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FORMATION OF NATIONAL DIGITAL INFRASTRUCTURE OF SCIENTIFIC RESEARCHES OF UKRAINE IN THE CONTEXT OF EUROPEAN INITIATIVES

Abstract. The papers is devoted to study of individual elements of globalization and the impact of European initiatives on the formation of an information space in the field of scientific research and the construction of the national digital infrastructure.

The measures taken in Ukraine in the framework of European initiatives and programs are considered, the example of which states that in the modern world there is a tendency to provide open access to knowledge and convergence of cultural systems, the separate tasks of forming of digital infrastructure in Ukraine in the context of the integration impact of European initiatives are outlined.

On the formation of a single information space in the field of scientific research and innovation.

An important feature of integrating the knowledge accumulated by people in different fields is the activity aimed at producing new knowledge and innovations in the countries of the European Union by creating the appropriate platforms, examples of which are discussed in papers.

This circumstance is important in shaping the national digital infrastructure in each EU country and the Eastern Partnership as a system-forming component of the European scientific space, the creation of which is dictated by globalization trends and integration processes. In our opinion, this is an indication of the search for ways to integrate research on the platforms and networks created by increasing the critical mass of the "active brain" in one place (platform) capable of providing a new quality of human activity in the form of ideas, technologies, etc.

An example of European programs shows that in the modern world the necessary preconditions for providing open access to knowledge in various spheres of human activity, which should be taken into account in the process of forming a digital infrastructure in Ukraine in the context of integration tendencies for the formation of a common research space, have been created, and some proposals have been made in this regard.

Keywords: globalization, integration, innovation, research space, knowledge, network technologies, network platform, digital infrastructure.

ФОРМУВАННЯ НАЦІОНАЛЬНОЇ ЦИФРОВОЇ ІНФРАСТРУКТУРИ НАУКОВИХ ДОСЛІДЖЕНЬ В КОНТЕКСТІ ЄВРОПЕЙСЬКИХ ІНІЦІАТИВ

Анотація. Розглянуто окремі елементи глобалізації, які виявились у формуванні загальноєвропейської цифрової інфраструктури та сприяли створенню в Європі єдиного дослідницького простору; розглянуто заходи, які здійснюються в Україні в межах європейських ініціатив та програм, на прикладі яких вказується, що в сучасному світі існує тенденція до забезпечення відкритого доступу до знань та зближення культурних систем, намічено окремі завдання формування цифрової інфраструктури в Україні в контексті інтеграційного впливу європейських ініціатив з формування єдиного інформаційного простору у сфері наукових досліджень та інновацій.

Важливою особливістю інтеграції накопичених людьми знань в різних сферах є діяльність, спрямована на продукування нових знань та інновацій в країнах Європейського Союзу завдяки створенню відповідних платформ, приклади яких розглядаються у статті.

Ця обставина є важливою при формуванні національної цифрової інфраструктури в кожній країні ЄС та Східного партнерства як системоутворюючої складової європейського наукового простору, створення якого продиктовано глобалізаційними тенденціями та інтеграційними процесами. На нашу думку, означене є свідченням пошуку шляхів у напрямі інтеграції наукових досліджень на створюваних платформах та в мережах за рахунок збільшення в одному місці (платформі) критичної маси "активного мозку" здатного забезпечити нову якість людської діяльності у вигляді ідей, технологій тощо.

На прикладі європейських програм показано, що в сучасному світі створені необхідні передумови забезпечення відкритого доступу до знань в різних сферах людської діяльності, які слід врахувати у процесі формування цифрової інфраструктури в Україні в контексті інтеграційних тенденцій з формування єдиного дослідницького простору, надано окремі пропозиції щодо цього.

Ключові слова: глобалізація, інтеграція, інновації, дослідницький простір, знання, мережеві технології, мережева платформа, цифрова інфраструктура.

ФОРМИРОВАНИЕ НАЦИОНАЛЬНОЙ ЦИФРОВОЙ ИНФРАСТРУКТУРЫ НАУЧНЫХ ИССЛЕДОВАНИЙ В КОНТЕКСТЕ ЕВРОПЕЙСКИХ ИНИЦИАТИВ

Аннотация. Рассмотрены отдельные элементы глобализации, которые проявились при формировании общеевропейской цифровой инфраструктуры и приводят к созданию в Европе единого исследовательского пространства; рассмотрены меры, которые осуществляются в Украине в рамках европейских инициатив и программ, на примере которых показано, что в

современном мире существует тенденция к обеспечению открытого доступа к знаниям и сближению культурных систем, намечены отдельные задачи формирования цифровой инфраструктуры в Украине в контексте интеграционного влияния европейских инициатив по формированию единого информационного пространства в сфере научных исследований и инноваций.

Важной особенностью интеграции накопленных людьми знаний в различных сферах является деятельность, которая направлена на продуцирование новых знаний и инноваций в странах Европейского Союза, благодаря созданию соответствующих платформ, примеры которых рассматриваются в данной статье.

Данное обстоятельство является важным при формировании национальной цифровой инфраструктуры в каждой стране ЕС и Восточного партнерства, как системообразующей составляющей европейского научного пространства, создание которого продиктовано глобализационными тенденциями и интеграционными процессами. По нашему мнению, отмеченное свидетельствует о поиске путей в направлении интеграции научных исследований на создаваемых платформах и в сетях за счет увеличения в одном месте (платформе) критической массы "активного мозга" способного обеспечить новое качество человеческой деятельности в виде идей, технологий.

На примере европейских программ показывается, что в современном мире созданы необходимые предпосылки обеспечения открытого доступа к знаниям в различных сферах человеческой деятельности, которые следует учесть в процессе формирования цифровой инфраструктуры в Украине в контексте интеграционных тенденций по формированию единого исследовательского пространства, предоставлены отдельные предложения по этому поводу.

Ключевые слова: глобализация, интеграция, инновации, исследовательское пространство, знания, сетевые технологии, сетевая платформа, цифровая инфраструктура.

Problem statement. Globalization processes, on the one hand, and the rapid development of technologies, the use of which can lead to unpredictable consequences, on the other hand, puts before the governments of the leading countries – leaders of technological innovations, one of the most urgent tasks of our time, which has its prerequisites, the essence of which is to ensure further civilizational development by combining the intellectual efforts of all countries aimed at creating a single digital infrastructure. The components of such infrastructure, in addition to software and hardware, include the network, data storage, computing and security, which can be used as services.

The relevance of the topic is substantiated by the need to take into account the experience and integration efforts of European countries aimed at sustainable development, safe use of science and technology.

Analysis of recent publications on the subject and identification of previously unsolved parts of the overall problem. The intensification of research on the implementation of the European integration path of Ukraine is a reflection of the processes that occur in the field of establishing communication of the scientific community, civil society and government [1,2]. Trends in the development of integration processes in the context of globalization are covered in the publications of individual authors [3]. Digital strategies of European governments in the field of social services are reflected in the OECD report [4]. Prospects for Ukraine's integration into the digital economy of Europe are set out in the materials of the International center for trade and sustainable development [5]. These developments make up a certain manifestation of the impact of globalization transformations on integration processes and approaches to the use of knowledge and experience accumulated worldwide.

The conceptualization of the integration approach is clearly reflected in the consideration of generative mechanisms of digital infrastructure, namely, the causal forces that explain how and why such infrastructure tends to develop in the context of value systems [6].

However, despite the presence of a significant number of studies aimed at finding ways to integrate efforts in the formation of digital infrastructure, the issues of the impact of integration processes associated with evolutionary changes and globalization processes are still insufficiently covered in the domestic literature.

The aim of the article. Therefore, the aim of this article is to analyze European policy initiatives on formation of the scientific research area of the European Union, the implementation of involved the countries of the Eastern Partnership (EP), and to find ways of development of the national digital infrastructure with the priority areas of EU programs.

Presentation of the main material. The events taking place in the civilizational world indicate that the XXI century was marked by a significant impact of globalization processes on all spheres of public life in every country of the world. This trend is clearly reflected in the European Union framework programs for research and technological development aimed at financing, supporting and promoting information integration and the formation of the European scientific space. Since 1984 7 such framework programs were financed and implemented [7].

Framework programs identified 10 priority topics for each of these subjects European technology platform (ETP) were selected facilitating dialogue between the scientific communities from related sectors and have their own strategy directions of development of scientific researches and introduction of their results into practice. In recent years, more than 30 ETP were created covering various sectors of the economy and science [8]. According to the European Commission, the development of the ETP will ensure the effectiveness of European investment in the research industry, will lead to the integration of the European Research Area (ERA) [9].

The formation of the European research area can be considered a modern innovation, which reflects the strate-

gy of technology development and research of European governments. The focus of this work is provided by conversion within a research space that allows us to imagine new technologies as services by creating a focus on service.

Taking the course of active participation in the projects of the ERA program, the Ministry of Education and Science of Ukraine in cooperation with the Council of young scientists at the MES adopted the "Road map of Ukraine's integration into the European research space (ERA-UA)", which identifies 6 main priorities of European integration of Ukrainian science, and it also formulated goals, activities, tools and indicators to achieve them [10].

One of the goals of priority 2A "Joint solution of problems caused by global challenges" was the goal aimed at improving cooperation of Ukraine with the EU member states, associated states, with researchers of these countries aimed at the integration of scientific research, the most effective use of joint resources to solve common problems, among which are the tasks of forming a multilateral network platform [10]. This is an excellent example of the formation of groups, whose participants in the presence of digital infrastructure of network platforms, in particular in the field of research, can implement their ideas and integrate them into collective knowledge.

The solution of the problem of formation of multilateral network platforms provides for the creation of appropriate digital infrastructure in Ukraine, involving a wide range of organizations, individual researchers, authorities. It should be noted that the development of such infrastructure is hampered by the existence of certain problematic issues related, in particular, to the lack of:

a) state program for the development of digital infrastructure;

b) constant dialogue between the authorities, representatives of science and the expert community, business and the public on the development of legislation in the field of telecommunications.

The solution to these problems lies in the establishment of fruitful cooperation of all stakeholders. In particular, this concerns the increase in the level of penetration and quality of the internet — only 58 % of citizens in Ukraine in 2018 had access to it [11].

The steps taken by the EU countries indicate that they associate their future with the technological changes of the 4th industrial revolution [12]. In this process, great attention is paid to integration not only within the EU, but also to strengthening cooperation with partners from other countries, including the Eastern partnership (EP) countries, which include Ukraine, to form the infrastructure and the Single Digital Market of Europe [13].

The formation of the digital infrastructure and digital market of the EU include: digital transformation of industry and research, based on the use of smart and e-technologies, cloud computing, the internet of things, mobile technology of the level 5G, digital services and electronic applications, cyber security, open data [14].

In order to connect to these activities and coordinate the activities of the EU Eastern Partnership program with other EU programs and enhance international cooperation, a network of regulators of electronic communica-

tions of the Eastern partnership countries (Eastern Partnership electronic Communications Regulators Network - EaPeReg) was created [15]. Using this network (the platform), the EP members adopted a decision on the concentration of the digital cooperation network on six priority themes, which are consistent with the themes of network digital Europe 4 (EU4Digital) [16].

The first topic concerned the rules and infrastructure of telecommunications, in which Ukraine acts as a coordinator. The work on this topic is related to the development of the regulatory framework for electronic communications in the Eastern partnership partner countries, which includes, in particular, comparative analysis of markets, coordination of frequency ranges, reduction of roaming tariffs among the Eastern partnership partner countries and the development of broadband.

The second topic concerns trust and security in the digital economy (coordinators Estonia and Moldova) and focuses on electronic identification, digital trust services, network, information and cyber security, all elements of e-government necessary for the interaction of cross-border services.

The third topic concerns e-commerce, e-trade, e-customs and e-logistics (coordinators — Belarus, Lithuania and Azerbaijan).

The fourth topic concerns digital skills (coordinators — Armenia and Latvia) aimed at promoting national strategies in the field of digital skills in the partner countries, particularly through the establishment of national coalitions for digital jobs with the "coalition for digital skills and jobs" of the EU.

The fifth topic of cooperation concerns ICT innovations and start-up ecosystems (coordinator — Azerbaijan), which aims to promote the development of research and innovation ecosystems in the field of ICT and their coordination with similar activities in the EU.

And, the sixth topic concerns the theme of e-health (coordinator — Georgia). This network is a special regional seminar on e-health, the purpose of which is to identify common problems for partner countries and formulate recommendations for the harmonization of the Eastern partnership program [16].

These topics focus on four priority areas (Figure):

I — Framework Conditions — promoting the development of the digital economy and society: rules of telecommunications, ICT innovations and start-up ecosystems and digital skills.
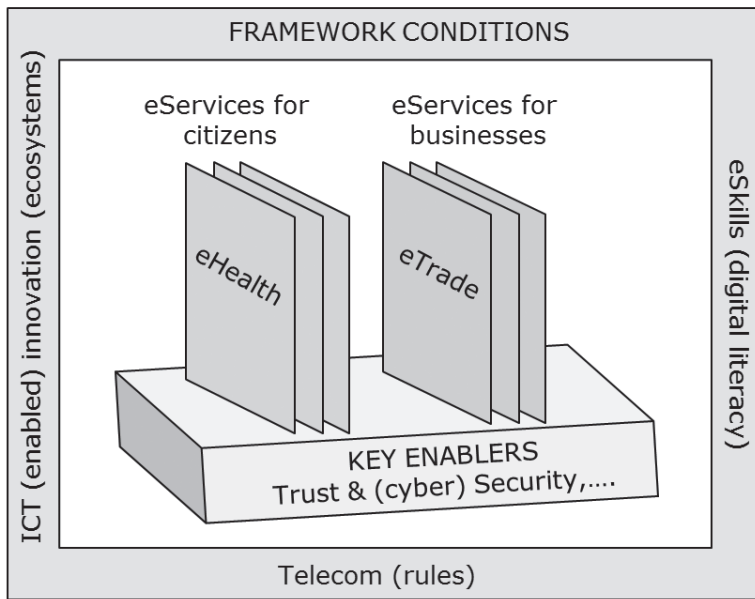
II — Key Enablers — for electronic services: electronic identification, trust services and cyber security.

III — cross-border electronic services for citizens (e-Health).

IV — cross-border e-services for business — e-Trade, including e-Commerce, e-customs and e-logistics.

A separate component of this initiative is fully dedicated to supporting the development of broadband access in the Eastern partnership region, which will enable Ukraine to increase its GDP from EUR 2,9 billion to EUR 4,3 billion per year [18].

In accordance with the Concept of development of the digital economy and society of Ukraine for 2018–2020, the creation of digital infrastructures is the main factor in expanding citizens' access to the global information envi-

Priority areas of digitalization within EU4 Digital [17]

ronment and knowledge. The main goal of their development is to overcome the "digital separation", which will enable all citizens of Ukraine without restrictions and difficulties of technical, organizational or financial nature to take advantage of digital opportunities regardless of their location or residence [19].

Conclusions and prospects for further research. It is obvious from the above that within the framework of European initiatives for the formation of a single research space, there are some trends in the formation of a new information culture as an external adaptation to globalization processes and intersectoral integration through the creation of international platforms and the formation of networks for the storage and exchange of knowledge, which will not only promote the comprehensive development of technologies, but also put their safe use under control.

In the context of the above, it is crucial to develop the scientific digital infrastructure, the formation of which will provide open access to scientific data and knowledge, will contribute to the commercialization of scientific research and reduce the burden on the state budget. In addition, the use of platforms and network solutions allows you to better promote new ideas, find stakeholders in their implementation.

In the process of formation of the national digital infrastructure in the field of scientific research, three necessary conditions can be identified, which reflect:

• The intensity of the data with which it travels across the network, in particular given use cases where the amount of data makes it impractical to transfer it over the network directly to the cloud or from the cloud to the point of use due to a problem with the amount of data, cost or bandwidth.

• Sensitivity to human latency — covers cases where the exchange of information, ideas are optimized for use in a group. In this case, reliability is the defining characteristic of this type of knowledge exchange.

• Sensitivity to latency from the communication medium: covers cases where information exchange is optimized for use between different technologies, ICT and mobile communications.

The above gives grounds to conclude that an important direction of development of the national digital infrastructure should be the development and implementation of a comprehensive state program of digitalization, the formation of demand for broadband Internet access services, which will be based on the application of the archetype approach. This will help to bridge the digital divide and will serve as an impetus for the development and well-being of not only cities and small towns, but also rural areas, whose connection to networks creates new opportunities for communities of economic and social development, it will provide access to knowledge, modern educational and other technologies, health services and the like.

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