate that the level of digital literacy and maturity of business entities must be increased. In this context, immediate changes in governance are needed, significant work on the implementation of available digital technologies and tools, as well as the improvement of digital literacy of human capital. These changes will make it possible to acquire unique competitive advantages and win new market segments. At the same time, the results of the index calculation (“*HIT*”) based on real data on the digital maturity of Ukrainian business entities will serve as a driving force for further practical actions to increase their digital development.

---

## 7. Conclusions

---

1. Justifying the feasibility of transition of national economies to open innovation models will facilitate the process of adapting the national economy to European requirements. The development of open national innovation systems is possible based on a balanced innovative policy of states, an important direction of which should be the implementation of multifunctional measures. These measures will accelerate the construction of open innovative models, supported by institutional support, will make it possible to take into consideration when planning the development of the trend of globalization of the world economy and national interests. Management of innovative activities of business entities based on open innovations contributes to the growth of productivity, increase of profitability, effective use of intelligent property, dynamic development of the company in general.

2. The formation of the digital economy confirms that the post-industrial stage of society development is based on the maximum use of intelligent potential. The specified economy should be evaluated not only by the increase in productivity or sales volume but also by how much it contributes to the improvement of a person or its degradation. Creating conditions for improving the standard of living, self-realization, and disclosure of talent of each person has a beneficial effect on the development of intelligent property, innovation activities, creative thinking, etc. Intelligence involves a dramatic increase in the role of human capital as a driving force for socio-economic development through the realization of its creative potential. Opportunities to ensure a high-quality level of intelligent potential of business entities are in the area of implementation of talent management programs.

3. The proposed concept of intelligent entrepreneurship presents the possibility of implementing the idea of combining the physical and digital worlds for the sake of innovation, increasing efficiency and growth rate of the global economy. Working together, specialists organize intelligent societies, as a result of which the generation of knowledge is carried out through an effective mechanism of synergy. This makes it possible to remove not only obstacles to the implementation

of specific intelligent potentials of individual individuals but also resource constraints in the production of the latest knowledge. Intelligent entrepreneurship combines rational intelligence, emotional culture, and spiritual consciousness. Under these conditions, intelligent entrepreneurship requires a holistic approach. The basis of rational and emotional intelligence is spiritual consciousness, or the coefficient of spiritual synapses (synapse quotient, SQ). Within the holistic approach, it is advisable to use the technology “intelligent map”.

4. Organizational knowledge occupies a prominent place in the cognitive process since it is about radical changes in the entire economic system and society in general – now it is a global network organism, where the area of consciousness occupies a prevailing place. In this context, the introduction of a management system for the advanced reproduction of new knowledge of intelligent entrepreneurship entities provides a solid basis for the creation of a strategic intangible asset – unique knowledge. The implementation of this system, taking into consideration the new knowledge and ideas identified, contributes to obtaining, in addition to the economic effect, such types of effect as technological, scientific, informational, social, environmental, etc. And as a result of the implementation of this system, the growth of the value of the enterprise due to the creation of new competitive products that can meet the growing needs of consumers.

5. Digitalization is a recognized mechanism of economic growth due to the ability of technologies to positively influence the efficiency, effectiveness, cost, and quality of economic,

public, and personal activities. At the same time, the main directions of digital transformation are customer interaction, optimization of operational processes and changes in the business model. In this context, the following areas (modules) of digital transformation stand out: customer experience; digital data development and application of innovations; partnership and collaboration; HR strategy and culture; digital literacy; value management. At the same time, it is important to ensure that the digital revolution of business is formed comprehensively and farsightedly, taking into consideration the priorities of equality, accessibility, inclusion, human dignity, international cooperation, and resilience.

6. The system-integrated methodological approach to determining the Index of Digital Transformation of Business Entities contains signs of a complex *HIT* system, namely the separation of four levels of indicator groups. They, in turn, form a certain system of sub indicators with appropriate weight coefficients. This approach makes it possible to determine the potential of digital maturity of an entrepreneur and his/her readiness to implement digital technologies in business practice in order to ensure its development. In this context, the annual assessment of the “Business Digital Transformation Index” implies identifying barriers to the development of the digital infrastructure of entrepreneurship, developing recommendations for increasing digital maturity and obtaining reliable data for quantitative and qualitative assessment of digital development (potential) of business entities.

## References

1. Amosha, O., Pidorycheva, I., Zemliankin, A. (2021). Key trends in the world economy development: new challenges and prospects. *Science and Innovation*, 17 (1), 3–17. doi: <http://doi.org/10.15407/scine17.01.003>
2. Ostrovska, H. (2017). Intellectual entrepreneurship under a new paradigm of economic activity. *Herald of Ternopil National Economic University*, 2 (84), 83–97. doi: <http://doi.org/10.35774/visnyk2017.02.083>
3. Zakharchyn, R. M. (2019). The main aspects of intellectual entrepreneurship in terms of innovative development. *Ekonomika ta upravlinnia pidpriemstvamy*, 27, 147–152. Available at: [http://www.market-infr.od.ua/journals/2019/27\\_2019\\_ukr/25.pdf](http://www.market-infr.od.ua/journals/2019/27_2019_ukr/25.pdf)
4. Johannisson, B., Kwiatkowski, S., Dandridge, Th. C. (1999). Intellectual Entrepreneurship – Emerging Identity. A Learning Perspective. Available at: <http://www.seipa.edu.pl/s/p/artykuly/92/926/Intellectual%20Ent.%20Defined.pdf>
5. Chervitz, R. Developing Intellectual Entrepreneurship. Available at: <https://webpace.utexas.edu/chervitz/www/ie/scientist.html>
6. Abosede, J. A., Onakoya, A. B. (2013). Intellectual Entrepreneurship: Theories, purpose and Challenge. *International Journal of Business Administration*, 4 (5), 30. doi: <http://doi.org/10.5430/ijba.v4n5p30>
7. The Innovator's Forum. Harvard. Available at: <https://theinnovatorsforum.org/content/about>
8. Ryne, T. V. (2019). Intelligent Enterprise Index. Available at: <https://www.zebra.com/us/en/blog/posts/2019/are-you-smarter-than-average-company-assess-enterprise-intelligence.html>
9. Rippa, P., Secundo, G. (2019). Digital academic entrepreneurship: The potential of digital technologies on academic entrepreneurship. *Technological Forecasting and Social Change*, 146, 900–911. doi: <http://doi.org/10.1016/j.techfore.2018.07.013>
10. Zdun, M. (2021). Entrepreneurship, innovation, economic development and a socializing institution – as a chain of related categories. *Rozprawy Społeczne*, 15 (1), 125–144. doi: <http://doi.org/10.29316/rs/135383>
11. Allen, J. S., Stevenson, R. M., O'Boyle, E. H., Seibert, S. (2020). What matters more for entrepreneurship success? A meta-analysis comparing general mental ability and emotional intelligence in entrepreneurial settings. *Strategic Entrepreneurship Journal*, 15 (3), 352–376. doi: <http://doi.org/10.1002/sej.1377>
12. Pylypenko, H., Fedorova, N., Huzenko, I., Naumenko, N. (2020). Paradoxes of economic development: science and innovation in the modern world. *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu*, 2, 153–159. doi: <http://doi.org/10.33271/nvngu/2020-2/153>
13. Pererva, P., Kuchynskiy, V., Kobielieva, T., Kosenko, A., Maslak, O. (2021). Economic substantiation of outsourcing the information technologies and logistic services in the intellectual and innovative activities of an enterprise. *Eastern-European Journal of Enterprise Technologies*, 4 (13 (112)), 6–14. doi: <http://doi.org/10.15587/1729-4061.2021.239164>
14. Datsii, N. (2021). Intellectual potential management as a new paradigm of sustainable development of public administration. *Investytsiyi: Praktyka Ta Dosvid*, 16, 64–69. doi: <http://doi.org/10.32702/2306-6814.2021.16.64>

15. Druker, P. (2014). *Praktika menedzhmenta*. Moscow: Mann, Ivanov i Ferber, 416.
16. Sipa, M. (2019). Diversification of Capabilities of Economies in the Field of Talent Management. Poland Against the Background of the European Union. *European Journal of Sustainable Development*, 8 (2), 268–278. doi: <http://doi.org/10.14207/ejsd.2019.v8n2p268>
17. Edvinsson, L. (2005). *Korporativnaya dolgota. Navigatsiya v ekonomike, osnovannoi na znaniyakh*. Moscow: INFRA, 248.
18. Nebrat, V. (2017). Development of entrepreneurship in Ukraine: historical determinants and prospects. *Ekonomika i Prognozuvanna*, 3, 140–156. doi: <http://doi.org/10.15407/eip2017.03.140>
19. Ostrovska, H., Maliuta, L. Y., Sherstiuk, R., Lutsykyv, I., Yasinetska, I. (2020). Development of intellectual potential at systematic paradigm of knowledge management. *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu*, 4, 171–178. doi: <http://doi.org/10.33271/nvngu/2020-4/171>
20. Strutynska I., Dmytrotsa, L., Kozbur H., Melnyk, L. (2020). System-Integrated Methodological Approach Development to Calculating the Digital Transformation Index of Businesses. *Proceedings of the 16th International Conference on ICT in Education, Research and Industrial Applications. Integration, Harmonization and Knowledge Transfer. Volume I: Main Conference, ICTERI 2020*. Kharkiv, 2740, 373–379. Available at: <http://ceur-ws.org/Vol-2740/20200373.pdf>
21. Strutynska, I., Dmytrotsa, L., Kozbur, H., Hlado, O., Sorokivska, O. (2021). Working-Out of Recommendation System to Increase the Digital Maturity Level of Enterprises. *2020 IEEE International Conference on Problems of Infocommunications Science and Technology. PIC S and T 2020 – Proceedings*, 147–151. doi: <http://doi.org/10.1109/picst51311.2020.9467978>