

INNOVATIVE DEVELOPMENT OF CLUSTERS AS THE BASIS OF ECONOMIC RECOVERY OF UKRAINE

Andrii Karpenko, Doctor of Economic Sciences, Professor
National University "Zaporizhzhia Polytechnic", Ukraine

Rodion Sevast'yanov, PhD in Economics, Associate professor
National University "Zaporizhzhia Polytechnic", Ukraine

Natalia Karpenko, PhD in Public Administration, Associate professor
National University "Zaporizhzhia Polytechnic", Ukraine

During the studied period of 2010-2020, the number of R&D organizations gradually decreased. This is a negative trend. Let's consider statistical data on the dynamics of R&D expenditures in Ukraine (Fig. 2).

Innovative development is an important component of the country's economic growth. The development of innovative industrial high-tech clusters for successful

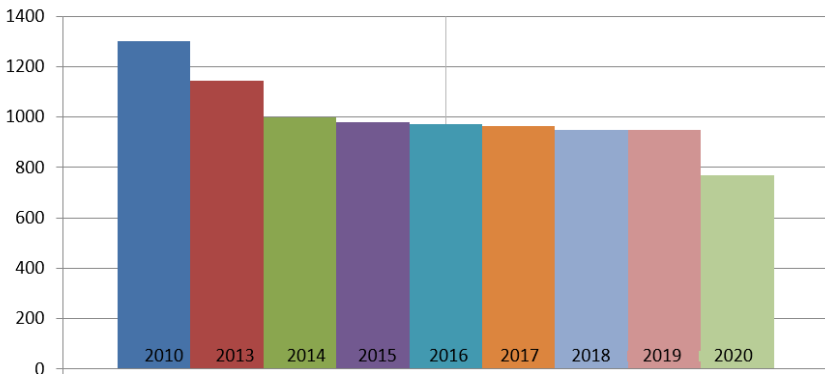
integration into the global economy is important for Ukraine. Clusters consolidate the existing potential of companies in order to obtain synergies. Clusters also make it possible to reduce the negative consequences of mistrust and competition within local territories.

Scientific research and innovation are important factors that influence the place of countries in the Global Innovation Index. Ukraine has a high educational and scientific potential, innovative system. Such potential is capable of producing various innovations in the form of ideas, scientific developments and patents.

The knowledge economy is an important realization for human potential in the innovation system. The formation of the innovation system is based on the close interaction of structures involved in the production and commercialization of scientific knowledge and technologies. Therefore, their collaboration is important to achieve common goals. At the same time, knowledge is exchanged and consensus is reached (Karpenko, 2018).

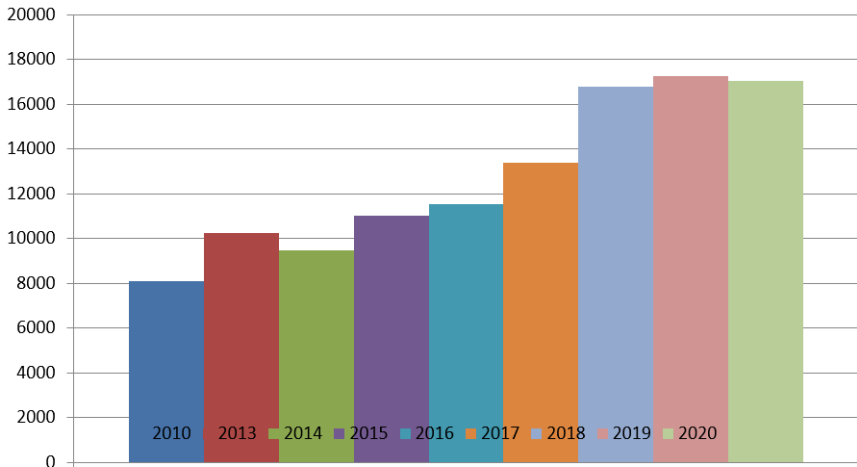
Ukraine has a high educational and scientific potential. The development of these potentials is a prerequisite for the creation and implementation of innovations in the form of ideas, scientific developments and patents. Among the competitive advantages of Ukraine, one can single out market capacity, quality of higher, secondary and professional education.

Among the main barriers to the development of innovations in Ukraine, the authors single out the imperfection of regulatory institutions and insufficiently developed innovation infrastructure. In fig. 1 shows the number of organizations R&D.



formed by the authors on the basis of information from the State statistic service of Ukraine (State,2022)

Fig. 1. The number of organizations in Ukraine that carried out R&D work for the period 2010-2020



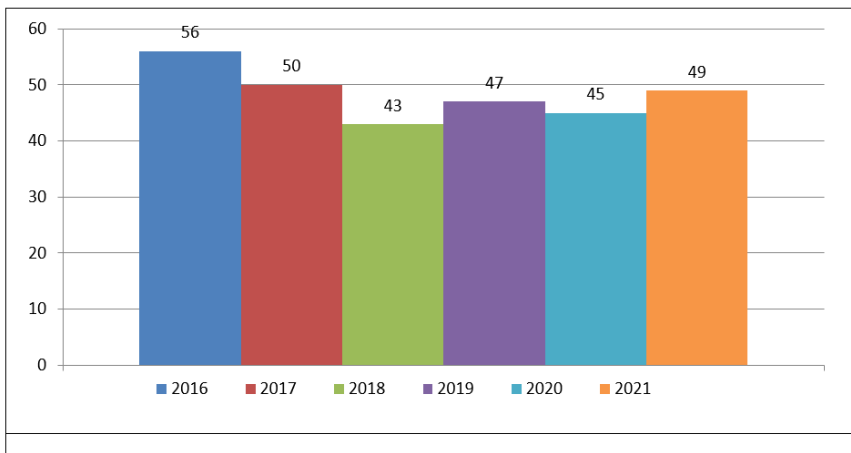
formed by the authors on the basis of information from the SSC of Ukraine (State,2022)

Fig. 2. R&D expenses in Ukraine for the period 2010-2020, million UAH

In 2010-2020, there is a trend of growth in the R&D expenditure indicator. However, the devaluation and inflation processes in 2018-2020 did not allow fundamentally improving the innovation system.

In Ukraine, there is a Strategy for the development of the sphere of innovative activity for the period until 2030. The dynamics of costs for the implementation of scientific research and development in the dollar equivalent did not even reach the level of 2010.

Consider the indicator of the Global Innovation Index. It highlights the productivity of innovation ecosystems of 132 countries and tracks global innovation trends (Fig. 3).



formed by the authors on the basis of information from the World Intellectual Property Organization (Global, 2020)

Fig. 3. Ranking of Ukraine in the Global Innovation Index

In 2020, Ukraine ranked 45th in the Global Innovation Index. The best year according to this indicator is 2018 with a rating of 43. Until the 2022 war, Ukraine was unable to fundamentally improve its innovation activity and kept its position in the range of 40-60 places in the Global Innovation Index.

Economic losses as a result of the military invasion of Russian troops in Ukraine are deepening the crisis in the economy. Therefore, the authors propose to consider economic growth mainly on an innovative basis with the active use of the potential of cluster development. Clusters are formed with the aim of strengthening the own positions of mainly small and medium-sized businesses, obtaining more significant advantages on the market.

Clusters allow to combine and coordinate all levels of innovation policy. Clusters ensure the concentration of resources and the creation of a favorable environment for economic development in the form of innovations. Interaction and synergy of scientists, business, authorities and the public can be achieved in clusters.

In order to solve the tasks, National University "Zaporizhzhia Polytechnic" participates in the cluster development of the Zaporizhzhia Cluster "EAM" (Engineering-Automation-Machinery). The implementation of this project contributed to the development of cluster processes in the specified regions. There have also been positive changes in innovation ecosystems and influence on the development of the cluster movement in Ukraine.

The National University "Zaporizhzhia Polytechnic" is a member of the Zaporizhzhia Cluster "Engineering – Automation – Machinery" (EAM Zaporizhzhia). This organisation is based on a collaboration of a wide variety of players in engineering as well as automation and machinery. Members of the cluster include the Zaporizhzhia Chamber of Commerce and Industry, industrial enterprises (Triada Ltd Co., Roll Grand, Blysk metal service pro), IT companies (Infocom Ltd), industrial parks (Konecranes), and other organisations. At 2021 was the signing of the Memorandum of Cooperation between the EAM cluster and the INDUSTRY CLUSTER 4.0, an important Czech

association of engineering and IT companies. Such measures are relevant in terms of developing global and regional value chains in the context of Ukraine's cooperation with the EU's countries.

Table 1

Structure of regional cluster of Zaporizhzhia regional Cluster "Engineering – Automation – Machinery" (EAM) as of 2022 (Compiled by authors from open sources)

Name	Brand	Services	Official site
ZAPORIZHZHIA CLUSTER "ENGINEERING – AUTOMATION – MACHINERY"		A platform for companies in the Zaporizhzhia region working in the Engineering, Automation and Machinery sectors to share best practices and create a consolidated industry position	https://www.zamcluster.zp.ua
NATIONAL UNIVERSITY "ZAPORIZHZHIA POLYTECHNIC"		Basic and applied research, training. The university prepares specialists for the aviation, aerospace, electrical, electric power, metallurgical, machine-building, radio-electronic industries	https://zp.edu.ua
ASSOCIATION OF INDUSTRIAL AUTOMATION OF UKRAINE (APPAU)		Development of the local market through set-up of professional standards in technical field and in business development. It represents the interests of the Ukrainian industrial automation community.	https://appau.org.ua
ZAPORIZHZHIA CHAMBER OF COMMERCE AND INDUSTRY (CCI)		Certification of origin of goods, Customs broker services, ATA carnet, Legal Services, Translation agency, Organization of international economic cooperation, Implementation of quality management systems, Certification of commercial documents, Educational courses, Conference service, Conference halls for rent, Public procurement, Commodity expertise, Price examination, Patent and license services, Definition of codes.	https://www.cci.zp.ua
WELDING ENGINEERING COMPANY LLC "TRADA LTD. AND CO."		Development and creation of welding technologies, design of robotic technological complexes, Laser cutting, Metal casting, Plasma forming, Plasma cutting, Electroplating services.	http://www.trada-welding.com
LLC "GLOSS METAL SERVICES PRO"		Production of polypropylene equipment for galvanic processes, supply of voltage rectifiers	http://bmservice.pro
LLC "ROLL GRAND"		Manufacturer of components for all types of gates	https://rollgrand.com/
PLANT OF METAL STRUCTURES LLC "PC KOTLOMONTAZH"		Boilers, boilers, desluders, gas cleaning equipment, building metal structures	https://steel-work.com.ua
PRIVATE SMALL INDUSTRIAL AND COMMERCIAL ENTERPRISE "ASSOL"		Production of bulldozers, modernization and overhaul of equipment	https://assol.com.ua/
LLC "LIZMARK"		Production of freight elevators and cottage elevators	https://lizmark.in.ua
LLC "SATURN"		Production of auto parts and spare parts for agricultural machinery, services services for the production of equipment and machining of metals	https://saturnmto.com.ua
LLC "TERMOLIT"		Production of innovative equipment for melting, heating and hardening of metals	https://termolit.com
LLC "TAVRIA FOUNDRY COMPANY "TALCO"		Foundry production of aluminum alloys	https://talco.com.ua
LLC "THERMO-ENGINEERING"		Design and construction of industrial and civil construction facilities, modernization or repair of industrial equipment	http://ufern.com
PRIVATE ENTERPRISE "YUZHTRANSOLIS PLUS"		Gates of various levels of complexity for domestic and industrial purposes	https://www.vvostok-urp.zp.ua
LLC "GREEN SYSTEM"		Turkey solar power plants, service in the field of alternative energy and energy efficiency	https://greensystem.com.ua https://iplonstos.biz https://electro-auto.com.ua
LLC "INFOCOM"		Automation software development (MES, ERP)	https://ia.ua
LLC "IT PROJECT"		Design and implementation of IOT at facilities of industrial complexes, agriculture, transport, housing and communal services	https://www.atiko.com.ua
HR COMPANY "WORLDWIDE OPPORTUNITIES"		Employment, training and retraining services for specialists.	https://wwop.com.ua
"ECOTECHNOLOGY COMPANY "GRANIT" LLC		Collection and removal of various types of garbage and waste in Zaporizhzhia and Ukraine (organic waste collection)	https://gmnik.com.ua
"BRIGHTMEDIA COMPANY" LLC		Brightmedia is the agency that creates values. From creating a name to shooting a commercial featuring (rebrand, launch new product, roadmap for the project)	https://brightmedia.ua
LLC "UKRAINSTANDARTSERIFIKA CIYA"		Company services: CE certification (for export to the EU), a full range of work on CE marking, Consulting on ISO standards, Certification in accordance with standards, Assessment of conformity of products in accordance with the technical regulations of Ukraine, Product testing, Production attention, Certification of internal auditors	www.ukrstandart.net

Zaporizhzhia Cluster "EAM" is included in the regional development strategy until 2027. The draft action program for the development of small and medium enterprises in the city of Zaporizhzhia for 2022-2025 has been included in the action plan. A joint innovation ecosystem of the region was also created for the purpose of innovation and R&D (research and development), production of new generation products ("Industry 4.0"), as well as joint implementation of engineering projects. Enterprises and organizations of the cluster created more than 1.6 thousand jobs and paid about 70 million UAH taxes (2020). The basis of the cluster formation is the coordination and

synchronization of cooperation of participants in the following areas: definition of common goals and needs; building trust through networking and regular communications; launching a specific action plan, etc.

In September and November 2021, cluster representatives visited Lithuania and the Czech Republic and signed 2 memoranda of cooperation with two clusters (INDUSTRY CLUSTER 4.0 and Lithuanian Automotive Export Association LAuGEA Cluster) on cooperation and development of global value chains with more than 50 participating companies. The INDUSTRY CLUSTER 4.0 presents the Czech association of engineering and IT companies. Such measures are relevant in terms of developing global and regional value chains in the context of Ukraine's innovative cooperation with the EU's countries (Karpenko, 2022). The purpose of the INDUSTRY CLUSTER 4.0 is to create an important center of business in engineering, strengthening competitiveness and innovation activities, in particular through the implementation of the concept "Industry 4.0" (Digitization and automation of manufacturing processes (Industry 4.0); Preparation of human resources in technical fields; Improvement of export capabilities of companies). The cluster is currently composed of leading production or technological companies and research facilities from the region (Industry, 2022). Cooperation with the Lithuanian LAuGEA Cluster also seems promising. This cluster presents companies related to the automotive industry and science. LAuGEA Cluster members are actively involved in international research and innovation program projects, international exhibitions and business missions, as well as collaborating with various companies, government agencies, non-governmental organizations, research and product development partners, and other institutions of similar activity. Research, development and innovation (R&D&I) activities are carried out by taking advantage of laboratories owned by cluster members and partners (LAuGEA, 2022).

In order to integrate the economy of Ukraine into the global economy, it is necessary to ensure the innovative development of enterprises. It seems important to support international cooperation between enterprises on global business platforms.

Innovative activity of Ukraine in 2010-2020 changed at a slow pace. The lack of tangible progress is related to the reduction of research and education costs as a percentage of GDP. The level of development of innovative infrastructure is insufficient to ensure the intensive growth of Ukraine's economy. The protection of intellectual property rights and the development of clusters should be considered important components of the innovation infrastructure.

In order to intensify the development of the innovative economy, it is important for the state to use financial incentives for the development of clusters, promote the modernization of production, involve scientific institutions in the implementation of innovative projects, etc. Clusters should ensure readiness for the introduction of innovations. Clusters should also be open to participation in new projects related to the restoration of Ukraine's infrastructure. The activities of the Zaporizhzhia Cluster "EAM" are aimed at the development of the economy of Ukraine in the field of innovative activity.

Global innovation index 2020. URL:

https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020.pdf

INDUSTRY CLUSTER 4.0.: official site. URL: <https://ic40.cz>

LAuGEA Cluster: official site. URL: <https://laugea.com>

State statistic service of Ukraine: official site. URL: <http://www.ukrstat.gov.ua>

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