

DOI: 10.31617/1.2023(151)09

UDC 332.1:338.28(477)=111

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## REGIONAL STARTUP ECOSYSTEMS OF UKRAINE

*The startup ecosystem of each country contains separate elements and reflects the effectiveness of their interaction, which is also reflected in regional ecosystems. The aim of the research is to identify and rank the start-up ecosystems of the regions of Ukraine according to various indicators, distinguish the differences between the ecosystems and determine the main directions of their development, expansion within a separate region. In the research multifactorial comparative analysis in four stages has been used, such as: justification of the indicator system, normalization of the matrix of standardized coefficients, squaring of all elements of the matrix of standardized coefficients and placement of the obtained rating values by rank. The highest level is characterized by a sufficient number of supporting elements that help startups find financing options and accelerate market entry processes; the high level has a dynamic ecosystem that helps early-stage startups find support and funding programs; the medium level has a developing ecosystem, and the existing business structure contributes to the development of the startup movement in the region; the low level has the potential for further development and additional initiatives by local authorities and business structures. According to the rating, the highest level was determined in Kyiv region, the high level is found in Dnipropetrovsk, Lviv, Odesa and Kharkiv regions, the average level is found in Donetsk and Zaporizhia regions. Other regions belong to the lower and the lowest levels, which emphasize the promising development of startup ecosystems in the regions. Regions with the highest level can focus on maintaining and expanding their existing ecosystem by providing*

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## РЕГІОНАЛЬНІ СТАРТАП- ЕКОСИСТЕМИ УКРАЇНИ

*Екосистема стартапів кожної країни містить окремі елементи та відображає ефективність їх взаємодії, що також відбивається на регіональних екосистемах. Метою статті є ідентифікація та ранжування стартап-екосистем регіонів України за різними показниками, розмежування відмінностей екосистем та визначення основних напрямків їх розвитку, розширення в межах окремого регіону. У дослідженні застосовано багатофакторний порівняльний аналіз у чотири етапи: обґрунтування системи показників, нормування матриці стандартизованих коефіцієнтів, зведення всіх елементів матриці стандартизованих коефіцієнтів у квадрат та розміщення отриманих рейтингових значень за рангом. Найвищий рівень характеризується достатньою кількістю допоміжних елементів, які допомагають стартапам знайти варіанти фінансування та прискорити процеси виходу на ринок; високий – має динамічну екосистему, яка допомагає стартапам на ранніх стадіях знайти підтримку та програми фінансування; середній – має екосистему, що розвивається, а існуюча структура бізнесу сприяє розвитку стартап-руху в регіоні; низький – має потенціал для подальшого розвитку та додаткових ініціатив з боку місцевої влади та бізнес-структур. Згідно з рейтингом, найвищий рівень визначено у Київській області, високий – у Дніпропетровській, Львівській, Одеській та Харківській, середній – у Донецькій та Запорізькій. Інші регіони належать до нижчого та найнижчого рівнів, що підкреслює перспективність розвитку стартап-екосистем у регіонах. Регіони з найвищим рівнем можуть зосередитися на підтримці та розширенні своєї існуючої*



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*additional support and funding for startups; with high indicators they can focus on the further development of its dynamic ecosystem, creating more clusters and events to attract startups and investors; medium level regions can concentrate on increasing the number of supporting elements to make it easier for startups to find funding and scale; with a low level regions can focus on conducting competitions, hackathons, involving the IT community for the development of the startup community.*

*Keywords:* startup, startup ecosystem, ranking, multifactorial comparative analysis, regions of Ukraine, ranking of regions, regional startup ecosystems.

*екосистеми, надаючи додаткову підтримку та фінансування для стартапів; з високими показниками – на подальшому розвитку своєї динамічної екосистеми, створюючи більше кластерів і заходів для залучення стартапів та інвесторів; середнім рівнем – на збільшенні кількості допоміжних елементів, щоб полегшити стартапам пошук фінансування та масштабування; з низьким рівнем – на проведенні конкурсів, хакатонів, залучаючи IT-спільноту для розвитку стартап-спільноти.*

*Ключові слова:* стартап, стартап-екосистема, рейтингування, багатofакторний порівняльний аналіз, регіони України, рейтинг регіонів, регіональні стартап-екосистеми.

**JEL Classification:** R11, M13.

### **Introduction**

The technological and digital revolutions have created the prerequisites for the transition of startups from business projects to a different type of entrepreneurial activity with an innovative component. As part of this, a separate element of support stood out in the global structure, the startup ecosystem, which is formed from people and organizations of various types (physical or virtual) interacting as one system to expand existing capabilities and create new startups. The startup ecosystem of each country includes separate elements and reflects the effectiveness of their interaction, which also affects regional ecosystems.

The study of regional ecosystems will allow the differences in ecosystems to be distinguished, the main directions for development and further expansion in the context of a separate region, and the formation of a general economic strategy will be identified.

The development of regional startup ecosystems in Ukraine has been studied by Ukrainian scientists such as N. Sitnik (2020), Yu. Polyakova (2016, 2018), V. Smachylo, V. Khalina, and D. Chayka (Smachylo et al., 2021) who have focused on the structural elements, competitiveness, and maturity of these ecosystems and the state's role in their formation and development. Foreign researchers such as D. Cukier, F. Kon (2018), K. Mamede, R. Escalfoni, and J. Oliveira (2018) have studied approaches to ranking startup ecosystems. A new emphasis in the study of the ranking of startup ecosystems in a regional context is to focus on the ranking of regions of Ukraine based on indicators of the startup ecosystem, such as the number of startups, co-working spaces and hubs, accelerators and incubators, universities, and companies that produce products and services.

The aim of the research is the identification and ranking of startup ecosystems of regions of Ukraine according to various indicators to

distinguish differences in ecosystems and determine the main directions of their development and expansion within a specific region.

In the research a multivariate comparative analysis has been used, which includes four stages: substantiation of the indicator system, normalization of the matrix of standardized coefficients, squaring all elements of the matrix of standardized coefficients, and placement of the obtained rating values according to the rank. Indicators used to rank ecosystems include the number of startups, co-working spaces and hubs, accelerators and incubators, universities, product companies, and service companies. The rating is based on five levels: the highest, high, medium, low, and the lowest. For a more detailed analysis of the start-up ecosystem of the regions, indicators of the involvement of graduates of higher education institutions in start-up activities, ecosystem value, and percentage distribution of head offices of start-ups by region have been used.

### **1. Approaches to the regional startup ecosystem assessment**

The startup ecosystem is a set of elements that directly or indirectly influence on the business environment and create opportunities for the support and development of startups at each stage of the startup life cycle. The ecosystem is a dynamic phenomenon that changes depending on internal and external market trends. Reactions to changes that have occurred in the past and present affect the effectiveness of a startup's entry into the domestic or global market.

Thriving regional startup ecosystems significantly impact local economic development, job creation, and growth. The changing local conditions of each region highlight the attractiveness of applying the best practices of higher-level ecosystems to developing regions and expanding the practice of interaction between geographically close regions (Blaga & Bakker, 2021).

The joint positions of Ukrainian (Sitnik, 2020), Moiseienko et al., (2020) and foreign scientists (Mamede et al., 2018, Bala Subrahmanya, 2022, Ziakis et al., 2022) are up to the following elements that have a favorable effect on the startup ecosystem:

- industry – business mentors, business partners, venture funds, banks, availability of access to interaction with various organizations and enterprises, as well as the use of additional resources allow startups to globalize faster;
- politics – the quality and efficiency of the government at different levels, regulatory and legal support, special measures developed by the state to support the startup sector;
- science – R&D funding, the relationship between entrepreneurial education and business performance, universities and research centers in the region act as providers of new technologies and catalysts of market opportunities.

The effectiveness of the ecosystem is also complemented by indispensable actors/factors, including finance, human resources, support system (including accelerators and incubators), and business and technology mentors. The presence of the components mentioned above is one of the mandatory requirements for the startup ecosystem since their absence can be reflected in the absence of the ecosystem, the ineffectiveness of the ecosystem, or the short-term existence (Sitnik, 2020).

D. Cukier and F. Kon, in the study of startup ecosystems in the section of individual cities, note that the startup ecosystem is similar to a biological ecosystem, which is displayed as a living organism and undergoes changes over time. Some changes can be planned and controlled, while others result from unpredictable forces acting inside and outside the ecosystem. As a result of the analysis of the startup ecosystems of Tel Aviv, Sao Paulo, and New York, the authors developed a maturity model of startup ecosystems, which includes four levels: nascent (presence of startups, a small number of investment deals, possible availability of state support), evolution (successful companies, a particular regional impact, and impact on the local economy, job creation), maturity (a large number of investment deals, the global impact of startups, the first generation of successful entrepreneurs), self-sufficiency (a large number of startups, entrepreneurial ecosystem support, an inclusive environment) (Cukier & Kon, 2018).

V. Smachylo, V. Khalina, and D. Chayka singled out the set of participants of the local startup ecosystem, which includes local authorities, as well as structures belonging to the territorial community; advisory and control bodies related to business operation; educational and scientific institutions, which, including, have their formations promoting the development of innovations; business promotion institutions (business incubators, accelerators); associations of employers, businesses and the public whose activities are aimed at mutual sustainable development (clusters, public organizations, contractual and legal associations); current business; investors and financial and credit institutions (Smachylo et al., 2021).

## **2. Ranking of regional startup ecosystems in Ukraine**

The ranking of the startup ecosystem by regions will be carried out according to such *indicators* as:

- the number of startups – the total number of startups that were created in recent years within a separate area;
- the number of co-working spaces and hubs – availability of space and material resources for a team or independent work of startup founders on its further implementation;
- the number of accelerators and incubators – support programs that include access to financial and human resources;

- the number of universities – creating conditions for improving entrepreneurial competencies and obtaining more information about startups and their features;
- the number of product companies – developing software for creating their product and its further implementation (Green book of product companies and startups, 2021);
- the number of service companies – companies that provide custom software development services (Moiseienko et al., 2020), service companies develop startups within the company (corporate) or can act as investors.

The multifactor comparative analysis includes 4 stages (Polyakova, 2016, 2018):

*Stage 1* is substantiation of the system of indicators, according to which the evaluation of the results and the formation of the initial data were carried out;

*Stage 2* is normalization of the matrix of standardized coefficients  $a_{ij}$  by dividing all values by the maximum in each column, calculations are carried out according to the following formula:

$$a_{ij} = \frac{x_{ij}}{\max x_i}. \quad (1)$$

*Stage 3* is all elements of the matrix of standardized coefficients are squared, and the results are added up by strips, after which the square root is determined from the sums obtained, calculations are made according to the following formula:

$$R_j = \sqrt{\sum_{i=1}^n a_{ij}^2}. \quad (2)$$

*Stage 4* is the placement of the received rating estimates according to the rank and definition of each region in the rating.

The ranking of regions will be based on five levels: highest, high, medium, low, and lowest. The highest level is characterized by the fact that the ecosystem has a sufficient number of supporting elements, which helps the startup to find a more significant number of financing variations and a faster process of entering the market with a finished product or service, respectively, is a motivating factor for the creation and development of a startup within the given region.

*The high level* has a dynamic ecosystem that helps startups in the early stages to find support and funding programs, including accelerators and incubators, clusters, and the presence of events, conferences, and meetings that allow startups to learn more about opportunities and search for investors, institutions of higher education, allow to attract more the number of students, talents who can create new innovative solutions in the future.

*The middle level* has a developing ecosystem, and the existing business structure (associations, entrepreneurs, consultants, business schools) participates in the promotion of the startup movement in the region, which also contributes to the attraction of startups from other regions; the disadvantages are a small number of supporting elements that make it difficult to find funding and scale.

*Low level* is holding competitions, hackathons, support from the IT community for the development of the startup community, the total number of ecosystem objects does not allow the region to create a robust ecosystem, has the potential for further development and additional initiatives from local authorities and business structures, who are interested in expanding the network of startups.

*The lowest level* is characterized by the initial level of creating an ecosystem, cooperation between government organizations, the business community, and higher education institutions helps to solve the initial tasks in expanding the startup ecosystem.

According to the ranking of regional startup ecosystems at the beginning of the war in Ukraine, the highest level is in Kyiv region, the high level is noted in Dnipropetrovsk, Lviv, Odesa, and Kharkiv regions, and the average level is in Donetsk and Zaporizhia regions (*Table 1*).

*Table 1*

Ranking of regional startup ecosystems by regions of Ukraine

Value	Rating	Region
R>2	Highest	Kyiv region and Kyiv
1>R>2	High	Dnipropetrovsk, Lviv, Odesa, Kharkiv
0.5>R>1	Average	Donetsk, Zaporizhzhia
0.5>R>0,3	Low	Vinnytsia, Zhytomyr, Ivano-Frankivsk, Kirovohrad, Mykolaiv, Ternopil, Cherkasy
0.3>R	The lowest	Volyn, Zakarpattia, Rivne, Sumy, Luhansk, Poltava, Kherson, Khmelnytskyi, Chernivtsi, Chernihiv

*Source:* arranged by the author.

Kyiv region is characterizes by many successful startups that became unicorns as part of scaling or growing into large enterprises, such as Grammarly, PetCube, Ajax Systems, Grammarly, and Jooble. To a large extent, the highest rating is influenced by the fact that Kyiv is the capital of Ukraine, and the majority of founders and investors focus on establishing or continuing their activities within the framework of this region. The most popular industries for the creation of startups are marketing and sales, software and data, social direction, and leisure (*Table 2*).

Table 2

The region with the highest level of the startup ecosystem

	Number of startups	Number of coworking spaces and hubs	Number of incubators, accelerators	Number of universities	Product companies	Service companies	Rating
Kyiv region	42	32	26	9	1265	303	2.0840
	Matrix of standardized coefficients						
	0.3750	1.0000	1	0.4500	1.0000	1	

Source: arranged by the authors based on (Accelerators of Ukraine n.d., Ukrainian Tech Ecosystem Overview n.d., Ecosystem metrics n.d., Ukraine Startup Ecosystem Overview, 2022).

The largest share of startup headquarters concentrate in Kyiv: as of January 2022 – 53.2 % in Kyiv and 1.9 % in Kyiv region, in December 2022, the number of startups decreased to 40 % in Kyiv and a slight increase to 2 % in Kyiv region, while Kyiv remains the central place of the Ukrainian startup ecosystem (Reports Polish-Ukrainian Startup Bridge, Ukrainian Startup Fund, Warsaw Stock Exchange, 2022). Over the past five years, the value of the ecosystem (the cumulative sum of the estimated value of all startups in the ecosystem) is constantly increasing, compared to 2019, in 2023, it increased by 116 %, which is the highest indicator among the regional centers of Ukraine (Figure 1). The value of the ecosystem of Kyiv region has remained unchanged for the past three years and amounts to USD 12.9 million. USA, and in this indicator, it is inferior to Odesa region.

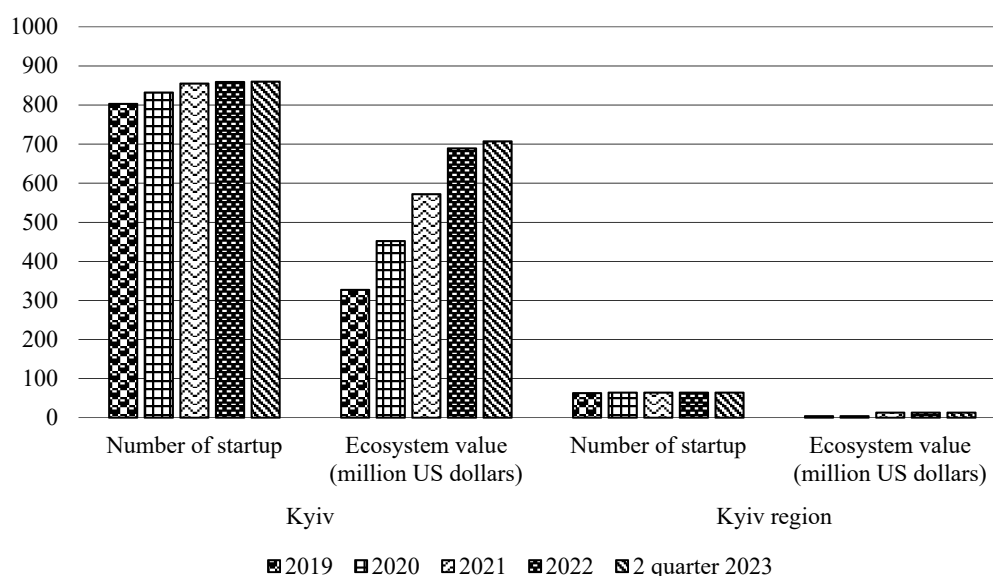


Figure 1. The number of startups and the value of the ecosystem of Kyiv region and Kyiv for the 2019 – 2nd quarter of 2023

Source: Compiled by the author based on Dealroom data (University Ukraine, n.d.).

The highest level of the startup ecosystem in Kyiv region and in Kyiv is confirmed by the number of graduates who founded startups; among 91 institutions of higher education (including state and private), 40 % have graduates of the founders. The largest share of graduates belongs to the National Technical University of Ukraine "Ihor Sikorskyi Kyiv Polytechnic Institute" (218 – startups founded by graduates, 198 – graduate founders, 12 – graduates who became founders and raised more than EUR 10 million, 1 – graduate-founder of a unicorn ) and Kyiv National University named after Taras Shevchenko (199 – startups founded by graduates, 169 – graduate founders, 14 – graduates who became founders and raised more than EUR 10 million, 1 – graduate-founder of a unicorn).

The dynamic development of the IT industry, the development of digital competencies and the concentration of talents in leading universities, the development of corporate universities and innovative infrastructure, and the development of infrastructure and comfort in the city are characteristic of regions with a high level (*Table 3*).

Kharkiv region had an active and promising startup scene in pre-war. Combining a large reserve of highly qualified and highly skilled and talented workforce/experts, more significant cost savings, competitive infrastructure, and many other advantages, Kharkiv was considered the most dynamic, fast-growing city and was the leading technological destination in the entire Ukrainian market (Kharkiv: A Promising Startup Scene In Eastern Ukraine, 2015). Support for startups in this region also took place based on higher education institutions:

- the "Entrepreneurial University" initiative (V. N. Karazin Kharkiv National University, Kharkiv National University of Radio Electronics, Kharkiv Polytechnic Institute) – an academic course for one semester, based on the classic incubation program implemented in Ukraine and Moldova (YEP incubator: focus on impact projects for Ukraine's recovery, 2022);

- the center of entrepreneurship of V. N. Karazin Kharkiv National University – startup contests "Karazin StartUp Week," Spark startup center of Kharkiv Polytechnic Institute – holding a school seminar "Startup intensive for teachers".

Startups in Lviv region operate on already formed markets, and the competition consists in comparing the product and its characteristics with other positions. Analysis of competitors showed that startups, in most cases, do not have significant uniqueness compared to others; some are even identical in functionality. The absence of identity includes the potential risk that the search for financing may take a long time and, in the end, the startup will not materialize. In Lviv, the startup ecosystem consists of the following elements: co-working spaces and hubs, communities, incubators, and startup events.



Table 3

The region with a high level of the startup ecosystem

Region	Number of startups	Number of coworking spaces and hubs	Number of incubators, accelerators	Number of universities	Product companies	Service companies	Rating
	Matrix of standardized coefficients						
Dnipro	64	4	1	21	89	37	1.2108
	0.5714	0.1250	0.0385	1.0500	0.0704	0.1221	
Lviv	112	13	3	15	129	138	1.3995
	1.0000	0.4063	0.1154	0.7500	0.1020	0.4554	
Odesa	78	5	3	20	97	38	1.2427
	0.6964	0.1563	0.1154	1.0000	0.0767	0.1254	
Kharkiv	95	17	3	19	109	102	1.4277
	0.8482	0.5313	0.1154	0.9500	0.0862	0.3366	

Source: compiled by the authors based on (Akseleatory Ukrayiny, n.d. Ukrainian Tech Ecosystem Overview, n.d. Ecosystem metrics, n.d. Ukraine Startup Ecosystem Overview, 2022).

The highest involvement of graduates in startup activities in regions with a high level concentrated in Lviv region (among 21 higher education institutions, 30 % of graduates of higher education institutions are involved in startup activities) and Odesa region (52 % of 23 higher education institutions). A smaller number displayed in Dnipropetrovsk and Kharkiv regions may be related to the unstable situation on the eastern border (Figure 2).

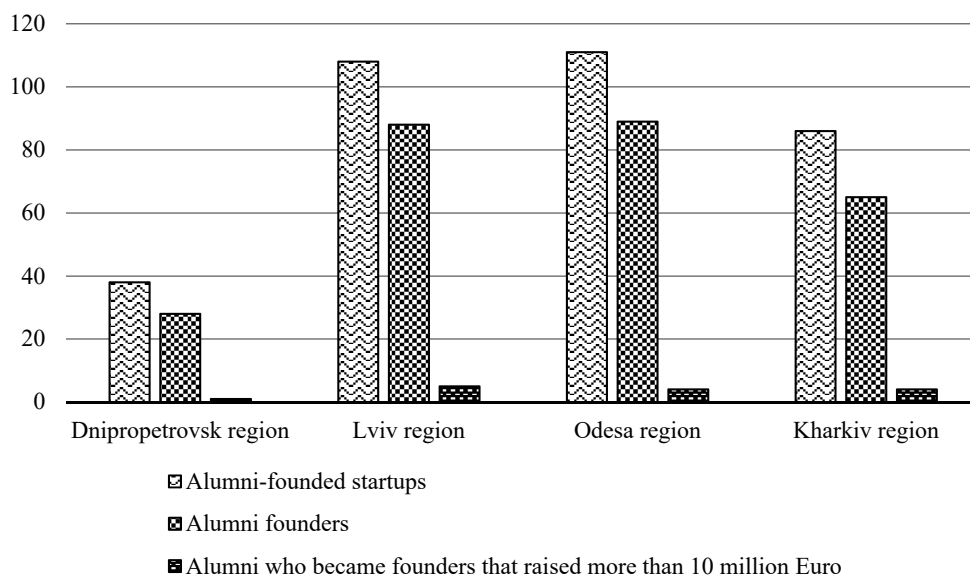


Figure 2. The number of graduates of higher education institutions in regions with a high level who take up start-up activities

Source: Compiled by the author based on Dealroom data (University of Ukraine, n.d.).

According to the "Ukrainian Startup Ecosystem" report, dated January 2022, 10.8 % of startup head offices were located in Kharkiv region, 8.2 % in Lviv region, 3.8 % in Dnipropetrovsk region, and 3.2 % in Odesa region. A study of the report on the impact of war on startups in December 2022 showed that the increase occurred in Lviv region by up to 10 % and in Odesa region by up to 4 %, Kharkiv region suffered the most losses, the number of head offices decreased to 5 %, Dnipropetrovsk region also notice reduction to 2 % (Reports Polish-Ukrainian Startup Bridge, Ukrainian Startup Fund, Warsaw Stock Exchange, 2022).

The number of startups and the value of the ecosystem in high-level regions tend to increase yearly. The researched areas with a high level of development of the startup ecosystem, together with Kyiv, formed the five main centers of development of the IT sector in Ukraine, in particular, an important role is played by IT clusters, which also influence the ecosystem through the implementation of projects aimed at the development of a favorable environment for technological business, activation of startups in the student environment, investment forums (Kolomiyets', 2016).

Startups operate mainly in cities with a population of more than 100 000 inhabitants, that is, in large urban centers, 6 % of startups are located in small towns, and more often in rural areas than in small cities (Reports Polish-Ukrainian Startup Bridge, Ukrainian Startup Fund, Warsaw Stock Exchange, 2022).

For regions with an average level of development of the startup ecosystem (before the full-scale invasion, *Table 4*), the development of projects and the implementation of measures to support and develop the ecosystem were characterised as:

*Donetsk region:* Industrial enterprises and production facilities were lost due to hostilities in the territory of the region, which hurt the economic development of the region, at the same time, networks of Sikorsky Challenge startup schools at universities developed, the USAID project "Economic Support of Eastern Ukraine" was created for the development of the innovation ecosystem of eastern Ukraine: Starobilsk – Severodonetsk – Slovyansk – Kramatorsk – Pokrovsk – Mariupol, the presence of IT clusters (IT-cluster Donbas, Mariupol IT-cluster, IT-cluster Reactor), the largest in the region "Startup Center 1991" operated in Mariupol (for 2 years, startups of this center received USD 600 thousand of investments) (Innovative reintegration: how startups in the east create new opportunities, 2021), an acceleration program based on the GCIP Regional Accelerator in Donetsk region;

*Zaporizhzhia region:* cooperation between state organizations and business accelerators, conducting activities to strengthen the region's business potential in youth entrepreneurship development and creating business hubs.

Table 4

The region with an average level of the startup ecosystem

Region	Number of startups	Number of coworking spaces and hubs	Number of incubators, accelerators	Number of universities	Product companies	Service companies	Rating
	Matrix of standardized coefficients						
Donetsk	5	1	4	10	0	0	0.5260
	0.0446	0.0313	0.1538	0.5000	0	0	
Zaporizhzhia	16	3	3	15	18	23	0.7816
	0.1429	0.0938	0.1154	0.7500	0.0142	0.0759	

Source: compiled by the authors based on (Akselatory Ukrainy, n.d. Ukrainian Tech Ecosystem Overview, n.d. Ecosystem metrics, n.d. Ukraine Startup Ecosystem Overview, 2022).

The most significant part of graduates engaged in startup activities concentrated in the Vasyl’ Stus Donetsk National University, which since 2014 has been territorially located in Vinnytsia region due to the occupation. Zaporizhzhia region is characterized by extensive experience in mechanical engineering and production in such fields as automotive, aerospace, and energy, startups in these sectors can use the existing infrastructure to develop their ideas and commercialize innovative products or services.

An important direction in support of startups during the war is the creation of programs, in particular, 1991 Reload (Donetsk, Luhansk, Zaporizhzhia, Kharkiv, Kherson, Mykolaiv, and Odesa regions), opportunities for recovery and the search for new directions of development are allocated for startups (Program for restoring the operation of startups in the eastern and southern regions of Ukraine, 2022).

Regions with low levels of the startup ecosystem are characterized by expanding the network of supporting elements and creating communication platforms with business and state authorities. Of great importance in the development of startup ecosystems for the regions, as mentioned earlier, is the activity of regional development agencies, which also establish partnerships with international organizations and promote regions as places for investment and entrepreneurship (Table 5).

The largest startup concentration is in Vinnytsia, Ivano-Frankivsk, and Mykolaiv regions (Figure 3). According to the "Digital Development Program for 2018–2022" in the implementation report in 2021 in the Vinnytsia region, support for the activities of the Startup School "Sikorsky Challenge" was allocated UAH 300 thousand was given from the city budget to equip a prototyping laboratory for startups and innovators in the city of Vinnytsia, a memorandum was signed on the creation of the Innovation Cluster, as well as the filling of the ecosystem of the "Krystal" innovation and technology park, the task of which is to establish practical cooperation between educational institutions, institutions, businesses, authorities, and the city community (Report on the implementation of the Digital Development Program for 2018–2022 in 2021, 2021).

*Table 5*

The region with a low level of the startup ecosystem

Region	Number of startups	Number of coworking spaces and hubs	Number of incubators, accelerators	Number of universities	Product companies	Service companies	Rating
	Matrix of standardized coefficients						
Vinnytsia	8	3	1	9	16	19	0.4711
	0.0714	0.0938	0.0385	0.4500	0.0126	0.0627	
Zhytomyr	4	0	0	7	7	4	0.3521
	0.0357	0	0	0.3500	0.0055	0.0132	
Ivano-Frankivsk	9	3	1	6	12	14	0.3301
	0.0804	0.0938	0.0385	0.3000	0.0095	0.0462	
Kirovohrad	4	0	1	7	2	3	0.3541
	0.0357	0	0.0385	0.3500	0.0016	0.0099	
Mykolayiv	7	2	2	8	17	7	0.4177
	0.0625	0.0625	0.0769	0.4000	0.0134	0.0231	
Ternopil	11	1	2	6	10	7	0.3273
	0.0982	0.0313	0.0769	0.3000	0.0079	0.0231	
Cherkasy	8	0	0	8	15	9	0.4076
	0.0714	0	0	0.4000	0.0119	0.0297	

*Source:* compiled by the authors based on (Akseleratory Ukrayiny, n.d. Ukrainian Tech Ecosystem Overview, n.d. Ecosystem metrics, n.d. Ukraine Startup Ecosystem Overview, 2022).

The largest startup concentration is in Vinnytsia, Ivano-Frankivsk, and Mykolaiv regions (*Figure 3*). According to the "Digital Development Program for 2018–2022" in the implementation report in 2021 in the Vinnytsia region, support for the activities of the Startup School "Sikorsky Challenge" was allocated UAH 300 thousand was given from the city budget to equip a prototyping laboratory for startups and innovators in the city of Vinnytsia. a memorandum was signed on the creation of the Innovation Cluster, as well as the filling of the ecosystem of the "Krystal" innovation and technology park, the task of which is to establish practical cooperation between educational institutions, institutions, businesses, authorities, and the city community (Report on the implementation of the Digital Development Program for 2018–2022 in 2021, 2021).

Ternopil Region has the tools to build an innovative ecosystem. After all, a business incubator and a technology park operate here, the Tempus training and innovation entrepreneurship program is implemented, and a technical university operates here. At the same time, the depression of the region, the lack of strong economic ties with a real business, and the incompleteness of the Technopark brand as an innovative leader negate these opportunities (Bakushevych et al., 2019). However, it is an essential perspective for the Ternopil region that in the Global Startup Ecosystem 2023 report, the startup ecosystem of Ternopil is among the world's top 1000 (Ukraine Startup Ecosystem Overview).

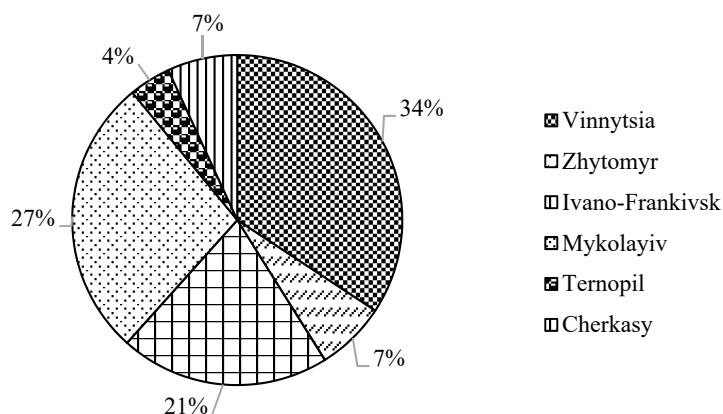


Figure 3. Percentage distribution of startups in regions with a low level of the startup ecosystem

Source: Compiled by the author based on (Reports Polish-Ukrainian Startup Bridge, Ukrainian Startup Fund, Warsaw Stock Exchange, 2022).

Ternopil National University of Economics and Ivan Pulyu Ternopil National Technical University have been played a vital role in the startup ecosystem, providing a skilled workforce and promoting entrepreneurship through specialized programs and initiatives (Figure 4). They offer courses and resources to develop entrepreneurial skills and encourage students to implement startup ideas. According to Dealroom, the ecosystem value is Zhytomyr region – USD 65 thousand, Mykolaiv and Ternopil regions share USD 500 thousand, and the highest value is USD 1.8 million in Cherkasy region.

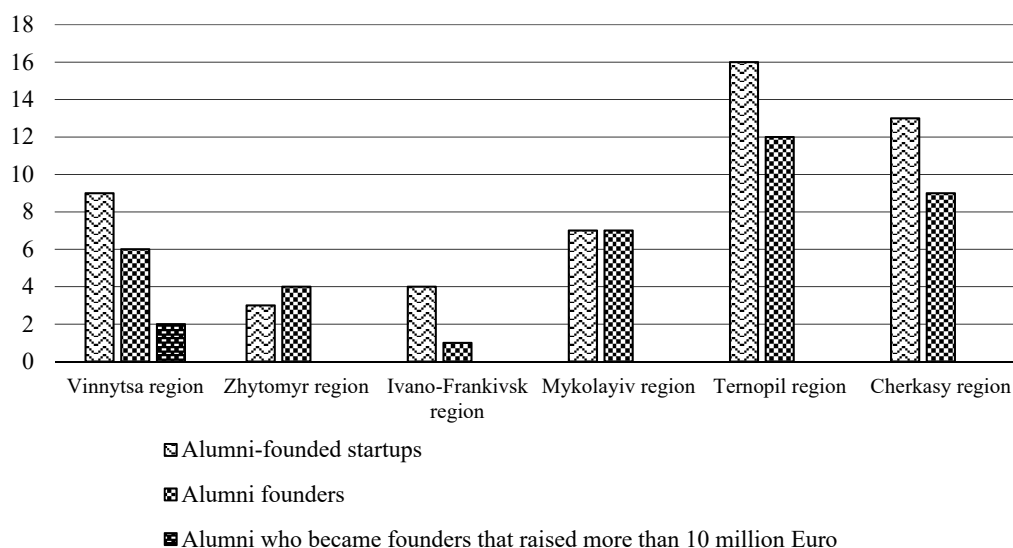


Figure 4. The number of graduates of higher education institutions in regions with a high level who take up start-up activities

Source: Compiled by the author based on Dealroom data (University of Ukraine, n.d.).

The regions need to expand the opportunities for financing startups through the involvement of venture capital funds, business angels, or the creation of local investment funds. For startups at the initial stages, an urgent issue is the expansion of coworking spaces, accelerators, and incubators, which can function based on higher education institutions, business structures, or independently, as well as the organization of regular networking events, industry conferences, and mentoring programs can facilitate communication between startups, industry experts and investors.

In the regions with the lowest level, regional development agencies in each of the specified areas of Ukraine conduct various activities to support the startup ecosystem and promote the development of innovative businesses in the region (*Table 6*).

*Table 6*

The regions with a low level of the startup ecosystem

Region	Number of startups	Number of coworking spaces and hubs	Number of incubators, accelerators	Number of universities	Product companies	Service companies	Rating
Volyn	6	1	2	3	7	4	0.1802
	0.0536	0.0313	0.0769	0.1500	0.0055	0.0132	
Zakarpattia	3	0	1	1	4	9	0.0748
	0.0268	0	0.0385	0.0500	0.0032	0.0297	
Rivne	4	0	2	5	13	3	0.2644
	0.0357	0	0.0769	0.2500	0.0103	0.0099	
Sumy	2	0	3	4	5	5	0.2322
	0.0179	0	0.1154	0.2000	0.0040	0.0165	
Luhansk	1	0	2	2	0	0	0.1265
	0.0089	0	0.0769	0.1000	0	0	
Poltava	6	4	2	5	11	7	0.2958
	0.0536	0.1250	0.0769	0.2500	0.0087	0.0231	
Kherson	4	0	1	6	4	4	0.3049
	0.0357	0	0.0385	0.3000	0.0032	0.0132	
Khmelnysk	4	1	1	6	2	5	0.3066
	0.0357	0.0313	0.0385	0.3000	0.0016	0.0165	
Chernivtsi	6	1	1	5	3	10	0.2625
	0.0536	0.0313	0.0385	0.2500	0.0024	0.0330	
Chernihiv	4	0	1	5	11	7	0.2566
	0.0357	0	0.0385	0.2500	0.0087	0.0231	

*Source:* compiled by the authors based on (Akseleratory Ukrayiny, n.d. Ukrainian Tech Ecosystem Overview, n.d. Ecosystem metrics, n.d. Ukraine Startup Ecosystem Overview, 2022).

The small number of startups in the lowest-performing regions implies relatively limited entrepreneurial activity in these regions. This may be due to several factors, such as a need for more awareness of entrepreneurship, limited access to financing, or a less developed startup culture. To improve startup ecosystems, efforts should focus on encouraging entrepreneurship and creating an environment that promotes and supports the creation of new businesses. In the studied areas, graduates are involved in startups from the leading higher education institutions in regions.

Regional development agencies in these regions provide several services and support for startups, including:

- provision of information and advice on business development, financing opportunities, and market research;
- organization of various startup events and competitions, such as hackathons, presentation competitions, and startup weekends, which offer opportunities to communicate and get to know potential investors and partners;
- providing training and educational programs such as startup schools, mentoring programs, and incubators to help entrepreneurs develop their skills and business ideas;
- facilitating access to funding sources, including grants, loans, and venture capital, as well as the connection of startups with investors and financial institutions;
- creating favorable conditions for the development of startups, such as providing tax incentives, regulatory support, and infrastructure development, to attract and retain talent and investment in startups.

The above measures contribute to the development of the startup ecosystem in these regions, creating a favorable environment for the growth and success of startups. Regional development agencies act as a bridge between startups and various stakeholders, including government, investors, academic institutions, and industry associations, to facilitate collaboration and knowledge sharing. By supporting startups, the agencies help stimulate innovation, create jobs, and stimulate economic growth in their regions.

Internal and external factors control startup ecosystems. External factors, including the financial climate, the market, and large corporations – affect the overall structure of the ecosystem and how everything functions in it. A startup ecosystem in similar fields, but in different regions, can ultimately act differently, this happens due to different entrepreneurial cultures and pools of resources. Also, a separate component that can lead to significant changes in the functions of regional ecosystems is the accumulation and application of knowledge and skills and the attraction of additional talents from other regions. The ecosystem assessment by regions of Ukraine was carried out based on a multifactorial comparative analysis, which allows the distribution of regions according to the potential for creating startups. The importance of rating the ecosystem of regions is determined by the fact that, based on quantitative data, it is possible to identify the advantages and disadvantages of each ecosystem to determine the main strategic directions for improvement in individual positions. The dynamism of regional startup ecosystems highlights the need for further research and identification of additional factors and entities that directly or indirectly impact it.

### **Conclusions**

The rating of regions consists of five levels: highest, high, medium, low, and lowest. The highest level is characterized by a sufficient number of supporting elements that help startups find financing options and accelerate

the processes of entering the market. The high level has a dynamic ecosystem that helps early-stage startups find support and funding programs, including accelerators and incubators, clusters, and events. The mid level has a growing ecosystem, and the existing business structure is conducive to developing the startup movement in the region. The low level has the potential for further development and additional initiatives by local authorities and business structures. According to the ranking, the highest level is in Kyiv region, the high level is noted in Dnipropetrovsk, Lviv, Odesa, and Kharkiv regions, and the average level is in Donetsk and Zaporizhzhia regions. Other regions belong to the lower and lowest levels, which emphasizes the prospects for developing startup ecosystems in the regions. Kyiv region is characterized by many successful startups that have become unicorns as part of scaling or growing into large enterprises. Based on these conclusions, it is possible to formulate proposals for developing startup ecosystems in different regions. Regions with the highest level can focus on maintaining and expanding their existing ecosystem by providing additional support and funding for startups. High-performing regions can focus on further developing their dynamic ecosystem by creating more clusters and events to attract startups and investors. Mid level regions can focus on increasing supporting elements to make it easier for startups to find funding and scale. Regions with a low level can focus on conducting competitions and hackathons involving the IT community to develop a startup community. Overall, the research has been highlighted the importance of a robust startup ecosystem for developing innovation and entrepreneurship in the region and provides a basis for evaluating and comparing startup ecosystems across regions.

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**Conflict of interest.** The author certifies that she doesn't have financial or non-financial interest in the subject matter or materials discussed in this manuscript; the author has no association with state bodies, any organizations or commercial entities having a financial interest in or financial conflict with the subject matter or research presented in the manuscript.

The author has not received any direct funding for this research.

Mazur A. Regional startup ecosystems of Ukraine. *Scientia fructuosa*. 2023. № 5. S. 139-156. [https://doi.org/10.31617/1.2023\(151\)09](https://doi.org/10.31617/1.2023(151)09)

*Received by the editorial office 21.04.2023.*

*Send for revision 19.05.2023.*

*Accepted for printing 26.06.2023.*

*Published online 26.10.2023.*