Advances in Economics, Business and Management Research, volume 188
Proceedings of the International Conference on Business, Accounting, Management, Banking, Economic Security and Legal Regulation Research (BAMBEL 2021)

Revising the Prospects of Digitalization in the Context of Improving the Information Base for Mid-Term Budget Expenditures on Research and Development in Ukraine

Igor Yehorov [1] [0000-0002-3829-6383], Yaroslav Kotlyarevskyy [*] [2] [0000-0003-3542-6952]

[1] *Institute for Economics and Forecasting, Kyiv, Ukraine*
[2] *Ministry of Finance of Ukraine, Kyiv, Ukraine*
[*] *econexpert@ukr.net*

ABSTRACT
The course towards digital transformation proclaimed by the Government of Ukraine encourages greater use of relevant indicators in management practice, in the formation and implementation of sectoral policies. In the context of digitalization, a number of documents have been adopted, including the updated version of the National Informatization Program, the Ministry of Digital Transformation of Ukraine has been established, and action plans have been developed in various areas to improve the level of application of digital technologies. In particular, the corresponding long-term transformations will increasingly cover the areas of domestic science and education, and therefore will require the development of a professional consensus approach to the development of appropriate information and analytical support in the digitalization domain.

Keywords: *digitalization, science, R&D funding, mid-term budget planning, performance indicators.*

1. FOREWORD

In a broad context, it is worth paying attention to the use and information base of digitalization indicators in medium-term budget planning for financial support of education and science expenditures. The draft Budget Declaration 2022-2024 [1], developed by the Ministry of Finance of Ukraine and approved by the Cabinet of Ministers of Ukraine, defines the main directions of financial support for various sectors of the economy whilst the above-mentioned area is highlighted among them. The "State Education Policy" section focuses on the formation of a "New Ukrainian school" and mentions the need to "ensure the functioning of an effective network of institutions of higher and professional pre-higher education, improve the forms and methods of teaching, provide state support for the development of the material and technical base of educational institutions" and "encourage the best students and students by providing state scholarships and grants". Thus, the task of converting the country's leading universities (and they are usually state institutions) into modern research centers is not defined among the main ones. The next section - "State Science Policy" - primarily deals with the need to strengthen grant support, increase the share of competitive funding, support young scientists, increase the level of European integration and use rating indicators to evaluate activities. In this section, along with scientific organizations, higher education institutions are also mentioned. Both sections fail to provide information on the specific amounts of funding for these important areas of activity and indicators related to digitalization processes. However, the issues of digitalization in the relevant areas of activity are urgent both for education during the pandemic and post-pandemic recovery and for researchers from the academic and university sectors as they will determine the potential for the development of these areas in the long term.

2. RESEARCH RESULTS

It is now possible to analyze the corresponding information in the respective Appendix titled ‘Limits on expenditures and state budget loans and state policy goals in the relevant field of activity and performance indicators in 2020-2024".[2] Here, in our opinion, there are certain aspects that require methodological consensus and further improvement of coordination of interests to

establish the sustainability of public finances and increase the efficiency of sectoral spending and thorough consideration of priorities for the inclusive development of education and science. It is worth noting that indicators related to education and science are structurally contained in different sections. In addition to the "field-specific" sections, they can also be found in others – e.g. in the "Fostering technological efficiency of the economy" section, but it contains only one indicator that is directly related to the "technological horizon" - "Ukraine's place in the Global Competitiveness rating". It is advisable to emphasize that the indicators of this rating are based largely on subjective assessments of experts [3], and they are not always adequate for Ukraine (due to the practice of establishing relevant think tanks, in most developed countries this problem is not so pertinent). It would be much more rational to use the indicators of the European Innovation Scoreboard (EIS) to determine the level of scientific, technical and innovative development. [4]. The advantages of EIS include the use of exclusively statistical indicators and focus on the EU countries, which corresponds to the goals of the European integration policy. There are certain obstacles to EIS application due to the need for further reform of the domestic system of statistical indicators and regular conduct of national surveys of innovation activities according to the methodology of statistical services of EU member states. Such surveys have already been conducted repeatedly in Ukraine, but it is important to make them systematic and constantly update the indicator systems in order to adapt to the needs of the economy and Eurostat standards. It seems rational to use the indicators proposed in the World Bank Report [5] as additional innovative activity indicators.

The section relating to the Ministry of Education and Science of Ukraine places the main attention on educational activities, while R&D expenditures in higher education institutions are not provided for. At the same time, three indicators out of eleven for "Science and innovation" subsection of the budget declaration have a financial dimension: the level of funding for category A and B institutions and "ensuring the renewal of the material and technical base for scientific and scientific-technical activities". However, there are questions about the dynamics of such indicators: it is planned to halve them starting 2022. This raises the question of how exactly, under such conditions, it is possible to attain sustainable and advanced development goals of the domestic science. The situation is complicated by the multidirectional annual dynamics of the number of targeted grants (2020 – 216, 2021 - 50, 2024 – 120). It could be, of course, assumed that these grants will have a more solid cost dimension, but the document provides no relevant data on the amount of grant funding, so the issue needs to be clarified during the consideration of the document by the Verkhovna Rada of Ukraine. On the other hand, the number of priority research areas is set at 67 for the entire period, while the number of applied R&D areas will also have a certain volatile trend (2021 – 444, 2022 – 425, 2024 – 452). It is obvious that both the number of priorities and the number of developments can be easily changed due to the detail of priority areas, or the division of almost any scientific topic into 2-3 significant areas. In other words, these indicators are quite artificial and should not constitute the basis of the approach, if necessary, focus on measuring the effectiveness of using the allocated funds. This remark applies to the number of young scientists' projects, and the number of developments that are given in the document. It is clear that the R&D effect is fully manifested only over time, but it would be possible to consider the feasibility of introducing indicators of license sale revenues, the share of funding under contracts with government agencies, potential revenues from the sale of excess property, etc. It is believed that possible discrepancies arise also because at present the National Research Fund of Ukraine, which is supposed to provide the biggest share of grant funding from the state budget, has not acquired the status of the key spending unit of budget funds for R&D expenditures, which is envisaged by the Law of Ukraine "On Scientific and Scientific and Technical Activities". Accordingly, due attention is not paid to the actual provision of opportunities to further improve the efficiency of using funding, which would be based on the long-term strategic interests of the development of the domestic R&D sector. Also, given the limited fiscal space, the potential for digital transformation requires comprehensive consideration. Researchers have repeatedly noted that in order to close the gap with leading countries, Ukraine needs a strategy [6] of advanced digitalization of the economy, which, on the one hand, would take into account its significant structural and technological inferiority to the developed countries and act as one of the levers to quickly overcome such gap, and on the other hand, would significantly transform the country's approaches to economic management processes and strategic and operational decision-making [7-9] systems to adequately respond to current and future challenges and threats faced by our country, particularly on the basis of a flexible regulatory framework for implementing digital technologies in all areas of the economy, public administration and public life. [10]

It should be noted that information on other budget managers contains plans for the R&D without corresponding reports on the amount of funding or the relevant economic effect. For example, the system of indicators of the Ministry of Strategic Industries of Ukraine attracts attention as it provides for an increase in the share of innovative enterprises from 0.5% in 2022 to 2% in 2024. This indicator is ten times lower than the EU average, and also does not correspond to the data of the State Statistical Service of Ukraine on the current level of innovation activity in the country's industry

(15.8% in 2019). [11] At the same time, given the content of the document, it is of concern that the Ministry plans to fully complete the setup of a dedicated information system in 2021 (100% "degree of readiness" is used as an indicator), but does not see the feasibility of its further support and improvement, if we rely on the lack of relevant indicators in the medium-term horizon.

Separately, we consider it appropriate to focus on indicators and the corresponding information base that belong to a certain extent to digitalization indicators. There are only two of them in the appendix to the draft Budget Resolution 2022-2024: "Development of the national repository of academic texts" and "Development of the National Scientific Information System URIS and the Open Ukrainian Scientific Citation Index OUCI", but both of them are given in natural units of measurement, thus they lack accountability and transparency in terms of the ability to analyze the financial support for the creation and support of such institutionally important systems. As for scientific citation and publications, these indicators themselves, provided that the information base of their collection and processing is systematized, in our opinion, lack sufficient attention precisely in the context of their both quantitative and qualitative content to characterize the effectiveness of scientific activities. After all, they are a natural result of the scientific process and correspond to the methodology of cognition of scientific workflow, and can be used to normalize the latter. [12] Also, in the case of correct identification of strategic priorities for measuring publication activities in scientific workflow [13], the relevant summaries comprise an information base that is universal enough for application in the system of institutional financing, and in the project approach to funding based on a competitive and/or formula approach, in particular in the vast majority of European countries. [14]

For example, by evaluating the higher growth topics of publication activity in the field of artificial intelligence (AI) research compared to the average rate of publication activities in all other sectors, the Organization for Economic Cooperation and Development in its report on digitalization of science, technology and innovation focuses on the prospects of this area of scientific research, including for the infrastructure of scientific research. After all, it is argued that it is AI that can increase the effectiveness of science, even at times when the research efficiency is decreasing. [15] Moreover, the domestic regulatory framework contains the concept of development of artificial intelligence in Ukraine, which places the state policy priorities on the development of artificial intelligence in education and professional training, science, economics, cybersecurity, Information security, defense, public administration, legal regulation and ethics, justice. [16]

In the sections related to the National Academy of Sciences and branch academies of sciences, the picture seems to be similar. The volume of total financing is shown among financial indicators. Among the main performance indicators, the indicator "The number of created scientific and technical products (new types of products, technologies, materials, plant varieties, methods, theories, etc.) for basic research, state target programs and applied research works" is used. This very indicator of state statistics and its information base has been repeatedly criticized for the ambiguity of the content because summing up the number of "varieties of plants" and "theories" is at least incorrect and does not contain prospects for proactive development of the science and research. Moreover, many of the indicators have a planned negative trend, which leads to the conclusion that the effectiveness of scientific activities is planned to decrease, for example, the number of intellectual rights reservation documents (patents) and post-graduate students, which, in turn, does not correspond to the declared goals of socio-economic development of the country. For the National Academy of Medical Sciences in general, a significant increase in "surgical interventions" and medical visits is planned. In other words, it is not the level of success of an activity that is measured (for example, the proportion of fully cured patients), but the number of medical manipulations with an uncertain outcome.

3. DISCUSSION OF RESULTS

It should be noted that indicators of the use of "big data" in scientific activities, access to various databases, information about the availability of unique equipment, etc. are successfully used in global practice. The GENET (European NGO network on genetic engineering) access indicator [17], other indicators of the use of modern digital technologies would be relevant for Ukraine. In our opinion, it is necessary to measure the effectiveness of scientific activity in such aspects, focusing the attention of developers of medium-term plans and managers of funds on its information and infrastructure (virtual economy, BioTech, BlockChain, digital marketing, e-ID, FinTech, GovTech, LegalTech, NanoTech, RetailTech, TeleHealth, BigData, Industry 4.0, Society 5.0, Artificial Intelligence, SmartAgro), information and knowledge (science and education novels, semantic-cognitive innovations, Bigdata) and information and creative (copyright and Related Rights, Intellectual Property, Creative Industries) dimensions, which are the heralds of new socio-economic formations. [18]

At one time, there were relevant proposals based on the use of international digitalization indicators in Ukraine and other EU Eastern Partnership countries. [19] In particular, it was noted that the level of use of EU DESI (Digital Economy and Society Indicators) indicators was relatively low. As seen from the indicators of the Budget Resolution 2022-2024, which should characterize the activity of the Ministry of Digital Transformation of Ukraine, certain changes in recent

years have taken place at the national level. On the other hand, many problems are related with the use of digitalization indicators in specific areas of activity, in particular, even fairly obvious indicators that could be used in the innovation and scientific and technical area are ignored - the level of use for human capital development, confidentiality, etc. In particular, one of the prospective areas that should be taken into account is the chapter of the National Economic Strategy 2030. "Digital economy" the strategic goal of "Creating new opportunities for the realization of human capital, the development of innovative, creative and 'digital' industries and businesses " provides for the approval and implementation of digital rights, namely, ensuring the harmonization of digital rights with the best EU practices [20]. This will both prevent possible negative manifestations of digitalization in the R&D area (in particular, such as the lack of research hypotheses, performing calculations for the sake of the process of processing large data arrays, distortion of indicators and data that characterize scientific research) [15], and will ensure an appropriate level of accountability and ethics in many areas of science, in particular such sensitive ones as genetics, virology and medicine, AI machine learning, which is especially important in pandemic times and during the expected post-pandemic recovery.

4. CONCLUSIONS

Thus, to change the situation on improving and expanding the information base of medium-term planning for the development of the field of science is largely possible by adapting "common" indicators on applying digital technologies to the sectoral context, improving coordination in the system of interaction of key spending units during the preparation of strategic documents for the medium term, by involving scientists, specialists and experts in the processes of long-term planning for the development of science and research based on the information base, taking into account the priorities and prospects of digital transformation.

REFERENCES

[1] Draft Budget Declaration for period 2022-2024, available at: https://mof.gov.ua/storage/files/%D0%91%D1%8E%D0%B4%D0%B6%D0%B5%D1%82%D0%BD%D0%B0%20%D0%B4%D0%B5%D0%BA%D0%BB%D0%B0%D1%80%D0%B0%D1%86%D1%96%D1%8F%20%D0%BD%D0%B0%202022-2024%20%D1%80%D0%BE%D0%BA%D0%B8.pdf.

[2] Expenditure Ceilings and Funding of State Budget and Goals of Public Policy in Corresponding Sectors and Performance Indicators for period 2020-2024, available at: https://mof.gov.ua/storage/files/%D0%94%D0%BE%D0%B4%D0%B0%D1%82%D0%BE%D0%BA%201%20%D0%93%D1%80%D0%B0%D0%BD%D0%B8%D1%87%D0%BD%D1%96%20%D0%BF%D0%BE%D0%BA%D0%B0%D0%B7%D0%BD%D0%B8%D0%BA%D0%B8%20%D1%82%D0%B0%20%D1%86%D1%96%D0%BB%D1%96%20%D0%BD%D0%B0%202022-2024%20%D1%80%D0%BE%D0%BA%D0%B8.pdf.

[3] Appendix A: The Global Competitiveness Index 4.0 Methodology and Technical Notes, available at: http://reports.weforum.org/global-competitiveness-report-2019/appendix-a-the-global-competitiveness-index-4-0-methodology-and-technical-notes/

[4] European Innovation Scoreboard, available at: https://ec.europa.eu/growth/industry/policy/innovation/scoreboards_en.

[5] Path for Ukraine's Economic Growth: Technology Upgrading, WB, Washington, DC - October 2019, 63 p.

[6] Korystin, O.Ye. (2020), Chapter 4. State Legal Police of Scientific Prediction. Public administration in the digital economy, monograph, Tallinn, Scientific Center of Innovative Researches OU, DOI: 10.36690 PADE

[7] Cigdem Tarhan and Can Aydın (2019), "Why Should Municipalities Use Management Information Systems in Their Decision-Making Processes?", *International Journal of Information Technology and Computer Science*, vol. 11, no. 4, pp. 1-8, DOI: 10.5815/ijitcs.2019.04.01

[8] Tengku Adil Tengku Izhar (2017), "Ontology Based Framework to Configure the Organizational Goal Analysis and Decision-Making", *International Journal of Information Technology and Computer Science*, vol. 9, no. 9, pp. 53-59, DOI: 10.5815/ijitcs.2017.09.05

[9] Darshan M. Tank (2015), "Enable Better and Timelier Decision-Making Using Real-Time Business Intelligence System", *IJIEEB*, vol. 7, no. 1, pp. 43-48, DOI: 10.5815/ijieeb.2015.01.06

[10] Kindzerskyi, Yu. (2020), "Genesis and features of the digital economy in the context of prospects for its formation in Ukraine", *Ekonomika ta derzhava*, vol. 8, pp. 10–14. DOI: 10.32702/2306-6806.2020.8.10

[11] Scientific and innovation activities in Ukraine in 2019. State Statistical Service of Ukraine, available at:

http://www.ukrstat.gov.ua/druk/publicat/kat_u/2020/zb/09/zb_nauka_2019.pdf.

[12] Gasanov, S.S. Kotlyarevsky, Ya.V. Melnikov, O.V., Kniaziev, S.I. Shtangret, A.M. and Semenyuk, E.P. (2019), *Methodological Approaches to Labor Norming in Scholarly Research and Development, Sci. innov*., vol. 15, no. 1, pp. 15-24, DOI: 10.15407/scine15.01.005

[13] Kotlyarevsky, Ya.V. Radchenko, A.I. Melnikov, O.V. and Semenyuk, E.P. (2018), "Strategic Priorities in Measuring the Publication and Publishing Works in Scholarly Research Activity", *Sci. innov*., vol. 14, no. 5, pp. 5-16. DOI: 10.15407/scine14.05.005.

[14] Sokolovska, A.M. Kotlyarevskyy, Y.V. and Tymchenko, O.M. (2018), "Models of Science Funding in Ukraine: Current Situation and Development Prospects. Strategies for Economic Development: The experience of Poland and the prospects of Ukraine", *Baltija Publishing*, pp. 126-143, available at: http://rep.btsau.edu.ua/bitstream/BNAU/2297/1/%D0%9F%D0%BE%D0%BB%D1%8C%D1%88%D0%B0%20%D0%9A%D0%B5%D0%BB%D1%8C%D1%86%D0%B5%20%D0%B8%D1%8E%D0%BD%D1%8C%202018%20%D1%87%D0%B0%D1%81%D1%82%D1%8C%201%20%281%29.pdf#page=130 (last accessed 30.06.2021)

[15] OECD (2020), The Digitalisation of Science, Technology and Innovation: Key Developments and Policies, OECD Publishing, Paris, DOI: 10.1787/b9e4a2c0-en.

[16] Concept of Artificial Intelligence Development in Ukraine. Order of the Cabinet of Ministers of Ukraine on December 2, 2020 № 1556-p, available at: https://zakon.rada.gov.ua/laws/show/1556-2020-%D1%80?lang=en#Text.

[17] GENET (European NGO network on genetic engineering), available at: http://www.genet-info.org/

[18] Kotlyarevskyy, Ya.V. Melnychenko, A.A. Ivanytska, O.I. Semenyuk, E.P. Kniaziev, S.I. and Melnikov, A.V. (2020), "New Economy: Evolution of Forms and Research Methodology", *Sci. innov.*, vol. 16, no. 1, pp. 15-30, DOI: 10.15407/scine16.01.015

[19] Yehorov, I.YU. and Hryha, V.YU. (2019), "Comparative analysis of the availability of digitization indicators in Ukraine and other EU Eastern Partnership countries", Statystyka Ukrayiny, no 1, pp. 45-57.

[20] National Economic Strategy until 2030. Order of the Cabinet of Ministers of Ukraine on 3 of March 2021 № 179, available at: https://zakon.rada.gov.ua/laws/file/text/88/f503442n31.doc