JMFS
Journal of Management and Financial Sciences

Volume XVIII
•
Issue 57
pp. 9–31
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Start-up Support Ecosystems in Central and Eastern Europe

Abstract

This study fills the research gap as to how start-ups are supported in Central and Eastern European (CEE) countries by identifying the development level of different factors of start-up ecosystems support and showing the countries that are leading in certain areas. It further builds on and deepens the research conducted in the years 2019–2023, with the current study based on the latest available reporting period data for the year 2023.

In order to reach the research objective, the authors used several research methods, including literature analysis, secondary sources analysis, statistical analysis, and an expert panel conducted using the Delphi and binary comparison techniques. The results show that Lithuania and Estonia are the leaders in start-up support ecosystems in CEE, while Poland, Czechia, Slovenia, and Latvia follow in terms of start-up support ecosystems maturity.

The research results have several practical implications regarding start-up support ecosystems evolution, data identification, and institutional best practice transfer that impact the success of CEE countries. Based on the recent reporting period data, the study fills the existing research gap in terms of a synthetic summary of start-up support ecosystems in CEE countries.

Keywords: start-up ecosystems, start-up accelerator, start-ups, venture capital, artificial intelligence
JEL Classification: L26, M13

Introduction

Central and Eastern Europe (CEE) has recently become an attractive destination for start-ups, observing a growing tech scene with many innovative enterprises, and home to numerous organisations and initiatives supporting start-ups. Start-up support ecosystems are the subject of studies and rankings, both national and international, examining both public policies aimed at entrepreneurship and innovation, as well as various factors that support start-ups at all stages of their development.

According to the Organisation for Economic Co-operation and Development [OECD, 2020], Central and Eastern European countries include Albania, Bulgaria, Croatia, Czechia,

Estonia, Lithuania, Latvia, Poland, Romania, Slovakia, Slovenia and Hungary. For the purposes of this study, this group has been expanded to include Ukraine and, under the common name CEE, is subject to in-depth and systematic research on start-up support ecosystems. The team of authors recognised a lack of comprehensive analyses of start-up support ecosystems relating to this geographic area. This study is relevant for start-up ecosystem stakeholders, who may benefit from the outlined insights, enhancing the start-up support ecosystem in CEE.

The aim of the study is therefore to fill the identified theoretical gap by answering the question of how CEE countries support start-up creation and growth. The specific objectives of this study include answering the question at which stage of development are the various factors comprising start-up support ecosystems in CEE countries, and identifying which CEE countries achieve the highest level of advancement in creating start-up support ecosystems.

The study begins with a presentation of the research methodology, indicating the research methods and techniques adopted to achieve the above-mentioned specific objectives, the temporal and geographical scope of the study, and its duration. In the subsequent chapters, the authors present the various factors comprising start-up support systems in CEE countries. This is followed by the empirical section of the study, concerning individual start-up support factors, before concluding by providing a synthetic assessment and ranking of start-up support ecosystems in CEE countries and Ukraine. The conclusion section presents findings and recommendations for the theory of start-up support ecosystems and economic practice in the studied area.

Theoretical background

In recent years, entrepreneurial ecosystems and their ability to foster innovation and economic development have attracted increasing attention from researchers, policy-makers, and business practitioners [Autio et al., 2018; Fernandes Ferreira, 2021; Roundy et al., 2018]. Start-up support ecosystems were defined by Spiegel [2017, p. 49] as "a union of localised cultural outlooks, social networks, investment capital, universities, and active economic policies that create environments supportive of innovation-based ventures". Although the ecosystems concept is cross-disciplinary in nature and used in financial, economic, socio-demographic or political research areas, only a few research papers and reports have so far analysed start-up support ecosystems relating to CEE countries specifically, with international studies indicating a diversity of factors examined and countries included. A summary highlighting the existing gap, which this study aims to fill, is presented in Table 1.

We aim to fill this gap by contributing to existing knowledge on how CEE countries support start-up development, what are the stages of their entrepreneurial ecosystems' development, and which ecosystems in CEE are the most developed. An important context for the research is the influence of AI on start-ups from the CEE region.

Table 1. Overview of selected factors of start-up support ecosystems and the geographic scope of the studies

Institution, Research Title, Year of Publication	Selected factors of start-up support ecosystems	Does the study include all 12 CEE countries and Ukraine?
European Startup Network, Report on a survey of EU start-ups and the COVID-19 pandemic [2023]	Assessment of local public support during the COVID-19 pandemic, recommendations and challenges	Broadly, without the CEE context
Startup Genome, Global Startup Ecosystem Report [2023]	Local networks, global networks	No (3 out of 13)
European Commission, European Innovation Scoreboard [2023]	Human resources, attractiveness of the research and development system, intangible assets, business environment, business financing, private investments	Yes (13 out of 13)
European Commission, Science, Research and Innovation Performance of the EU [2024]	Demographic potential, economic productivity, economic growth, institutions, and additionally this edition covers the COVID-19 pandemic and Russia's invasion of Ukraine	No (12 out of 13), excluding Ukraine
World Intellectual Property Organization, Global Innovation Index [2023]	Institutions (policy, regulations, business environment), human capital (including education), infrastructure (IT technologies), market, innovation networks, knowledge creation, knowledge absorption, knowledge diffusion	Yes (13 out of 13)
European Startups, The Past, Present and Future of European Tech [2021]	Recommendations for start-ups and EU member states in various areas (e.g. financing, talent acquisition, legal solutions)	Broadly, CEE analysed as a whole

Source: own elaboration based on: European Innovation Scoreboard, European Commission [2023]; Global Innovation Index, World Intellectual Property Organization [2023]; Global Startup Ecosystem Report, Startup Genome [2023]; Report on the survey of EU start-ups, European Startup Network [2023]; Science, Research and Innovation Performance of the EU, European Commission [2024]; The Past, Present and Future of European Tech, European Startups [2021].

Research methodology

CEE countries are taking various steps to improve their start-up support ecosystems, with the aim to make these systems more entrepreneur- and investor-friendly, to achieve dynamic growth, and to support start-ups in expanding internationally and achieving global success.

To systematise the approach to studying start-up support ecosystems, the team of authors conducted an expert panel consisting of entrepreneurship and innovation researchers, examining six factors that make up the start-up support ecosystems of CEE countries. These are as follows:

- socio-economic development;
- tax systems;
- intellectual property protection;
- start-up accelerators;
- clusters and network organisations that unite startups;
- venture capital funds.

The literature published by international organisations was analysed in order to determine the development stage of each factor in the start-up support ecosystems of CEE countries. Additionally, this goal was also pursued using document analysis and source data, including

legal acts of individual CEE countries, electronic audits (i.e. research of official websites of institutions related to the presented area based on prepared research questions), time series data analysis, and statistical analyses.

To identify which CEE countries are the most advanced in creating start-up support ecosystems, the authors conducted an expert panel using the Delphi method, in which the co-authors of this research participated as subject matter experts within the domains they were researching and successfully published about in the past. A key feature of the Delphi method was the systematic use of the binary comparison technique of all start-up ecosystem factors by the panel experts, enabling an assessment of the relative weights of start-up ecosystem factors. For the six factors comprising start-up support systems, the weights of each factor were determined using the binary comparison technique (with the sum of all weights totalling 100%). The expert researchers responsible for preparing the chapters dedicated to each factor of the start-up support ecosystems then rated them across the examined countries on a scale of 1 (very low development) to 5 (very high development) for each of the 13 countries examined. The results of the Delphi method panel are presented in the form of a ranking indicating leaders in start-up support ecosystems in the CEE region. Additionally, to showcase start-up successes from the CEE region, the case study method was used, allowing for the presentation of aspects explaining the successes of enterprises from CEE countries.

The research team aimed to use the latest available data sources to enable international comparisons of the factors of start-up support ecosystems in the CEE region, including the latest available data from 2023. The geographical scope of the study includes CEE countries as defined by the Organisation for Economic Co-operation and Development (OECD): Albania, Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. For cognitive reasons, Ukraine was also included in the study of selected factors of start-up support ecosystems. This study was conducted from 27 June to 19 July 2024.

Elements of start-up support ecosystems in CEE countries

The factors comprising the start-up support ecosystems in CEE countries are presented and discussed in the subsequent subchapters of the study, including socio-economic development, tax systems, intellectual property protection, start-up accelerators, regulatory sandboxes, clusters, and venture capital funds. In the section following the discussion of the individual factors of the ecosystems, their rankings are presented in relation to all factors, along with both detailed and synthetic assessments applied for the studied countries.

Analysis of the level of regional development in CEE countries

The level of economic development is an important element of the environment, and can undoubtedly significantly influence not only the investment attractiveness of individual countries, but also stimulate the creation and growth of start-ups.

Numerous studies confirm the existence of a relationship between the level of economic development and activity in the area of new innovative enterprises, indicating it as one of the areas positively influencing entrepreneurship [Highfield, Smiley, 1987; Mata, 1996], with studies clearly indicating a positive relationship between economic growth and the formation of new enterprises [Audretsch, Acs, 1994; Ilmakunnas, Topi, 1996].

The countries of Central and Eastern Europe are important partners in the process of European integration, although, unfortunately, the level of their economic development differs in many respects from that of other EU countries. The analysis of the level of regional development differentiation was conducted, with Table 2 presenting changes in the GDP per capita level from 2009 onwards, relative to the EU average for each member state.

Table 2. GDP per capita in PPS (real expenditure per capita in PPS 2020=100)

GDP per capita in PPS (real expenditure per capita in PPS 2020=100)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Albania	28	29	30	30	29	30	30	30	30	30	30	31	31	34	35
Bulgaria	44	45	46	47	46	47	48	49	50	52	53	55	57	62	64
Croatia	63	61	61	62	62	61	61	63	64	65	67	65	70	73	76
Czechia	87	84	84	84	86	88	89	89	91	92	93	93	92	90	91
Estonia	64	66	71	74	76	78	76	77	79	82	83	85	86	85	81
Hungary	65	66	67	67	68	69	70	69	69	71	73	74	75	76	76
Latvia	53	54	56	61	63	64	65	66	67	69	69	72	71	72	71
Lithuania	57	61	66	71	74	76	75	76	79	81	84	88	89	89	86
Poland	60	63	65	67	67	67	69	69	69	71	73	76	77	80	80
Romania	52	52	55	57	55	56	57	59	63	66	70	73	73	75	80
Slovakia	72	76	76	77	78	78	79	73	71	70	71	74	73	71	73
Slovenia	86	85	84	83	83	83	83	84	86	87	89	89	90	90	91

Source: Eurostat [2024].

An analysis of the average growth rate of change for these values shows that the highest average growth rates during the period under review were observed in Lithuania (+3.49% on average per year) and Romania (+2.86%). Table 3 shows the average annual growth rate for the period under study.

Most of the regions (NUTS2) within the analysed countries will be covered by preferential funding opportunities within the framework of cohesion funds in the financial perspective 2021–2027, meaning that from the point of view of start-ups, preferential conditions will

continue to be initiated to support their development with European funds, including direct management funds at European Commission level and shared management funds at European Union country level.

Table 3. Average growth rate of GDP per capita (2009–2023)

Lithuania	103.49
Romania	102.86
Bulgaria	102.67
Latvia	102.38
Poland	102.24
Estonia	102.21
Albania	101.5
Hungary	101.21
Croatia	101.14
Slovenia	100.35
Czechia	100.26
Slovakia	99.89

Source: authors own calculation on the basis of GDP per capita in PPS published by Eurostat on the European Union's official website "Europa"[2024].

In 2023, businesses across the world had to deal with major increases in production prices, most notably those of electricity, gas and heating, but no less important was the increase in prices of raw materials, semi-finished products, and especially the rising cost of wages, which has led to one of the highest business bankruptcy totals since 2011, according to S&P Global Intelligence [NPR, 2023].

Companies in all CEE countries were also affected by electricity price increases in 2023, especially in first half year, when inflation was observed in countries such as Poland, Croatia, Slovakia, Hungary, Slovenia, Czechia and Albania. However, in the second half of the year energy prices rose only in the three following countries: Poland, Slovenia and Albania, which is presented in Table 4.

Table 4. Electricity prices per kWh for non-household consumers in EU-27 and CEE countries in 2022 and 2023 in EUR

Country	2022-S1	2022-S2	2023-S1	2023-S2
Latvia	:	:	:	:
Lithuania	0.1925	0.3257	:	:
Ukraine	:	:	:	:
Poland	0.1707	0.1969	0.2737	0.2713
Slovenia	0.1856	0.2188	0.2409	0.2491
Albania	0.1268	0.1316	0.1362	0.1468
Czechia	0.2174	0.2385	0.2536	0.2335
Slovakia	0.2594	0.3051	0.3310	0.2940

cont. Table 4

Country	2022-S1	2022-S2	2023-S1	2023-S2
European Union – 27 countries (from 2020)	:	0.2534	0.2492	0.2355
Croatia	0.1802	0.2744	0.3165	0.2539
Hungary	0.2313	0.3257	0.3486	0.3019
Bulgaria	0.1968	0.2064	0.1725	0.1559
Estonia	0.1847	0.2821	0.1862	0.1862
Romania	0.2512	0.3655	0.2028	0.1975

Source: Electricity prices for non-household consumers – bi-annual data (from 2007 onwards) [Eurostat, 2024].

In 2023, the rising value of the Labour Cost Index was also challenging for companies in CEE. The Labour Cost Index includes employee compensation, with wages and salaries in cash and in kind, employers' social security contributions, and employment taxes regarded as labour costs minus any subsidies received. CEE countries experienced an average growth rate of 0.72 points in 2023, in comparison with a decrease of 0.43 points for EU-27 countries. Significantly impacted were Hungary, Latvia and Slovenia, which is presented in the Table 5.

Table 5. Labour cost index values for EU-27 and CEE countries in 2023

Countries	2023-Q1	2023-Q2	2023-Q3	2023-Q4
Croatia	11.4	14.5	16.3	15.6
Czechia	7.4	7.9	8.2	6.0
Estonia	11.7	13.2	11.0	10.8
European Union – 27 countries (from 2020)	5.4	4.9	5.6	4.1
Hungary	9.6	17.2	15.1	16.2
Latvia	6.3	12.2	12.0	10.9
Lithuania	13.6	12.4	11.2	11.2
Poland	10.8	13.3	12.2	13.1
Romania	14.4	14.4	15.1	16.8
Slovakia	7.5	9.2	7.3	9.0
Slovenia	7.2	14.5	5.0	11.8

Source: Labour cost index by NACE Rev. 2 activity – nominal value (quarterly data) [Eurostat, 2024].

Tax systems for start-ups in CEE countries

Start-ups are considered by many scholars as a key source of innovation, entrepreneurship, job creation, productivity growth or economic and societal impact [Adelino et al., 2017; Audretsch et al., 2020; Darnihamedani et al., 2018; Decker et al., 2014; Edwards, Todtenhaupt, 2020], although taxation can affect the number of funded start-ups. Taxes have a strong relationship with start-ups rates [Braunerhjelm, Eklund, 2014; Cullen, Gordon, 2007; Darnihamedani et al., 2018; Gentry, Hubbard, 2000] because they reduce the expected entrepreneurial profit [Darnihamedani et al., 2018]. Taxes, as refundable tax savings from

business losses or a compensating surtax on the profits of start-ups, may also alleviate the various market failures faced by start-ups at the beginning of their entrepreneurial activities [Gordon, Sarada, 2018].

From the point of view of start-up expectations, what matters most are the tax incentives that a given country may offer to start-up entrepreneurs, and the reduction of bureaucracy and support in raising capital [Kollmann et al., 2016]. Governments of Central and Eastern European countries can stimulate the increase of the start-ups funding through appropriately designed tax systems dedicated to start-ups [Basso et al., 2018]. An attractive tax system for start-ups should have a low level of complexity and contain simple and stable rules, and should also feature a small number of tax payments per year, as well as a relatively short time needed to settle and pay taxes.

In the United States, Startup Acts, such as the 2012 Jumpstart Our Business Startups Act, encourage funding of small businesses by easing many of the country's securities regulations or granting them a wide range of benefits, from simplified administrative requirements to tax reliefs [Audretsch et al., 2020]. Several European countries, including Ireland, the Netherlands, Germany, Sweden, France, Portugal or Spain, similarly to the United States Startup Act, also have comprehensive legislation for promoting the start-up ecosystem. Unfortunately, among Central and Eastern European countries, only Estonia and Latvia introduced complex start-up legislation. Estonia has the highest number of start-ups per capita, according to the State of European Tech 2022 report, and is one of the few countries with no corporate income tax on retained and reinvested profits and relatively low (14–20%) income tax on distributed profits. Meanwhile, in Latvia, the Law on Aid for Start-up Companies provides aid in the form of i) a fixed payment aid programme, personal income tax and enterprise income tax relief; and ii) an aid programme for attracting highly qualified employees, personal income tax and enterprise income tax relief [Bikse et al., 2018].

According to OECD experts, corporate and capital gain tax regimes appear to play a key role in funding new start-ups due to attracting venture capital investments [Breschi et al., 2018]. Similarly, Venancio et al. [2022] underline that corporate taxation is an imperative constraint for entrepreneurship. Among the governments of Central and Eastern European countries, the most frequently used tax incentives were: i) tax holidays, i.e. exemption from paying corporate income taxes (after meeting additional requirements), e.g. in Czechia or Hungary; ii) creation of special economic zones or special industrial zones with privileged taxation, which offer (after meeting additional requirements), e.g. corporate income tax relief, subsidies for new jobs creation, subsidies for strategic investments, or exemptions from real estate tax, e.g. in Poland, Czechia or Latvia; iii) relief for research and development activities in the form of the possibility to deduct costs incurred for research and development from the corporate income tax base after meeting additional requirements, e.g. in Hungary, Lithuania, Poland or Latvia; iv) reducing the tax rate temporarily, e.g. in Romania for the first 24 months for newly established micro entrepreneurs; v) investment tax reduction, e.g. in Romania or Slovakia [Deloitte, 2017–2023; EY, 2017–2023; PwC, 2017–2023].

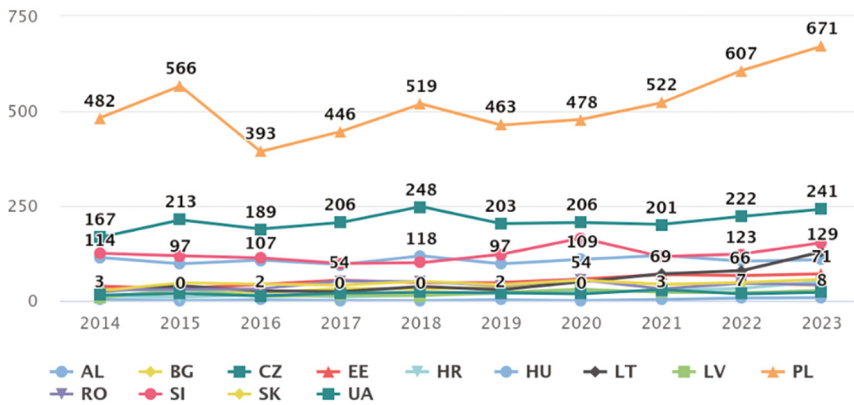
Central and Eastern European countries took several actions in the years 2017–2023 to improve their tax systems and make them more start-up friendly. These countries actively engage in tax competition to boost the competitiveness of their domestic businesses, including start-ups, and to attract investors and entrepreneurs from other countries, including their neighbours.

Intellectual Property protection in Central and Eastern Europe

Intellectual property protection is considered a decisive factor in the development of start-ups. Scholars indicate that start-ups have low awareness of what intellectual property is and find creation and implementation of an intellectual property protection strategy expensive [Baran, Zhumbaeva, 2018]. In this subchapter, intellectual property protection of CEE countries was investigated based on European Patent Office (EPO) data referring to European patent applications and European patents awarded (grants).

In 2023, the biggest number of European patents applications submitted per 1 million citizens was in Slovenia, Lithuania and Estonia, while the lowest number of European patent applications was in Ukraine, Albania and Romania. Research on the number of European patents granted indicates that the biggest number of grants applied to Slovenia, Estonia and Czechia, while the lowest number referred to Ukraine, Albania and Romania. Among all 13 countries researched, Poland accounted for 41.4% of all European patent applications and 39% of European patents granted.

Figure 1. Trends in European patent submissions in 2023



Source: EPO [2023].

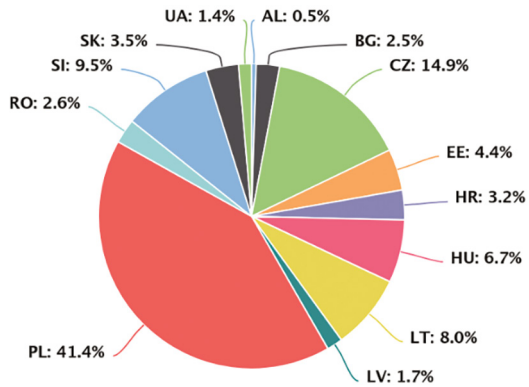
Table 6. Intellectual protection activity in CEE in 2023 in relation to European patents metrics

	Country	Population (in millions) – 2023	European patents (applications) – 2023	European patents (applications) per 1 million citizens – 2023	European patents (granted) – 2023	European patents (granted) per 1 million citizens – 2023
1	Albania	2.83	8	2.83	2	0.71
2	Bulgaria	6.92	40	5.78	23	3.32
3	Croatia	4.04	51	12.64	8	1.98

	Country	Population (in millions) – 2023	European patents (applications) – 2023	European patents (applications) per 1 million citizens – 2023	European patents (granted) – 2023	European patents (granted) per 1 million citizens – 2023
4	Czechia	10.49	241	22.96	134	12.77
5	Estonia	1.33	71	53.38	20	15.04
6	Hungary	9.73	108	11.1	63	6.47
7	Latvia	1.89	27	14.26	15	7.94
8	Lithuania	2.79	129	46.14	20	7.17
9	Poland	37.84	671	17.73	258	6.82
10	Romania	19.2	42	2.19	23	1.20
11	Slovakia	5.46	56	10.26	23	4.21
12	Slovenia	2.11	153	72.55	53	25.12
13	Ukraine	36.7	22	1.67	14	0.38

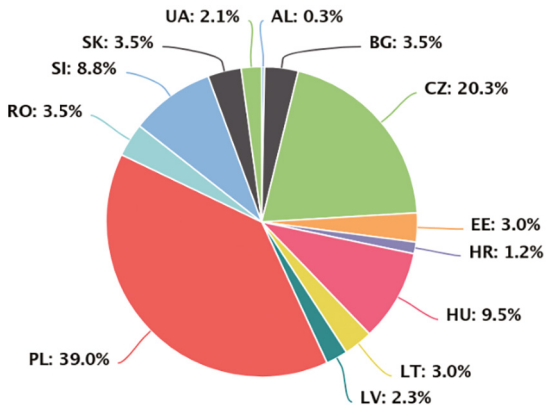
Source: own elaboration based on EPO [2024].

Figure 2. Percentage of European patent applications in the total number of applications submitted in CEE in 2023



Source: EPO [2023].

Figure 3. Percentage of European patents granted in the total number of applications submitted in CEE in 2023



Source: EPO [2023].

Start-up accelerators and clusters in CEE countries

Western European countries continue to dominate start-up rankings, offering better environmental conditions for entrepreneurs compared to Central and Eastern European countries. Prestigious rankings such as *The Global Startup Ecosystem Index Report 2023* and *The Global Startup Ecosystem Index 2023* highlight the changes that occurred in the start-up market in 2023. While the directions of change in the start-up market in 2020–2021 were largely determined by the COVID-19 pandemic, the decisive factor in the years 2022–2023 was the war in Ukraine, which triggered rapid economic and political changes, particularly in Central and Eastern European countries. Additionally, the steady global development of artificial intelligence in 2023 undoubtedly introduced new trends, shaping the further dynamics of this sector. These changes are presented in a comparative summary of start-up accelerators in the Table 7.

Table 7. Start-up Accelerators in CEE countries according to StartupBlink

Country	Place in the Global Startup Rankings					Number of accelerators according to the StartupBlink report					Accelerators rated highest by Startupblink in 2023	Locations with the largest number of accelerators in 2023
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023		
Poland	20	27	30	33	34	10*	10*	10*	20	30	Climate-KIC Accelarator Programme, Reaktor X, Founder Istitute Warsaw, MIT Enterprise Forum CEE, Kogifi, Huge Thing	Warsaw, Krakow, Wroclaw, Poznan, Gdańsk
Estonia	13	11	13	13	12	5	9	11	16	23	Start-up Wise Guys, Superangel, Tartu Science Park, Storytek	Tallinn, Tartu
Romania	38	45	41	39	44	5	5	5	9	14	Spherik Accelerator, Alpha Hub, Techcelerator	Bucharest, Cluj-Napoca, Iași, Timisoara
Hungary	39	37	49	51	50	4	8	7	16	19	CEU InnovationsLab, MKB Fintechlab, OXO Labs, Hiventures, PortfoLion, ACME Labs	Budapest, Debrecen, Miskolc
Slovakia	49	51	56	58	62	3	3	3	5	7	Startup Centre at USP Technicom CEED Tech – Slovakia, Launcher	Bratislava, Kosice
Czechia	22	26	32	32	32	3	6	5	10	14	StartupYard, AI Startup Incubator, VSEM Accelerator, JIC, OPIFER	Prague, Brno, Ostrava, Plzen
Ukraine	31	29	34	50	46	15	12	12	19	28	BERRY, FoodTech accelerator by LvBS, YEP!, Jooble Venture Lab, Valle Impacta, Carrot	Kyiv, Lviv, Dnipro
Bulgaria	35	32	35	36	37	2	6	6	9	20	Start It Smart, Eleven Accelerator Venture Fund, Climate-KIC Accelerator Bulgaria, LaunchHub Ventures	Sofia, Varna, Plovdiv

Country	Place in the Global Startup Rankings					Number of accelerators according to the StartupBlink report					Accelerators rated highest by Startupblink in 2023	Locations with the largest number of accelerators in 2023
	2019	2020	2021	2022	2023	2019	2020	2021	2022	2023		
Lithuania	18	15	16	17	16	3	6	18	24	29	Hostinger, Tesonet, Baltic Sandbox, Kaunas STP, Startup It, TechHub, Tesonet, Bridgio	Vilnius, Kaunas
Slovenia	48	35	46	47	51	2	2	2	2	6	Hekovnik Startup School, ABC Accelerator	Ljubjana, Maribor
Croatia	50	39	37	45	48	N/A	N/A	N/A	1	1	Invento	Zagreb
Latvia	45	36	42	43	47	N/A	2	2	4	7	Startup Wise Guys, TechHub Riga, Overkill Ventures	Riga
Albania	85	72	78	75	72	N/A	1	1	9	8	Oficina, Triple City, Epoka University	Tirana, Shkoder, Vlore

* According to the authors of this study, the number of accelerators in Poland in 2019–2020 is underestimated in the cited StartupBlink report.

Source: own elaboration based on data from www.startupblink.com/accelerators.

The analysis presented for 2023 clearly shows an increase in the number of accelerators in almost all the presented countries, with the exception of Albania, where the number of accelerators decreased from 9 to 8 in 2023, and in Croatia, where there remains only one accelerator, which was established in the capital in 2022. Despite the increasing number of accelerators in Ukraine, the country's position in the Global Startup Ecosystem Rankings has not yet returned to its pre-war status.

Table 8. Clusters in Central and Eastern European countries

Year / Country	2019	2020	2021	2022	2023
Poland	67	71	76	79	82
Romania	51	52	59	63	66
Bulgaria	26	26	29	31	33
Lithuania	24	28	27	29	29
Hungary	23	25	26	28	28
Ukraine	23	14	14	16	26
Czechia	18	20	21	22	35
Croatia	13	14	15	15	15
Estonia	11	14	14	14	14
Latvia	11	13	14	14	14
Albania	2	2	2	2	3
Slovakia	4	15	25	25	28
Slovenia	17	17	19	19	20

Source: own elaboration based on data from the European Cluster Collaboration Platform.

Table 8 shows the number of clusters in various CEE countries from 2019 to 2023. The highest number, steady across the studied periods, is observed in Poland and Romania, while the smallest number of clusters is in Albania. Comparing the data from the last four years, the number of clusters systematically increased in most countries: Poland, Bulgaria, Romania, Czechia, Slovakia, Slovenia, and even Ukraine, while Estonia, Croatia, Latvia, Lithuania and Hungary maintained the same number of clusters as in the previous year.

To summarise, Estonia remains the leader among the studied countries, maintaining 12th place in the global ranking compiled by StartupBlink. Poland, which ranked 34th, dropped one spot in 2023 compared to the previous year, continuing the downward trend since 2019. Despite a better result compared to the previous year, Ukraine ranked 46th in 2023, still far from its position before the Russian invasion, which has had a highly negative impact on the promising and impressive potential of the Ukrainian start-up ecosystem. A decline is also observed in Croatia, despite the emergence of the first accelerator in the country's capital, as well as in Romania, Slovenia, Slovakia and Latvia. The years 2020–2023 in Europe are undoubtedly shaped by a sense of significant uncertainty and threat, which was also felt by the start-up ecosystem. The sense of considerable uncertainty and threat in Europe, initiated by the COVID-19 pandemic and then deepened by the armed conflict on Ukraine's eastern border, has also been intensified by the accelerating technological progress in the fields of automation and artificial intelligence. On the one hand, the development of technology has created new opportunities for innovation and efficiency, while on the other, it has highlighted the security and business ethics risks involved.

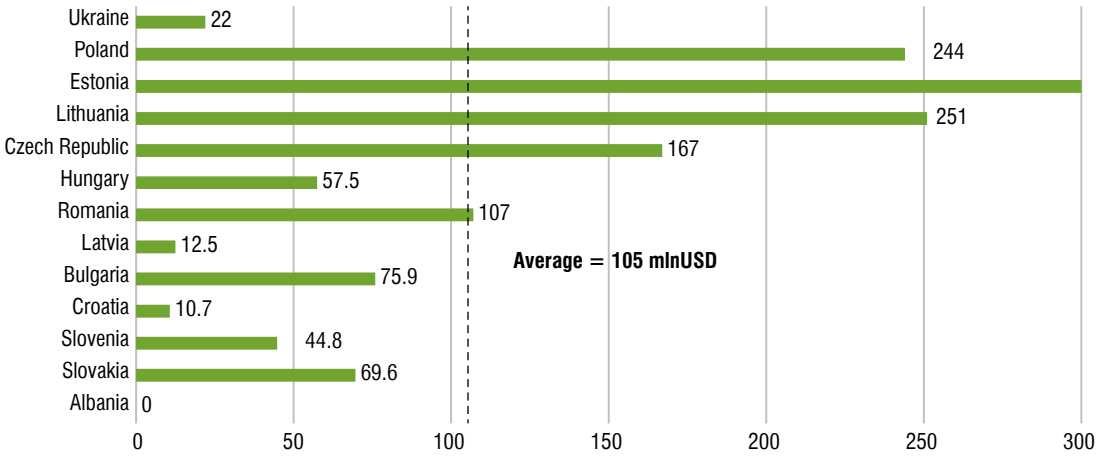
Activity of venture capital (VC) funds in Central and Eastern Europe

Academic researchers point out that VC funds play an important role in early-stage financing of start-ups due to their unique competences of investments screening, negotiation and investment monitoring of risky business fundamental for economic growth [Bonini, Capizzi, 2019]. This subchapter elaborates on the activity of VC funds in Central and Eastern Europe in 2023, with secondary data used in VC activity research derived from the digital investment platform dealroom.co based in Amsterdam. Dealroom.co aggregated data from 3 132 591 technology-oriented enterprises (start-ups and scale-ups), 219 430 investors, and also 884 438 financing rounds on the date of the research performed (29.06.2024).

The cumulated value of VC investments in 2023 in the researched countries amounted to USD 1.37 billion, and was over 3 times lower than in 2022, when it reached USD 4.3 billion. The average cumulated value of VC investments in 2023 was USD 104.9 million per country. In 2023, Estonia, Lithuania and Poland accumulated 58% of the value of all VC investments within the 13 countries researched. The value of VC investments in Poland in 2023 reached USD 244 million and was over 2 times lower than in 2022, when it reached USD 505 million. The cumulated number of investment rounds of VC funds in 2023 in the researched countries added up to 900. The biggest number of investment rounds was realised in Poland, which was

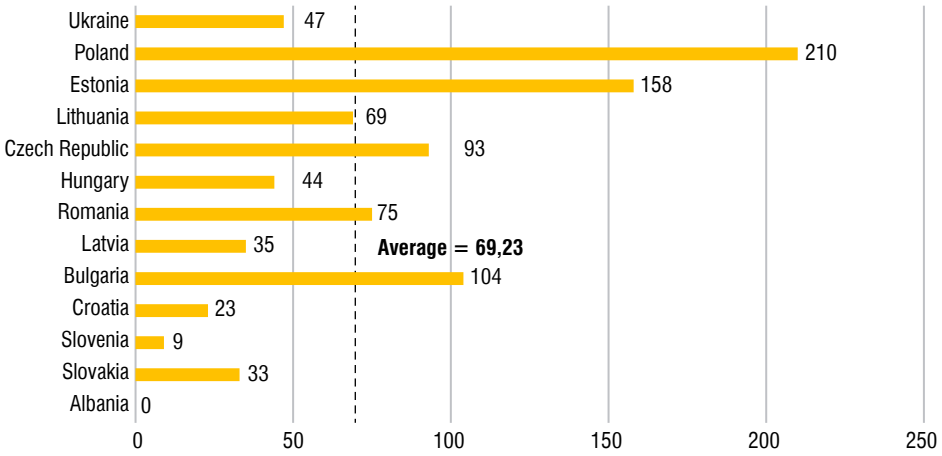
responsible for 23% of investment rounds in researched countries, while the biggest average values of singe investment rounds occurred in Slovenia and Lithuania, where they reached, respectively, USD 4.97 million, and USD 3.64 million. The average value of a single investment round in Poland was USD 1.16 million, over 2 times lower than in 2022. The average value of a single investment round in Estonia, which in 2022 was USD 10 million, dropped to USD 1.9 million in 2023. In 2023, the countries with the biggest value of VC transactions were Estonia, Lithuania and Poland, with a decrease in the value of VC investments occurring in all the researched countries, partially attributed to the lack of public funding subsidising VC fund activities in CEE, the volatile environment, including the post-pandemic environment, and the war in Ukraine.

Figure 4. The cumulated value of VC investments in millions of USD in 2023



Source: own elaboration based on dealroom.co data.

Figure 5. The cumulated number of VC financing rounds in 2023



Source: own elaboration based on dealroom.co data.

Synthetic assessment and ranking of start-up support ecosystems in CEE countries

To assess the level of development of Central and Eastern European countries within the start-up support system, the research team applied a weighted point scoring technique. The countries were analysed in six categories, which were operationalised by experts responsible for research in the selected area. On a scale of 1 (very low) to 5 (very high), they evaluated each country using a previously defined scale, with weights assigned based on a binary comparison technique the create the ranking. This technique involves making pairwise comparisons in which each category is compared to the others, and its importance is determined through a simple majority vote.

During the research using the binary comparison technique, the weights of the individual factors (totalling 100%) that comprise the start-up support ecosystems in CEE countries were determined as follows: socio-economic development – 14.29%, tax systems – 9.52%, intellectual property protection – 4.76%, start-up accelerators – 23.81%, clusters – 19.05%, and venture capital funds – 28.57%.

Table 9. Ranking and overall assessment of individual CEE countries

Position	Country	Total Score	Category	Change in the total score as compared to the ranking published in 2023	Score in the ranking published in 2023
1	Lithuania	4.90	leader	**0.86**	4.05
2	Estonia	4.62	leader	**0.03**	4.59
3	Poland	3.90	rising star	**0.04**	3.86
4	Czechia	3.62	rising star	−0.32	3.94
5	Slovenia	3.33	rising star	−0.01	3.35
6	Latvia	2.95	rising star	−0.22	3.17
7	Romania	2.76	developing system	**0.41**	2.35
8	Slovakia	2.38	developing system	−0.52	2.90
9	Bulgaria	2.33	developing system	−0.48	2.81
10	Hungary	2.33	developing system	−0.11	2.45
11	Albania	1.71	developing system	**0.15**	1.56
12	Croatia	1.67	developing system	−0.41	2.07
13	Ukraine	1.57	developing system	−0.36	1,94

Source: own elaboration [2024].

Adopting a synthetic measure, which is the sum of weighted scores across the individual factors, made it possible to identify the most developed start-up support ecosystems in CEE. In a panel study of experts using the Delphi method, three ranks were established to reflect the level of development of individual countries:

I. "Leader" – a total score of at least 80% (4.00 points or more) on a scale of 1 to 5;
II. "Rising Star" – a total score of at least 60% and a maximum of 79.99% (from 3.00 points to 3.995 points);
III. "Developing" – a total score of less than 60% (less than 3.00 points).

Table 10. Detailed assessments of factors comprising start-up support ecosystems in CEE countries and the combined evaluation of a given country in the context of the entire region

Factor	Weight (%)	Albania	Bulgaria	Croatia	Czechia	Estonia	Lithuania	Latvia	Poland	Romania	Slovakia	Slovenia	Ukraine	Hungary
Development	14.29	0.29	0.43	0.43	0.57	0.57	0.71	0.43	0.43	0.57	0.29	0.71	0.00	0.43
Taxes	9.52	0.19	0.29	0.29	0.38	0.48	0.48	0.48	0.29	0.29	0.29	0.38	0.19	0.29
Intellectual property	4.76	0.05	0.05	0.05	0.10	0.19	0.14	0.05	0.05	0.05	0.05	0.24	0.05	0.05
Accelerators	23.81	0.71	0.71	0.24	0.95	1.19	1.19	0.95	0.95	0.71	0.71	0.95	0.48	0.71
Clusters	19.05	0.19	0.57	0.38	0.76	0.76	0.95	0.76	0.76	0.57	0.76	0.76	0.57	0.57
VC	28.57	0.29	0.29	0.29	0.86	1.43	1.43	0.29	1.43	0.57	0.29	0.29	0.29	0.29
Total score	100	1.71	2.33	1.67	3.62	4.62	4.90	2.95	3.90	2.76	2.38	3.33	1.57	2.33

Source: own elaboration prepared to determine the weights of individual criteria in the set of factors comprising the examined start-up support ecosystems in CEE [2024].

As a result of the analysis, two start-up support ecosystems were identified as "Leaders" (Lithuania and Estonia), four ecosystems qualified as rising stars (Poland, Czechia, Slovenia, Latvia), and eight ecosystems fell into the developing system category (Romania, Slovakia, Bulgaria, Hungary, Albania, Croatia, Ukraine). Table 9 presents the ranking and overall scores for the CEE countries, while Table 10 details the scores of the ten distinguished factors comprising the start-up support ecosystems for each of the analysed countries.

Start-ups and Artificial Intelligence (AI). New perspectives and challenges for entrepreneurs

The introduction of ChatGPT by Open AI at the end of 2022 was a landmark event in the field of new technologies, with the tool finding widespread use at lightning speed, becoming a major technology trend in 2023. The event reinforced previous thinking about the crucial importance of ICT technologies as a driver of innovation and development, although giving priority to AI technologies. AI dominated the public debate on the development of economies and businesses, including start-ups, which was also reflected in the widespread research interest on the issue. AI data was included, for instance, in an annual Eurostat model questionnaires on ICT (Information and Communication Technologies) usage and e-commerce in enterprises, collected on a yearly basis by the National Statistical Institutes (NSIs). The survey population

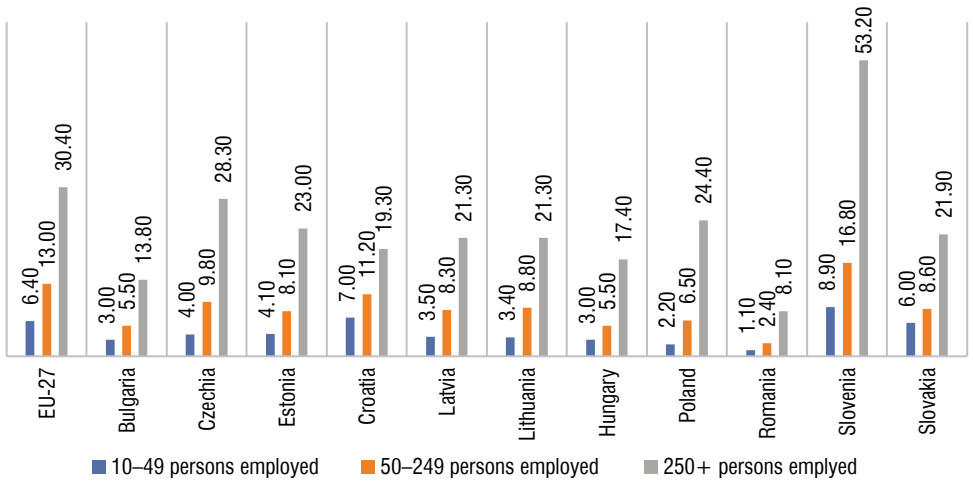
in the study consists of enterprises with 10 or more employees and self-employed persons, whereas the AI technologies covered by the study are successively:

- AI_TTM – Enterprises use AI technology performing analysis of written language (text mining),
- AI_TSR – Enterprises use AI technology converting spoken language into machine-readable format (speech recognition),
- AI_TNLG – Enterprises use AI technology generating written or spoken language (natural language generation),
- AI_TIR – Enterprises use AI technology identifying objects or persons based on images (image recognition, image processing),
- AI_TML – Enterprises use machine learning (e.g. deep learning) for data analysis,
- AI_TPA – Enterprises use AI technology automating different workflows or assisting in decision making (AI based software robotic process automation),
- AI_TAR – Enterprises use AI technology enabling physical movement of machines via autonomous decisions based on an observation of the surroundings (autonomous robots etc.).

Despite extensive discussions on AI technology, based on the abovementioned Artificial Intelligence by size class of enterprise dataset it should be noted that to date they show relatively low use by enterprises in CEE countries, as well as in EU countries in general, especially among enterprises in the SME sector. The exception were enterprises from Slovenia, for which for each of the classes in terms of their size, and the percentage of indications regarding the use of AI technology, exceeded the average for EU-27 countries, with more than 50% of large enterprises (more than 250 employees) declaring use of at least one form of AI technology. However, in general, enterprises in the CEE countries covered in the study were relatively less likely to use at least one the forms of AI technology included in the survey compared to all enterprises in the EU-27, which was particularly true for large enterprises with over 250 employees (11.81% vs. 16.60%). Companies from the CEE countries surveyed were also relatively less likely to consider using AI in their operations compared to the EU average (7.59% vs. 10.00%, respectively), especially companies with 50–249 employees (6.32% vs. 9.60%, respectively), which is presented in Figure 6.

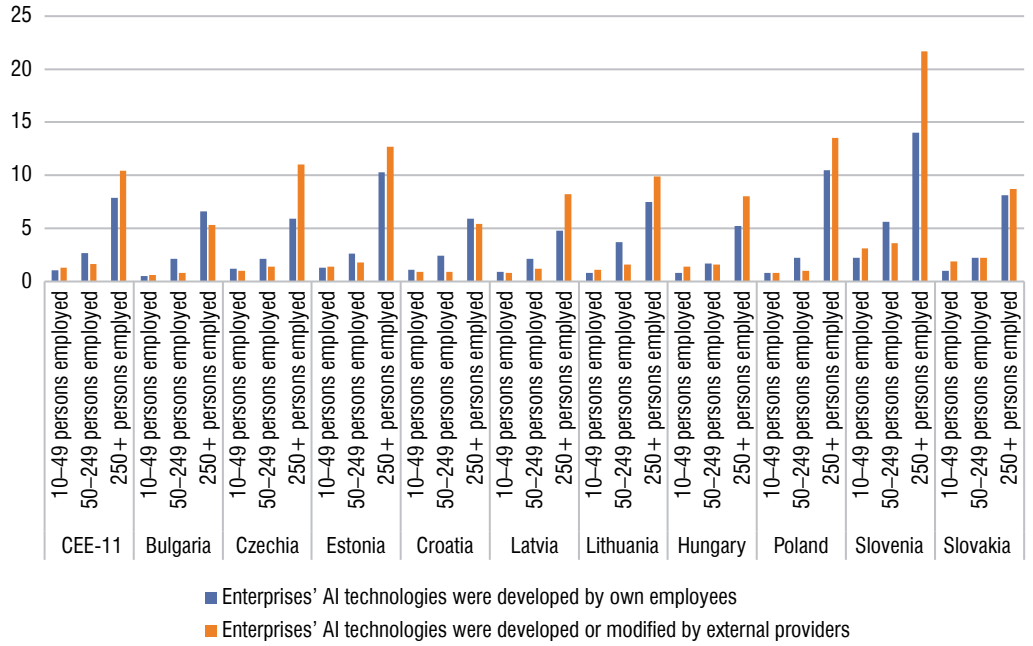
The low level of usage of AI technology by companies in CEE countries, according to respondents, is mainly due to the lack of relevant expertise. Given the characteristics of start-ups as innovative organisations, focused mainly in the area of high technology, and including knowledge, data and information processing technologies [Criscuolo et al., 2012], such a state of affairs may present an opportunity for their potential inclusion as a partner in the implementation of AI technologies in both the SME sector and large enterprises. This cooperation can take place, for example, under the SaaS (Software as a Service) model, according to which the customer receives the software they need, made available via the Internet. As a result, the company becomes a global operator, with minimal or no cost associated with the distribution of such services [Beauchamp et al., 2018].

Figure 6. Enterprises in UE-27 and CEE countries using at least one form of AI technology in 2023 by size class of enterprise (in %)



Source: own elaboration based on Artificial Intelligence by Size Class of Enterprise published by Eurostat [2024].

Figure 7. Development of AI technology in CEE countries in 2023 by size class of enterprise and source (in%)



Source: own elaboration based on Artificial Intelligence by Size Class of Enterprise published by Eurostat [2024].

Also supporting this postulate is the fact that in CEE countries, AI technology was developed or modified by external providers more often than by own employees in small and large enterprises, indicating their willingness to co-opt in this field (respectively: 10.44% vs 7.88% for big enterprises and 1.3% vs 1.06% for small enterprises), whereas enterprises

with 50–249 persons employed more often declared development of AI technology by their own employees (2.67% vs 1.61%), which is shown in Figure 7.

The growing use of AI in enterprises is also favourable from a start-up perspective. In both analysed groups of countries (i.e. CEE and the EU-27), an increase in the share of enterprises using AI technology in the structure of total enterprises was observed from period to period, although the increase was insignificant (up to 4 pp compared to the base year – 2021). However, it is noteworthy that the differences between the two groups of countries narrowed in the periods studied (from 5.6 pp in 2021 to 4.79 pp). Among CEE countries, the increase in the share of enterprises using at least one of the surveyed forms of AI technology in the structure of total enterprises from period to period concerned most of the surveyed countries, with the exception of Bulgaria and Croatia. The largest increases were experiences in Poland and Hungary (2.9 pp and 2.16 pp, respectively).

Summary

The presented research results and practical examples in this paper illustrate how particular CEE countries support start-ups, with the article also providing a synthetic overview of the start-up support ecosystems in CEE countries based on international comparisons using the latest available data sources. The Delphi method panel study enabled identification of the most advanced CEE countries in terms of the functioning of their start-up support ecosystems, which was achieved by translating the overall scores obtained by the studied countries into a classification of leading, rising and developing countries.

The research results show that Lithuania and Estonia are the leaders in start-up support ecosystems in CEE, while Poland, Czechia, Slovenia and Latvia follow suit in terms of start-up support ecosystems maturity. Considering the identification countries with developed start-up support ecosystems in the CEE region, the authors emphasise the importance of disseminating knowledge and experiences regarding these ecosystems, as well as making efforts to institutionally transfer best practices from leading to developing CEE countries.

The research particularly focuses on the application of AI technologies in start-ups, with a need for further, in-depth research based on standardised, comparable data and a unified timeframe, as well as an approach that involves testing proposed solutions before implementing them into economic practice.

According to the authors, future research phases could expand to a broader view of the efficiency of support ecosystems, with countries, as socio-economic entities, deliberately and rationally managing public funds. The goal is not only to build elaborate and extensive support ecosystems, but rather ensure that their functioning leads to the creation of large, recognisable technological companies with a global reach.

In conclusion, the research objectives to evaluate the maturity of start-up support ecosystems in CEE and identify regional leaders were successfully met through the application of

Delphi-based expert evaluation and data analysis. The findings confirms that Lithuania and Estonia exhibit the most developed ecosystems, while several other countries are progressing but still face structural gaps. Looking forward, we anticipate that continued EU cohesion funding, the growing integration of AI technology, and increasing cross-border knowledge transfer will accelerate the development of start-up ecosystems across the region. Future studies should assess not only structural indicators, but also the impact and effectiveness of public and private support in fostering globally competitive start-ups.

References

1. Acs, Z.J., Audretsch, D.B. (1994). New-Firm Startups, Technology, and Macroeconomic Fluctuations. *Small Business Economics*, 6, pp. 439–449. DOI: 10.1007/BF01064858.
2. Adelino, M., Ma, S., Robinson, D. (2017). Firm Age, Investment Opportunities, and Job Creation. *The Journal of Finance*, 72, pp. 999–1038. DOI: 10.1111/jofi.12495.
3. Audretsch, D., Colombelli, A., Grilli, L., Minola, T., Rasmussen, E. (2020). Innovative Start-Ups and Policy Initiatives. *Research Policy*, 49(10), 104027. DOI: 10.1016/j.respol.2020.104027.
4. Autio, E. et al. (2018). Digital Affordances, Spatial Affordances, and the Genesis of Entrepreneurial Ecosystems. *Strategic Entrepreneurship Journal*, 12(1), pp. 72–95. DOI: 10.1002/sej.1266.
5. Baran A., Zhumabaeva A. (2018). Intellectual Property Management in Startups – Problematic Issues. *Engineering Management in Production and Services*, 10(2), pp. 66–74. DOI: 10.2478/emj-2018-0012.
6. Bikse, V., Lusena-Ezera, I., Rivza, B. (2020). Innovative Start-ups: Challenges and Development Opportunities in Latvia. *International Journal of Innovation Science*, 10(2), pp. 261–273. DOI: 10.1108/IJIS-05-2017 0044.
7. Bonini S., Capizzi V. (2019). The Role of Venture Capital in the Emerging Entrepreneurial Finance Ecosystem: Future Threats and Opportunities. *Venture Capital*, 2019 (2–3), pp. 137–175. DOI: 10.1080/13691066.2019.1608697.
8. Braunerhjelm, P., Eklund, J.E. (2014). Taxes, Tax Administrative Burdens and New Firm Formation. *Kyklos*, 67(1), pp. 1–11. DOI: 10.1111/kykl.12040.
9. Breschi, S., Lassébie, J., Menon, C. (2018). A Portrait of Innovative Start-Ups Across Countries. *OECD Science, Technology and Industry Working Papers*, 2018(02), Paris: OECD Publishing. DOI: 10.1787/f9ff02f4 en.
10. Campbell, C.M. (1996). The Effects of State and Industry Economic Conditions on New Firm Entry. *Journal of Economics and Business*, 48, pp. 167–183. DOI: 10.1016/0148-6195(96)00075-6.
11. Criscuolo, P., Nicolaou, N., Salter, A. (2012). The Elixir (or Burden) of Youth? Exploring Differences in Innovation Between Start-Ups and Established Firms. *Research Policy*, 41(2), pp. 319–333.
12. Cullen, J.B., Gordon, R.H. (2007). Taxes and entrepreneurial risk-taking: theory and evidence for the U.S. *Journal of Public Economics*, 91(7–8), pp. 1479–1505. DOI: 10.1016/j.jpubeco.2006.12.001.

13. Block, J.H., Darnihamedani, P., Hessels, J., Simonyan, A. (2018). Taxes, Start-up Costs, and Innovative Entrepreneurship. *Small Business Economics*, 51, pp. 355–369. DOI: 10.1007/s11187-018-0005-9.
14. Decker, R., Haltiwanger, J., Jarmin, R., Miranda, J. (2014). The Role of Entrepreneurship in US Job Creation and Economic Dynamism. *Journal of Economic Perspectives*, 28(3), pp. 3–24. DOI: 10.1257/jep.28.3.3.
15. Edwards, A., Todtenhaupt, M. (2020). Capital Gains Taxation and Funding for Start-Ups. *Journal of Financial Economics*, 138(2), pp. 549–571. DOI: 10.1016/j.jfineco.2020.06.009.
16. Eurostat (2024). Electricity Prices for Non-Household Consumers – Bi-Annual Data (from 2007 onwards). DOI: 10.2908/NRG_PC_205.
17. Eurostat (2024). Labour Cost Index by NACE Rev. 2 Activity – Nominal Value, Quarterly Data. DOI: 10.2908/LC_LCI_R2_Q.
18. Eurostat (2024). Artificial Intelligence by Size Class of Enterprise. DOI: 10.2908/ISOC_EB_AI. (accessed: 30.06.2024).
19. Fernandes, A.J., Ferreira, J.J. (2022). Entrepreneurial Ecosystems and Networks: a Literature Review and Research Agenda. *Review of Managerial Science*, 16(1), pp. 189–247. DOI: 10.1007/s11846-020-00437-6.
20. Gentry, W., Hubbard, G. (2000). Tax Policy and Entrepreneurial Entry. *The American Economic Review*, 90(2), pp. 283–287. DOI: 10.1257/aer.90.2.283.
21. Gordon, R., Sarada (2018). How Should Taxes be Designed to Encourage Entrepreneurship? *Journal of Public Economics*, 166, pp. 1–11. DOI: 10.1016/j.jpubeco.2018.08.003.
22. Highfield, R.A., Smiley, R.H. (1987). New Business Starts and Economic Activity: An Empirical Investigation. *International Journal of Industrial Organization*, 5, pp. 51–66. DOI: 10.1016/0167-7187(87)90006-3.
23. Ilmakunnas, P., Topi, J. (1996). Microeconomic and Macroeconomic Influences on Entry and Exit of Firms. *Review of Industrial Organization*, 15, pp. 283–301. DOI: 10.1023/A:1007786719982.
24. Kollmann, T., Stoeckmann, C., Hensellek, S., Kensbock, J. (2016). *European Startup Monitor, German Startups Association*, https://startupverband.de/fileadmin/startupverband/mediaarchiv/research/sonstige_studien/20161103_European_Startup_Monitor_2016.pdf
25. Mata, J. (1996). Business Conditions and Business Starts. *International Journal of The Economics of Business*, 3, pp. 295–306. DOI: 10.1080/758539568.
26. Bradshaw, M., Brockman, B.K., Roundy, P.T. (2018). The Emergence of Entrepreneurial Ecosystems: A Complex Adaptive Systems Approach. *Journal of Business Research*, 86, pp. 1–10. DOI: 10.1016/j.jbusres.2018.01.032.
27. Spigel, B. (2017). The Relational Organization of Entrepreneurial Ecosystems. *Entrepreneurship Theory and Practice*, 41(1), pp. 49–72. DOI: 10.1111/etap.12167.
28. Barros, V., Raposo, C., Venâncio, A. (2022). Corporate Taxes and High-Quality Entrepreneurship. *Small Business Economics*, 58, pp. 353–382. DOI: 10.1007/s11187-020-00413-0.

Internet sources

1. Andonova E., Basso A., Baltar E. (2018). Startup Innovation Ecosystems in Southern Europe, European Commission, Brussels, https://knowledge4policy.ec.europa.eu/sites/default/files/jrc113872-startup_ecosystems_in_southern_europe_en.pdf
2. Dealroom.co, https://app.dealroom.co
3. Deloitte (2017–2023). Tax Guides and Highlights, https://dits.deloitte.com/#TaxGuides
4. European Patent Office internet portal, https://new.epo.org/en/statistics-centre#/
5. EY (2017–2023), Tax and Law Guides, https://www.ey.com/en_gl/tax-guides
6. NPR: Why Corporate Bankruptcies Were Up in 2023 Despite the Improving Economy, https://www.npr.org/2023/12/28/1221401948/bankruptcies-corporate-rise- inflation-2023-interest-rates
7. PwC (2017–2023), Worldwide Tax Summaries Online, https://taxsummaries.pwc.com

Reports

1. Beauchamp M., Krysztofiak-Szopa J., Skala A. (2018). Polskie startupy, *Raport 2018*, Fundacja.
2. Beauchamp M., Krysztofiak-Szopa J., Skala A. (2018). Polskie startupy, *Raport 2018*, Fundacja Startup Poland.
3. Startup Ecosystem Rankings Report 2023, www.report.startupblink
4. The Global Startup Ecosystem Index Report 2023, https://startupgenome.com