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ONTOLOGY-BASED APPROACH TO SCIENTIFIC INSTITUTIONS INFORMATION REPRESENTATION

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ОНТОЛОГІЧНИЙ ПІДХІД ДО ПРЕДСТАВЛЕННЯ ІНФОРМАЦІЇ НАУКОВИМИ УСТАНОВАМИ

У статті представлений підхід до проектування онтологічної моделі для представлення інформації, накопиченої науковими установами. Онтологія дозволяє структурувати та систематизувати таку інформацію для подальшого використання в процесі оцінки діяльності установ. Загальна онтологія представлена системою взаємопов'язаних компонентів, кожна з яких дозволяє описати відповідний підпроцес як в рамках діяльності самої установи, так і в процесі її оцінки зовнішніми організаціями та міністерствами. Описано елементи всіх компонентів системи онтології. Практична розробка запропонованої онтологічної моделі була виконана з використанням платформи розробки онтологічних рішень TEDAOS.

INTRODUCTION. Scientific and educational activities are one of the most influential factors in the development of each country's economy. An objective analysis of the effectiveness of institutions and assessment of their functioning in terms of world and domestic science, education, economics, culture, improving the quality of human life is extremely important. It is important to obtain and analyze data in an open and transparent manner using objective methods of obtaining performance indicators.

Government agencies are complex organizational systems. They have a well developed hierarchical structure, consisting of many units and subordinate institutions. Information technology is the basis of information and analytical activities for the evaluation of such objects, and information processing is one of the most complex parts of the evaluation process. This is due to the large number of complex information flows circulating in such objects; high dynamics of change in their structure, which is due to legislative changes and the presence at each level of subjective factors; the need to take into account when processing both quantitative and qualitative information.

In the course of their operation, institutions accumulate a great deal of information (when it comes to scientific and educational organizations, such information includes scientific articles, reports, employee ratings, economic indicators, etc.) that can be used to evaluate them according to the national criteria [1,

2]. To evaluate the effectiveness of the organization the information used is already accumulated at the level of the organization. The idea to systematize and structure such information will not only facilitate its use at the institution level, but may also enable it to be used by the relevant authorities in the process of evaluating the quality of the institution's functioning. This research proposes to use the ontology as one of the knowledge representation models to organize information of scientific institutions for its structuring and systematization, as well as for its further processing and use.

The paper describes the approach to ontological model development for the representation of information accumulated by various scientific institutions and organizations. Such an approach involves the design of the ontological model structure, the description of ontological model ele-ments, and ontology direct development, as well as filling it with data using the appropriate environment for the onto-logical models development.

ONTOLOGY SYSTEM OF SCIENTIFIC INSTITUTIONS INFORMATION REPRESENTATION. The functioning of scientific organizations is associated with certain specific features that are not characteristic of other types of institutions. For example, the important indicators of the scientific process are as follows the number of publications, citations, various scientific indexes and ratings, participation in international projects and programs, completed scientific topics, trained specialists of different qualification levels in different specialties and specializations, and more. That is why the information produced during the operation of such institutions also reflects all levels (aspects) of such functioning. This feature must be taken into account when developing an ontological model. Also, several basic processes are involved in the process of organization of scientific activity: organization of activity of institution; definition of indicators by which it is possible to identify the level of performance of a certain type of activity in an institution; the existence of criteria for evaluating such indicators by which it is possible to evaluate the achievements of the organization and to determine whether its activity meets the requirements; organization of the institution's evaluation process itself.

On this basis, it is proposed that in the general ontology, several ontologies be highlighted in order to represent information accumulated by scientific institutions [3]. As a result of this selection, the overall ontology will be a system of ontologies, each describing the appropriate subprocess within both the activities of the institution itself and the process of its evaluation [4]. The system as a whole will allow both to structure and organize the information accumulated by scientific institutions, and to organize context-independent structures for its further processing and use.

Thus ontology system is a collection of several components (Fig. 1).

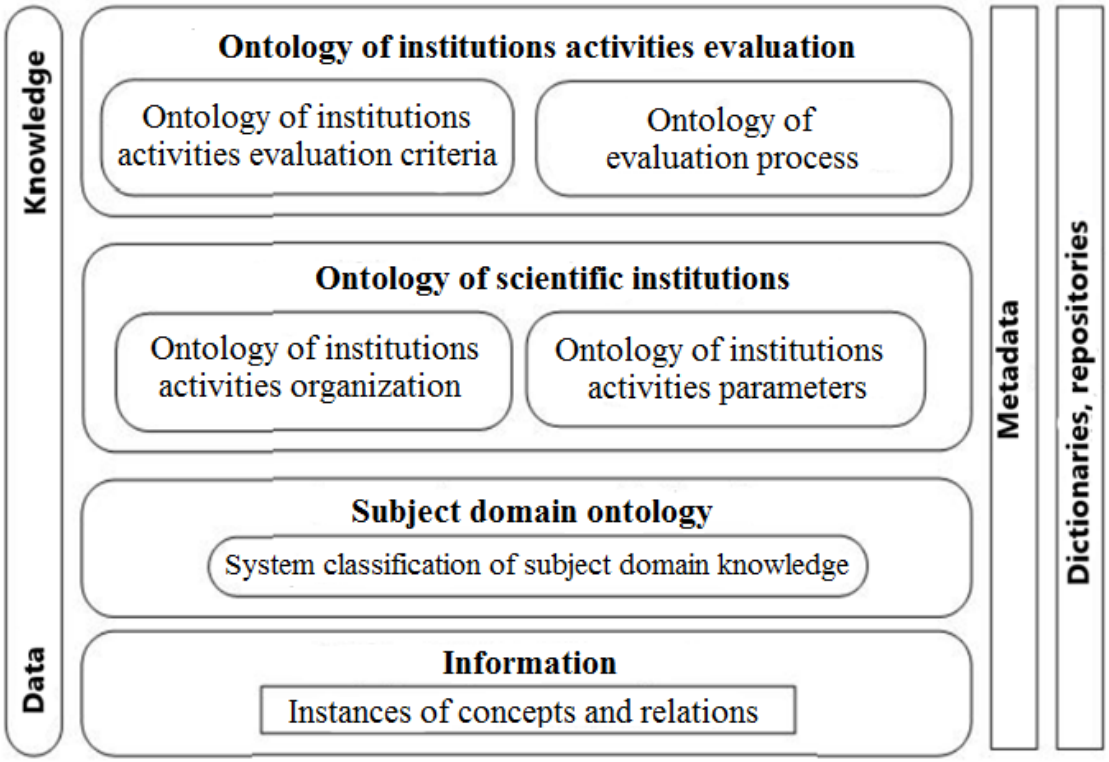

Fig. 1. Ontology system of scientific institutions information representation/

The developed system includes such ontologies as:

- Ontology of institutions activities evaluation – introduces concepts that make it possible to evaluate the effectiveness of the scientific activity of a particular scientific institution in the framework of its state review or establishment of its scientific level.
- Ontology of institutions activities evaluation criteria – sets criteria for evaluating the performance of the institution.
- Ontology of evaluation process – describes the assessment process itself by the relevant authorities.
- Ontology of scientific institutions – reflects all possible processes that occur within the scientific process within the activities of scientific institutions.
- Ontology of institutions activities organization – describes general concepts that relate to the organization of scientific activity as a whole.
- Ontology of institution activities parameters – allows to describe in detail the indicators on all aspects of the activity of the institution.
- Subject domain ontology – is based on the systematic classification of scientific activity.

Instances of classes and relations defined in an ontology form a database content that contains terms that represent the subject domain. Initial data for the knowledge representation model that characterize the subject area are various regulatory

documents, as well as textbooks, manuals, periodicals, reports, information resources and more.

The practical implementation of the ontological model and its filling was performed using the Transdisciplinary Educational Dialogues of Application Ontology Systems (TEDAOS) platform. The TEDAOS platform provides many software tools for storing and processing knowledge through the development of ontologies [5, 6]. During the construction of the ontological model, 895 objects and 2837 data elements (attributes) were created.

CONCLUSIONS. Proposed ontology system will not only enable the representation of information accumulated by scientific institutions in the process of activity, but also organize structures for its further use and processing. The ontological representation allows to evaluate the quality of scientific institutions functioning on the basis of national principles for such assessment. The information how to organize the evaluation process as well as generally accepted evaluation criteria are also stored in the ontological model.

References

1. "Regulations on state certification of research (scientific and technical) institutions" [https://zakon.rada.gov.ua/laws/show/469-98-%D0%BF/print]
2. "Methods of optimization (certification) of budget research institutions, which are fully or partially funded by the state budget" [https://zakon.rada.gov.ua/laws/show/1176-2011-%D0%BF/print]
3. L. Globa, R. Novogrudska and O. Oriekhov 2013 Method of heterogeneous information resources structuring and systematizing for Internet portals development, in Eurocon 2013, July 2013, pp. 319-326, DOI: https://doi.org/10.1109/EUROCON.2013.6625003
4. Globa, L., Novogrudska, R., Zadoienko, B., Junfeng, Y.: Ontology of scientific and educational institutions information. Information and telecommunication science, 2, 86-91 (2020). DOI: https://doi.org/10.20535/2411-2976.22020.86-91.
5. V.Yu. Velychko, M.A. Popova, V.V. Prykhodniuk, and O.E. Strizhak 2017 TEDAOS - IT platform for the formation of transdisciplinary information environments (in Ukrainian), Weap. Sys. Milit. Equip., no. 1, pp. 10-19.
6. M.A. Popova, O.E. Strizhak 2013 Ontological interface as a means of presenting information resources in a GIS environment, (in Ukrainian), Scient. Not. Taurida Nat. Univ., vol. 26(65), no. 1, pp. 127-135.