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Kostiantyn Oleksandrovych Meteshkin[1], Maksym Anatoliiovych Kukhar[2], Viktoriia Oleksandrivna Shevchenko[3], Liubov Oleksiivna Masliy[4]

[1]Doctor in Technical Sciences, Professor of the Department of Land Administration and Geoinformation Systems
O. M. Beketov National University of Urban Economy in Kharkiv (Kharkiv, Ukraine)
E-mail: meteshkin@gmail.com. **ORCID:** https://orcid.org/0000-0002-1170-2062
ResearcherID: AAG-7092-2021. **SCOPUSAuthorID:** 57214221308

[2]PhD in Technical Sciences, Associate Professor of the Department of Land Administration and Geoinformation Systems
O. M. Beketov National University of Urban Economy in Kharkiv (Kharkiv, Ukraine)
E-mail: ppoosshhttaa@ukr.net. **ORCID:** https://orcid.org/0000-0001-8305-6269. **ResearcherID:** ISR-8853-2023

[3]PhD in Technical Sciences, Associate Professor, Associate Professor
of the Department of Computer Science and Information Systems
Kharkiv National Automobile and Highway University (Kharkiv, Ukraine)
E-mail: vicashev@gmail.com. **ORCID:** https://orcid.org/0000-0003-0620-6811

[4]PhD Student of the Department of Land Administration and Geoinformation Systems
O. M. Beketov National University of Urban Economy in Kharkiv (Kharkiv, Ukraine)
E-mail: gnomomir@gmail.com. **ORCID:** https://orcid.org/0000-0003-3844-462X

EXPERIMENTAL VALIDATION OF THE CREATION OF CONDITIONAL NOOSPHERIC INTELLIGENCE USING GEOINFORMATION MODELING

The aim of this study is to test a model for the formation of conditional noospheric intelligence (CNI) based on data from academic staff of higher education institutions in Ukraine, using methods of mathematical and geoinformation modeling. CNI is considered a complex structure that includes administrative intelligence, integrated intelligence, and the qualification potential of natural intelligence carriers.

The study demonstrates that the qualification potential of academic staff is the foundation for the formation of CNI. The proposed methods and analytical schemes contribute to improving the rating evaluation system of academic staff in universities and to the creation of a prospective cadastral system of intellectual resources.

Keywords: *knowledge model; intelligent system; modeling; GIS; noospheric intelligence; experimental method.*
Fig.: 1. Table: 2. References: 12.

Urgency of the research. The current stage of scientific and technological progress is characterized by the active development of research in the fields of artificial intelligence (AI) and information technologies that utilize knowledge models. The rapid growth of information volumes and their accelerating increase create conditions that some researchers describe as approaching informational singularity. This necessitates the development of new approaches for the collection, processing, and analysis of large datasets, as well as the integration of knowledge from diverse sources. In response to these challenges, Grid and Smart technologies are evolving, including "smart" devices, buildings, cities, and other complex systems capable of adapting to changing conditions and ensuring efficient resource management. Therefore, this study proposes to examine the potential of an intellectual system representing the scientific capacity of Ukraine.

Target setting. The representation of information evolves as technical capabilities for its collection, processing, and storage improve. With the emergence of artificial intelligence technologies, perceptions of information have also changed. When considering information and data generated by both AI and humans, there remain certain differences and characteristics – human-generated information tends to be more accurate and of higher quality. This gives rise to the problem of transforming and integrating high-quality human-generated information into a unified complex. To address this, it is necessary to develop a coherent structure and classification of such information with reference to its creators.

Actual scientific researches and issues analysis. To form an understanding of the current state of research on the application and development of intelligent systems in education, works [1-5] were analyzed. The features of modeling for studying collective intelligence were examined in works [6-8]. For the analysis of GIS applications in modeling elements of intelligent systems, works [9=10] were reviewed. Relevant source data were obtained from materials [11-12].

Uninvestigated parts of general matters defining. Analysis of previous studies has shown that research on intelligent systems in various human activities has already been conducted. This includes the field of education, which conceptually remains a source of scientific potential for any country. In general, various concepts and models for developing different types of intelligent systems have been proposed. However, a key limitation is that these systems address scientific potential only to solve specific, isolated tasks, without focusing on the source of scientific ideas and solutions for the respective tasks. Moreover, quantitative indicators of the scientific component applied to the formation and functioning of intelligent systems are largely absent.

The research objective. The purpose of this study is to test a model for forming a conditional noospheric intelligence based on data from academic staff of higher education institutions in Ukraine, using methods of mathematical and geoinformation modeling.

The statement of basic materials. This study introduces the term conditional noospheric intelligence (CNI), based on V. I. Vernadsky's concept of the noosphere. CNI is understood as the system's ability to form groups of experts from among academic staff – the intellectual elite of higher education institutions – to solve current scientific, educational, and practical tasks. This process considers their qualifications, experience, competencies, and capacity for collaborative work, allowing for effective knowledge integration and ensuring high-quality decision-making across various fields.

The authors developed a model of conditionally noospheric intelligence, the core of which is implemented in analytical form:

$$M(I^{UN}) = \langle P(\Upsilon), \boldsymbol{I^A}, \boldsymbol{I^B} \overbrace{\boldsymbol{Q_j^{A^*}}, \boldsymbol{Q_h^{B\nabla}}, \subset, \boldsymbol{T}}^{\text{сигнатура}} \rangle. \quad (1)$$

where $P(\Upsilon)$ – denotes the qualification potential of natural intelligence bearers, determined by the set of multiple intelligence vectors Y={ρi}, i=1,9;

$\boldsymbol{I^A}$ – represents administrative intelligence, i.e., collective intellectual activity within organizational structures (department, meeting, council, etc.);

$\boldsymbol{I^B}$ – is the integrated (hybrid) intelligence, combining collective intelligence with knowledge models and artificial intelligence to solve weakly structured problems;

$\boldsymbol{Q_j^{A^*}}$ – describes the relationships of "being useful for solving tasks within a group of selected academic staff in the core Ω";

$\boldsymbol{Q_h^{B\nabla}}$ – denotes the set of relations forming morphism cones within the core Ω for solving complex problems across different subject areas;

$\subset$ – is the inclusion relation, reflecting the formation of the CNI core as a subset of the academic staff universe;

$\boldsymbol{Q_h^{B\nabla}}$ – represents the time axis, illustrating the process of knowledge accumulation, competence formation, and professional growth of academic staff.

Based on the previously obtained research results, the task arises to assess the quality of expert groups forming the core of CNI. Currently, there exist methods for achieving consensus in decision-making, including the Delphi method, decision matrices, and the judgment method, among others. The assessment of these methods' quality is based on the calculation of the Concordance Coefficient, which characterizes the degree of agreement among experts' opinions (expressed as ranks) across a set of criteria.

Unfortunately, this method cannot be fully applied when evaluating collective intelligence, particularly integrated intelligence and, even more so, CNI.

The authors of this study decided to verify specific provisions of $\boldsymbol{I^A}$ formation using their own example – a quantitative assessment of the collective intelligence of the co-authors (Prof. K. O. Meteshkin, Associate Professors M. A. Kukhar and V. O. Shevchenko, and Senior Lecturer L. O. Masliy).

The input data included values of qualification indicators and rules proposed at Kharkiv National University of Municipal Economy named after O. M. Beketov, which reflect all possible outcomes of academic staff member (ASM) intellectual activity and their evaluations.

In the case of the qualification indicators of Professor Kostiantyn Oleksandrovych Meteshkin's intellectual activity, they are tabulated and partially presented in Table 1 in bold font.

Table 1 – Qualification potentials of ASM and their quantitative characteristics

№	Rating Indicator	Quantitative Score (points)	Note
1	2	3	4
К1	Teaching experience	$t_1^г$=1; $t_2^г$=2; $t_3^г$=3; $t_4^г$=4.	Temporary horizons purposefulness professional NPR activities
К2	Academician / Corresponding Member of the National Academy of Sciences of Ukraine	60/40	60 – with training load; 40 – without training load
К3	Laureate of the State awards	50/40	50 with training load; 40 – without training load
К4	Award Winner Cabinet of Ministers of Ukraine	30/20	30 with training load; 20 – without training load
К5	Academician / Corresponding Member (International, non-governmental academy)	20/10	20 with training load; 10 – without training load
К6	Doctor of Science/ Candidate of Science	20/10	20 – doctor; 10 – candidate
К7	Honorable title « Honored» scientist and engineer	20	
К8	of Honor of the President of Ukraine, Cabinet of Ministers of Ukraine	20	
К9	Publication in the reporting period period textbook or manual with the stamp of the Ministries of Education and Science of Ukraine	20/15	20 – textbook; 15 – manual
К9.1	- individual textbook	20×k 20×1=20	k – number publications
К9.2	- two authors textbook	20/2×k	k – number publications
К9.3	- three or more authors	20/n×k	n – number co-authors; k – number publications
К9.4	- individual manual	15×k	k – number publications
К9.5	- two authors manual	15/2×k 7.5×4=30	k – number publications
К9.6	- three or more authors	15/n×k 15/3×1=5	n – number co-authors; k – number publications
К10	Edition monographs in the reporting period period	20	For each edition
К10.1	- alone	20×k 20×4=80	k – number publications
К10.2	- two authors	10/2×k	k – number publications
К10.3	- three or more authors	20/n×k 20/4×3=15	n – number co-authors; k – number publications
К11	Scholarship holder (grantee) of the President of Ukraine, Cabinet of Ministers of Ukraine	15	
К12	Awards of the Ministries of Education and Science of Ukraine and others ministries (excellent badge) education, etc.)	10	

End of table 1

1	2	3	4
K13	of Honor from the Ministry of of Education and Science of Ukraine	10	
K14	Member of the State certification commission, expert council of Ministries and of Education and Science of Ukraine	10	
K15	Chairman/ Scientist secretary / member of the special council from protection dissertations	10/7/5×k 5×2=10	10 – Head; 7 – scientist secretary; 5 – member of the special council; k – number special council
K16	Member of the Scientific and Methodological Committee commissions Ukraine	5	
K17	Member of editorial boards		
K17.1	- international magazines	10×k	k – number magazines
K17.2	- national professional journal according to the list of the Higher attestation commission Ukraine	5×k	k – number magazines
K18		10×k 10×4=40	k – number guides / consultations
K19	Leadership earlier protected candidate dissertations, scientific consultancy doctoral dissertations	5/3	5 – patents; 3 - other
K20	Patents / copyrights certificates (other security documents) received in the reporting period period		For each
K20.1	- Articles published in the reporting year period	6	
K20.2	- in journals with an impact factor	4	
K20.3	- in foreign magazines	144	
K20.4	- in journals according to the lists of the Higher attestation commission Ukraine	8	

Source: developed by the authors.

The professional activity of the professor was carried out at three higher education institutions, namely: Kharkiv Military University (KMU), the International Slavic University (ISU), and Kharkiv National University of Urban Economy named after O. M. Beketov. The duration of the professor's intellectual activity exceeds 30 years. He has published over 200 scientific and scientific-methodological works and possesses extensive experience in supervising candidates for academic degrees as well as providing consultation for doctoral students.

Formally, the set of ASM according to the staff schedule of the higher education institution and its organizational structure can be represented as:

$$P_{\text{вуз}} = \{P_5^A, P_4^A, P_3, P_2, P_1\}, \quad \left((P_1, P_2, P_3) \subset P_4^A\right) \subset P_5^A, \tag{2}$$

where P_1 – ASMs at the beginning of their careers, holding positions of assistant and lecturer, whose knowledge and intelligence are still in the developmental stage;

P_2 – senior lecturers and associate professors, whose knowledge and intelligence allow them to perform educational-methodical tasks as well as solve research problems with good quality;

P_3 – department professors, whose knowledge and intelligence are highly organized and enable them to solve educational-methodical and scientific problems with high quality;

P_4^A, P_5^A – heads of departments, deans of faculties, doctors and professors, whose knowledge and intelligence allow them to make correct and effective decisions. The superscript «A» denotes that these categories belong to the administration of the higher education institution.

It should be noted that the requirements of the Ministry of Education of Ukraine regarding academic titles and degrees of higher education institution academic staff initially establish certain preferences among teaching positions. Formally, this can be represented as a system of preferences or a career progression system for ASMs.

$$P_5^A \succ P_4^A \succ P_3 \succ P_2 \succ P_1, \quad (3)$$

where the symbol "≻" denotes the preference relation of ASMs for a particular position.

The question arises as to which indicators can be used to evaluate the effectiveness of a professor's intellectual activity over different time horizons of their professional career. In our view, one such indicator may be the qualification potential of an ASM, which takes into account the history of their intellectual activity.

The input data for constructing its utility function and determining the qualification potential realized by the professor at Kharkiv National University of Urban Economy named after O. M. Beketov may include a list of published scientific and methodological works, as well as information from the human resources department regarding the professor's personal achievements.

Thus, the analysis of this data showed that the utility function of the professor's intellectual activity over the entire professional career, i.e., over the interval $[0, t_4^{\text{r}}]$ takes the form:

$$Q[0, t_4^{\text{r}}] \to (K_1 \succ K_6 \succ K_9 \succ K_{10} \succ K_{15} \succ K_{18} \succ K_{20}), \quad (3)$$

Let us decompose the preference system (2) according to the highlighted intervals and determine the qualification potential for each of them:

$$Q[0, t_1^{\text{r}}) \to \left(K_1^1(2) \succ K_9^2(2) \succ K_{20.4}^3(1)\right). \quad (4)$$

At the beginning of their professional career, during the interval $[0, t_1^{\text{r}})$ years, the ASM co-authored two educational manuals and published three articles in scientific professional journals.

Then it can be written as $\sum_i^j \dot{K}(n) = \mathbf{7}$, where $\dot{K}$ denotes the total qualification potential realized during the initial interval of professional activity, i – is the indicator number in Table 1, j – is the total number of indicators, and nnn is the score for a single indicator. The total score characterizing the qualification of the ASM over the time interval $[0, t_1^{\text{r}}]$ is equal to 7.

Similarly, utility functions will be constructed for the intervals $[t_1^{\text{r}}, t_2^{\text{r}})$ and $[t_2^{\text{r}}, t_3^{\text{r}})$. They will take the following form:

$$Q[t_1^{\text{r}}, t_2^{\text{r}}) \to \left(K_1^1(2) \succ K_{9.6}^1(2) \succ (K_{20.4}^7(1)\right);\ \sum_i^j \ddot{K}(n) = \mathbf{11}, \quad (5)$$

$$Q[t_2^{\text{r}}, t_3^{\text{r}}) \to \left(K_1^1(3) \succ (K_{10.1}^{20}(1) + K_{10.3}^5(1)) \succ ((K_{20.4}^1(6) + K_{20.3}^2(28)\right), \sum_i^j \ddot{K}(n) = \mathbf{90}. \quad (6)$$

In formulas (5) and (6), $\ddot{K}$ and $\ddot{K}$ denote the total qualification potentials realized by the ASM over the intervals $[t_1^{\text{r}}, t_2^{\text{r}})$ and $[t_2^{\text{r}}, t_3^{\text{r}})$ respectively.

The utility function for the fourth interval will take the following form:

$$\left(\begin{array}{c} Q[t_3^{\text{r}}, t_4^{\text{r}}] \to \\ \to K_1^1(4) \succ K_6^1(20) \\ \succ \left(K_{9.1}^1(20) + K_{9.5}^5(5) + K_{9.6}^2(2)) \succ (K_{10.1}^{20}(3) + K_{10.2}^1(10) + K_{10.3}^4(5)\right) \succ \\ \succ K_{15}^2(5) \succ K_{18}^4(10) \succ ((K_{20.3}^{72}(2) + K_{20.4}^8(1) \end{array}\right), \quad (7)$$

the total score characterizing the qualification potential of the ASM over the interval $[t_3^{\text{r}}, t_4^{\text{r}}]$ will be equal to $\sum_i^j \widehat{K}(n) = \mathbf{365}$.

By analogy, we calculate the total qualification potential of Associate Professor M. A. Kukhar.

The professional activity of Associate Professor Maksym Anatoliyovych Kukhar began at Kharkiv National University of Urban Economy named after O. M. Beketov. The duration of his intellectual activity is 5 years. He has published over 49 scientific and scientific-methodological works.

The utility function of the intellectual activity of the associate professor over his entire professional career, i.e., for M. A. Kukhar, over the interval $[0, t_2^{\text{г}}]$ according to the data in Table 1, takes the following form:

$$Q[0, t_2^{\text{г}}] \to (K_1 \succ K_6 \succ K_{10} \succ K_{20}), \quad (8)$$

$$Q[0, t_1^{\text{г}}) \to \left(K_1^1(1) \succ K_6^1(10) \succ K_{10.3}^1(6) \succ K_{20.3}^{10}(1)\right), \quad (9)$$

$$Q[t_1^{\text{г}}, t_2^{\text{г}}) \to (K_1^1(2) \succ K_6^1(10) \succ K_{10.3}^1(5) \succ (K_{20.1}^3(1) + K_{20.3}^{12}(1) + K_{20.4}^1(1))). \quad (10)$$

The total score characterizing the qualification of the ASM over the time interval $[t_1^{\text{г}}, t_2^{\text{г}})$ is $\sum_i^j \ddot{K}(n) = \mathbf{33.}$

The total score characterizing the qualification potential of the ASM over the entire period $[t_1^{\text{г}}, t_2^{\text{г}}]$ is $\sum_i^j \widehat{K}(n) = \mathbf{60.}$

The professional activity of Associate Professor Viktoriya Oleksandrivna Shevchenko began at Kharkiv National Automobile and Highway University. The duration of her intellectual activity is 26 years. During this time, V. O. Shevchenko has published over 78 scientific and scientific-methodological works.

The utility function of the intellectual activity of Associate Professor V. O. Shevchenko over her entire professional career, i.e., over the interval $[0, t_4^{\text{г}}]$, according to the data in Table 1, takes the following form:

$$Q[0, t_4^{\text{г}}] \to (K_1 \succ K_6 \succ K_9 \succ K_{10} \succ K_{19} \succ K_{20}), \quad (11)$$

$$Q[0, t_1^{\text{г}}) \to \left(K_1^1(1) \succ K_{20.4}^1(1)\right), \quad (12)$$

$$Q[t_1^{\text{г}}, t_2^{\text{г}}) \to (K_1^1(2) \succ (K_{20.3}^1(1) + K_{20.4}^1(1))), \quad (13)$$

$$Q[t_2^{\text{г}}, t_3^{\text{г}}) \to \begin{pmatrix} K_1^1(3) \succ K_6^1(10) \succ K_{9.3}^1(3) \succ K_{10.3}^1(4) \succ (K_{20.2}^1(1) + K_{20.3}^{22}(1) + \\ + K_{20.4}^{30}(1)) \end{pmatrix}, \quad (14)$$

$$Q[t_3^{\text{г}}, t_4^{\text{г}}) \to \begin{pmatrix} K_1^1(4) \succ K_{10.3}^1(4) \succ K_{19}^3(5) \succ (K_{20.1}^2(1) + K_{20.3}^2(1) + \\ + K_{20.4}^{17}(1)) \end{pmatrix}. \quad (15)$$

The total score characterizing the qualification of the ASM over the time interval $[t_3^{\text{г}}, t_4^{\text{г}})$ is $\sum_i^j \ddot{K}(n) = \mathbf{44}$.

The total score characterizing the qualification potential of the ASM over the entire period $[t_1^{\text{г}}, t_4^{\text{г}}]$ is $\sum_i^j \widehat{K}(n) = \mathbf{123}$.

The professional activity of Senior Lecturer Liubov Oleksiivna Masliy began at Kharkiv National University of Urban Economy named after O. M. Beketov on April 1, 2014, in the position of laboratory assistant in the Department of Land Administration and GIS, where in the same year, in the autumn, she was additionally appointed as an assistant on a part-time basis. The duration of her intellectual activity exceeds 10 years. She has published over 35 scientific and scientific-methodological works.

The utility function of the intellectual activity of the senior lecturer over her entire professional career, i.e., over the interval $[0, t_3^{\text{г}}]$, according to the data in Table 1, takes the following form:

$$Q[0, t_2^{\text{г}}] \to (K_1 \succ \text{K}_9 \succ K_{10} \succ K_{20}), \quad (16)$$

$$Q[0, t_1^{\text{г}}) \to \left(K_1^1(1) \succ K_{10.3}^1(1) \succ K_{20.4}^1(1)\right), \quad (17)$$

$$Q[t_1^{\text{г}}, t_2^{\text{г}}) \to \left(K_1^1(2) \succ K_{9.6}^1(5) \succ K_{10.3}^3(1) \succ (K_{20.1}^2(3) + K_{20.3}^8(2)\right), \quad (18)$$

$$Q[t_2^{\text{г}}, t_3^{\text{г}}) \to \left(K_1^1(3) \succ K_{20.3}^4(2)\right). \quad (19)$$

The total score characterizing the qualification of the ASM over the time interval $[t_2^{\text{г}}, t_3^{\text{г}})$ is $\sum_i^j \ddot{K}(n) = \mathbf{11}$.

The total score characterizing the qualification potential of the ASM over the entire period $[t_1^{\text{г}}, t_2^{\text{г}}, t_3^{\text{г}}]$ is $\sum_i^j \widehat{K}(n) = \mathbf{46}$.

The obtained results are summarized in Table 2.

Table 2 – Quantitative assessments of the total qualification potentials of collective intelligence (TQPCI)

Full Name (F. M. L.)	$\sum_i^j \ddot{K}(n)$	$\sum_i^j \hat{K}(n)$	Υ
Meteshkin K. O.	90	365	$\overrightarrow{\rho_1}, \overrightarrow{\rho_3}, \overrightarrow{\rho_4}, \overrightarrow{\rho_5}, \overrightarrow{\rho_6}, \overrightarrow{\rho_7}, \overrightarrow{\rho_9}$
Kukhar M. A.	33	60	$\overrightarrow{\rho_3}, \overrightarrow{\rho_4}, \overrightarrow{\rho_6}$
Shevchenko V. O.	44	123	$\overrightarrow{\rho_3}, \overrightarrow{\rho_4}, \overrightarrow{\rho_5}, \overrightarrow{\rho_6}, \overrightarrow{\rho_8}$
Masliy L. O.	11	46	$\overrightarrow{\rho_1}, \overrightarrow{\rho_3}, \overrightarrow{\rho_9}$
I^A	178	594	$\forall \overrightarrow{\rho_i}, \neg\overrightarrow{\rho_2},$

Source: developed by the authors.

Table 2 presents data characterizing the collective intelligence I^A of the group, in this case, the co-authors of this article. It shows the total coefficients that represent the qualification potential of the group (the collective of co-authors). This composition cannot be considered an expert group, as it includes only one expert.

Analyzing the collective intelligence of this group, we find that the set Υ is incomplete, and the group of co-authors lacks a bearer of natural intelligence with the properties $\overrightarrow{\rho_2}$. However, the scientific and educational focus on the study of cadastral systems does not require musical abilities from the authors, and this can be neglected. This fact is indicated in Table 2 by the relation $\forall \overrightarrow{\rho_i}, \neg\overrightarrow{\rho_2}$.

For a clearer understanding of this approach, it is possible to visualize the TQPCI (Total Qualification Potential of Collective Intelligence) across Ukraine. Conditionally, we assume the average TQPCI of a Doctor of Sciences is 365, of a Candidate of Sciences (60 + 123) / 2 = 91 and for those without an academic degree, 46. As of early 2024, in the Unified State Electronic Database, there was presented 82091 academic staff members, 86,2 % of whom hold academic degrees: 20,4 % are Doctors of Sciences, 65,8 % are Philosophiae Doctor Candidates of Sciences, and 13,8 % have no academic degree. According to the registry of educational institutions in Ukraine, there are currently 519 higher education institutions (HEIs).

The conditional number of academic staff per HEI is 82091 / 519 ≈ 158, including 32 Doctors of Sciences, 104 Candidates of Sciences, and 22 without an academic degree. Accordingly, the TQPCI per HEI is calculated as: 32365 + 10491 + 2246 = 22156.

Based on these data, a QGIS model of the TQPCI distribution across Ukrainian HEIs was created (Fig. 1).

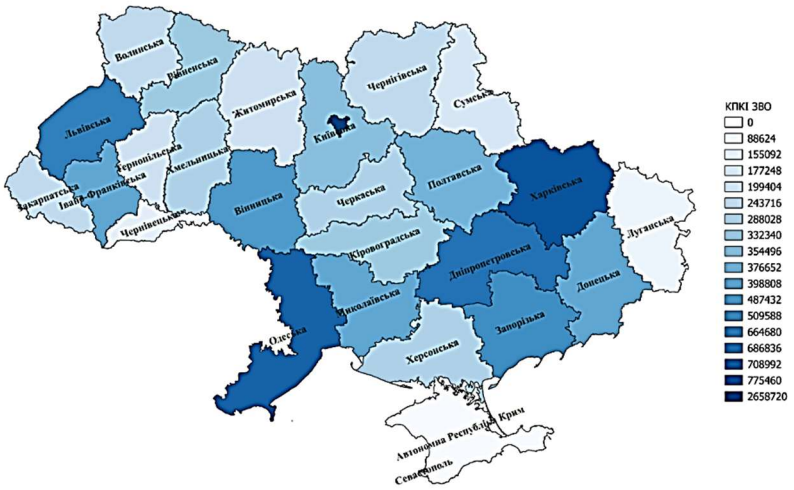

Fig. 1. Model of TQPCI Distribution by Number of HEIs and ASM in Ukraine
Source: developed by the authors.

These data are relevant and approximate to reality according to the experiment and open sources of the Ministry of Education. They reflect variations in scientific outcomes across HEIs depending on the composition of academic staff. However, these studies require a larger dataset to represent a complete and reliable model, taking into account not the average experimental indicator, but relevant data from various academic staff members.

Conclusions. In this study, the qualification potential of academic staff is presented for the first time as an element of conditional noospheric intelligence in a quantitative form. A model has been developed that integrates mathematical and geoinformation modeling methods, enabling the visualization and evaluation of the collective intellectual potential of higher education institutions across Ukraine. The model was tested, and quantitative indicators of the authors' qualification potential were established. Based on these indicators, a GIS-based model of the qualification potentials of the collective intelligence of Ukraine's regions was constructed.

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Костянтин Олександрович Метешкін[1], Максим Анатолійович Кухар[2], Вікторія Олександрівна Шевченко[3], Любов Олексіївна Маслій[4]

[1]доктор технічних наук, професор, професор кафедри земельного адміністрування та геоінформаційних систем Харківський національний університет міського господарства імені О. М. Бекетова (Харків, Україна)
E-mail: meteshkin@gmail.com. **ORCID:** https://orcid.org/0000-0002-1170-2062. **ResearcherID:** AAG-7092-2021

[2]кандидат технічних наук, доцент кафедри Земельного адміністрування та геоінформаційних систем, Харківський національний університет міського господарства імені О. М. Бекетова (Харків, Україна)
E-mail: ppoosshhttaa@ukr.net. **ORCID:** https://orcid.org/0000-0001-8305-6269
ResearcherID: ISR-8853-2023. **SCOPUSAuthorID:** 57214221308

[3]кандидат технічних наук, доцент, доцент кафедри комп'ютерних наук і інформаційних систем Харківський національний автомобільно-дорожній університет (Харків, Україна)
E-mail: vicashev@gmail.com. **ORCID:** https://orcid.org/0000-0003-0620-6811

[4]аспірант кафедри земельного адміністрування та геоінформаційних систем Харківський національний університет міського господарства імені О. М. Бекетова (Харків, Україна)
E-mail: gnomomir@gmail.com. **ORCID:** https://orcid.org/0000-0003-3844-462X

ЕКСПЕРИМЕНТАЛЬНИЙ ПІДХІД ДО СТВОРЕННЯ УМОВНОГО НООСФЕРНОГО ІНТЕЛЕКТУ ЗА ДОПОМОГОЮ ГЕОІНФОРМАЦІЙНОГО МОДЕЛЮВАННЯ

Метою цього дослідження є апробація та верифікація моделі формування умовно-ноосферного інтелекту на основі даних науково-педагогічних працівників закладів вищої освіти України із застосуванням методів математичного та геоінформаційного моделювання. Методологічна основа дослідження передбачає комплексний науковий підхід, який інтегрує методи моделювання, аналізу, синтезу, логічного узагальнення та емпіричні методи, що забезпечує всебічне вивчення динаміки та потенціалу колективних інтелектуальних ресурсів. Джерелами дослідження виступають результати наукової діяльності авторів та відкриті дані Міністерства освіти України.

У цій роботі вводиться термін «умовно-ноосферний інтелект» (УНІ), який базується на концепції ноосфери В. І. Вернадського. Під УНІ розуміється здатність системи формувати групи експертів із числа науково-педагогічних працівників (НПП) – інтелектуальної еліти ВНЗ – для вирішення актуальних наукових, освітніх та практичних завдань сучасності. Базуючись на цьому, авторами була розроблена модель формування умовно-ноосферного інтелекту.

Для верифікації моделі проведено кількісну оцінку колективного інтелекту співавторів дослідження з урахуванням їхніх кваліфікаційних показників, професійного досвіду та наукових здобутків. Використано функції корисності інтелектуальної діяльності на різних часових інтервалах, що дозволило визначити сумарний кваліфікаційний потенціал групи та оцінити ефективність колективного інтелекту. Аналіз показав, що не всі властивості природного інтелекту були повністю представлені в групі, проте специфіка досліджень у галузі кадастрових систем дозволяє вважати це обмеження несуттєвим для цілей роботи.

На основі отриманих даних створено геоінформаційну модель розподілу кваліфікаційного потенціалу колективного інтелекту по закладах вищої освіти України. Модель демонструє вплив складу науково-педагогічних працівників на наукові результати закладів, дозволяє оцінити потенціал колективного інтелекту на рівні установи та забезпечує основу для прийняття управлінських рішень щодо розвитку інтелектуальних ресурсів.

Дослідження показує, що кваліфікаційний потенціал науково-педагогічних працівників є фундаментом формування умовно-ноосферного інтелекту. Запропоновані методи та аналітичні схеми сприяють удосконаленню системи рейтингової оцінки науково-педагогічних працівників, створенню перспективної кадастрової системи інтелектуальних ресурсів, а також можуть бути адаптовані для використання в інших сферах науково-педагогічної та організаційної діяльності. Це підкреслює практичну значущість дослідження для підвищення ефективності управління знаннями та оптимізації використання людського капіталу у вищій освіті та суміжних сферах.

Ключові слова: *модель знань; інтелектуальна система; ноосферний інтелект; геоінформаційне моделювання; ГІС.*
Табл.: 2. Рис.: 1. Бібл.: 12.

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