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Startup Ecosystem and the Sharing Economy in CEE

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Abstract

INTRODUCTION: Central and Eastern Europe (CEE) has long been recognized as a region of excellent opportunities for building and growing startups and innovative businesses due to the availability of talent and capital efficiency. At the same time, there is an increase in sharing economy-oriented businesses due to digitalization and economic and environmental impacts. The research also incorporates a multidimensional taxonomic classification of the European innovation landscape based on the latest SAFE survey data.
OBJECTIVES: The present article introduces the characteristics and evolution of startups and the startup ecosystem. It also highlights the emergence and positive development of sharing economy startup companies in the CEE region. The primary objective was to segment EU member states into homogeneous clusters to identify structural similarities and disparities in innovation capacity, growth potential, and systemic financial barriers among CEE economies.
METHODS: Comparative analysis was used to create a coherent view of the issue at hand. We have examined statistical data from various surveys and statistical reports. The study also applied hierarchical cluster analysis as a quantitative form of classification to divide a heterogeneous group of EU countries into homogeneous clusters based on their similarity in the monitored parameters. This allows the identification of structural trends that are invisible when comparing averages.
RESULTS: A vibrant hub, the Central and Eastern Europe (CEE) startup ecosystem has seen its combined enterprise value soar from €89 billion in 2019 to €213 billion in 2023, with a higher average growth rate (2.4x) than the European average (2.1x). The region now boasts 52 unicorns, collectively valued at €129 billion, and is supported by key markets like Poland (leading with nearly 8,000 startups) and countries excelling in VC investment per capita, such as Estonia (€310). Furthermore, countries like Croatia, Ukraine, and Estonia show exceptional efficiency, creating more than twice the number of unicorns per funded startup than the European average. Moreover, the clustering process revealed three distinct national profiles—Innovation Leaders, the Stable Core, and the Financial Risk Zone—demonstrating that acute collateral deficiencies and low investor confidence remain critical impediments to scaling startups in specific CEE markets.
CONCLUSION: To continue supporting innovative startup companies from different areas of focus, including those from the sharing economy, it is important to pay attention to the development of a stimulating national and regional business environment. The study also concludes that transitioning from a stable economic core towards innovation leadership requires targeted policy interventions that move beyond traditional bank financing and address the identified systemic risks in high-risk zones.

Keywords: Startup, Innovation, Sharing Economy, Company

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1. Introduction

In recent years, the terminology surrounding the "startup" phenomenon has proliferated across both academic and professional discourse; however, the lack of a standardized definition continues to hinder precise empirical analysis. While often conflated with broader trends such as the sharing economy, the functional and structural nuances of startup enterprises remain frequently misinterpreted. This research

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aims to address this conceptual ambiguity by providing a rigorous definition of startup entities and situating them within the specific context of the sharing economy. Furthermore, this study maps the positioning of sharing-economy-based startups within the broader entrepreneurial ecosystems of Central and Eastern European (CEE) countries. By synthesizing existing literature and empirical evidence, this paper provides a comprehensive analysis of the complexities inherent in these emerging business models and their unique developmental trajectory in the CEE region. Despite the abundance of country-level economic indices, a comprehensive synthesis of firm-level subjective perceptions within the European entrepreneurial ecosystem remains empirically underdeveloped. This analysis bridges the existing research gap by shifting the unit of inquiry from macroeconomic output measures to the granular, perceived constraints experienced by Small and Medium Enterprises (SMEs). By categorizing EU nations into three distinct clusters based on their SAFE-derived risk profiles, this study explores an approach to nuanced policy analysis that moves beyond generalized EU-wide assessments. This taxonomic perspective may assist in identifying structural patterns—such as labour market variations or asymmetric credit frictions—that persist across member states. These findings are intended to offer policymakers a framework to better understand these developmental clusters, potentially informing the design of more targeted economic strategies.

To provide a rigorous foundation for this empirical analysis, the study is anchored in the Entrepreneurial Ecosystem Theory [1] and Institutional Theory [2]. While the Entrepreneurial Ecosystem Theory provides a theoretical lens to evaluate the interdependent actors, networks, and cultural factors enabling productive high-growth entrepreneurship, Institutional Theory allows us to critically examine how formal institutional constraints—specifically financial frictions and administrative regulations—shape the emergence and scalability of platform-based business models in the sharing economy. By applying these theoretical frameworks, this paper moves beyond descriptive metrics to explain the systemic, institutionally driven enablers of innovation in the CEE region.

2. Theoretical Overview

2.1. Startup and Startup Ecosystem

Startups are distinct from traditional small and medium-sized enterprises (SMEs) primarily through their strategic intent to search for a repeatable and scalable business model under conditions of extreme uncertainty [3]. From an academic perspective, they are temporary organizations designed to introduce disruptive innovations, often lacking established operational histories or substantial initial capital, which inherently forces them to rely on equity-based financing such as venture capital or business angels [4]. Unlike conventional nascent firms, startups operate with an agile, failure-tolerant methodology where rapid experimentation serves as the primary mechanism for validated learning and market adaptation [5,6]. In contrast to classic young businesses, they are mainly distinguished by 3 to 6 Startup phases (from first orientation, through growth to stock market entry or exit) [7]. However, if a startup wants to be successful, it is important that it not only has a good idea but also sufficient support. Therefore, it needs to be part of the startup ecosystem. The startup ecosystem is a complex network of various entities, processes, and interactions that work together to support and promote the creation and growth of new businesses. It's a complex and dynamic environment that requires a deep understanding of business, technology, and entrepreneurship to navigate successfully [8].

As we can see in Figure 1 startup ecosystem is an environment made up of people who work there, startups in their various phases, and different types of organizations in one place physically or virtually, interacting as a system to create new startup companies [9].

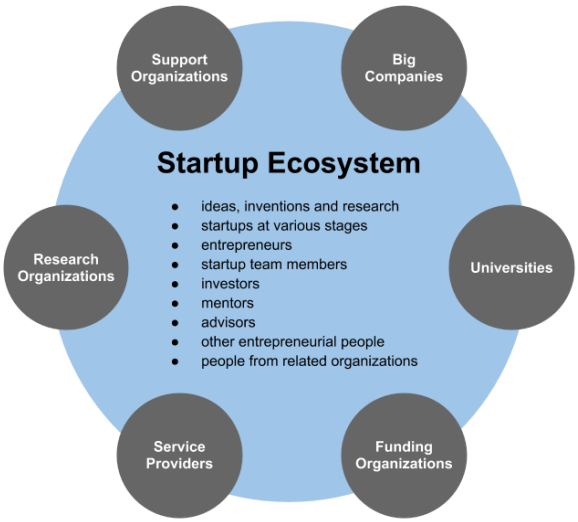

Figure 1. Startup Ecosystem [10]

It encompasses a range of institutions, policies, people, and businesses that can support the development of startups. It is the environment in which startups operate and includes startups themselves. The key components of the ecosystem are government (policies and programs), incubators and accelerators, financiers, digital infrastructure, and talent (tech and entrepreneurial). The ecosystem also compromises suppliers and customers, the culture of innovation, risk, entrepreneurship, and non-digital infrastructure such as transportation, energy and water [11]. The leading startup ecosystems serve to be excellent talent magnets. As startup ecosystems continue maturing, they bring out the best and the most interactive business minds along with bright investors, designers, developers and so on [12]. It establishes a fertile ground for burgeoning entrepreneurs to translate their conceptualizations into tangible enterprises, capitalizing on

their inventive prowess to instigate disruptive solutions [13]. Ecosystems will not just support the startup to operationalize but also help it grow and scale up [14].

So, although startups are the main component of the startup system, they are not alone in it. To progress successfully, every startup needs to be part of such an ecosystem because it is an environment that helps them grow, be it through financial support, consulting services, space, or research capabilities that can help them improve and further develop their innovative idea.

2.2. Sharing Economy: The new operating system for modern startups

Although the concept of sharing is nothing new, recent years have seen an enormous rise in the sharing economy. The central idea of sharing is the more efficient use of underutilised assets [15]. The sharing economy has not only become a staple of the global economy but has transformed the lives of billions of people by defining new ways of production, exchange and consumption through shared goods and services [16]. By changing how people consume, the sharing economy might redefine the roles of owners, consumers and producers, create innovative business models, disrupt existing industries, lead to an alternative economy and challenge political as well as regulatory institutions [17]. The paradoxical nature of the sharing economy lies in its dual characteristics. Sharing implies a moral economy of sharing within a small community of close others while economy implies a market economy whereas access-based consumption takes place within a potentially large community of distant others [18]. The primary goal of the sharing economy is to minimize the consumption of resources and services used to perform company operations while achieving maximum outcomes [19]. From a broad perspective, the sharing economy includes traditional government-to-peer (G2P) (e. g. public libraries, transportation, parks, and land) and business-to-peer (B2P) initiatives: however, much of the attention has focused on peer-to-peer (P2P) or collaborative consumption-based initiatives [20]. A sharing economy is a phenomenon characterised by the use of technology resources to facilitate the exchange of access to goods and services between two or more parties, which may be individuals or organisations, for a commercial fee [21]. The sharing economy, supported by digital platforms, efficiently matches the demand and supply of underused resources. Expanding globally and impacting different industries is offering a new path to sustainable resource consumption [22]. We can say that the advent of the digital platform made the sharing economy possible, where traditional sharing is mixed with the rental/ service platform business model so collaborative consumption as traditional sharing, bartering, lending, trading, renting, gifting and swapping, is redefined through technology and peer communities [23]. Sharing economic activities fall into four broad categories: recirculation of goods, increased utilization of durable assets, exchange of services, and sharing of productive assets [24]. The sharing economy is also a new and reversed business model, changing from B2B (business to business) to B2C (business to consumer) and further C2C (consumer to consumer). The latter type is a new business model derived from popular online trading or through digital platforms and is growing especially in the sharing economy. The idea of a sharing economy is that consumers share the same resources without switching ownership [25].

A fundamental prerequisite for the sharing economy to work is a robust digital platform that allows linking the demands of users with the demands of providers of underutilized resources to reduce overconsumption and preserve scarce resources for future generations [26]. At the same time, the sharing economy is essentially community-based, made up of individuals who share the same consumption-related values.

Based on these findings, it can be argued that in the 21st century, we can speak about collaborative consumption, where its access is driven by community and sharing and the collaboration may be local and face-to-face, or it can use the Internet to connect, combine, form groups, and find something or someone to create “many-to-many” peer-to-peer interactions. Simply put, people are sharing again with their community – be it an office, a neighbourhood, an apartment building, a school, or a Facebook network [27]. The rise of the sharing economy or collaborative consumption is enabling people to discover and realize the enormous benefits of access to products and services as opposed to ownership, and at the same time save money, space, and time, and make new friends [28]. An important element in the sharing economy is to generate trust among users as this enhances social value. Although trust between peers fosters successful exchanges within sharing economy communities, lack of trust greatly discourages individuals from sharing their goods or spaces with others [29].

3. Methodology

While preparing the paper, we have drawn on a variety of professional and research sources exploring the issue of startups, the startup ecosystem, and the sharing economy. We have used comparative analysis to create a coherent view of the issue at hand. At the same time, we have examined statistical data from various surveys and statistical reports provided by companies like Dealroom, Duamantes, CBInsights, and Tracxn, which have explored the problematics of startups and the sharing economy in the CEE countries. The data provided by these reports assess 2023 and 2024 period. While the theoretical constructs in this paper are grounded strictly in peer-reviewed academic literature, contemporary market sizing and venture capital flow data (2023–2024) are explicitly sourced from established professional databases (e.g., Dealroom, CBInsights). This dual approach ensures theoretical rigor while capturing the real-time empirical dynamics of the rapidly evolving ecosystem.

The methodological approach for data part analysis was based on a descriptive comparative framework, applied to a set of presented visual data:

- systematic visual inventory of the graphical representations with focus on the examined indicators values of the monitored metric in observed countries
- benchmarking analysis - comparison of performance for each country to identify statistical extremes (countries with highest and lowest results for all analysed determinants of quality and development level of startup ecosystems and sharing economy) to be able to recognize leading and lagging entities and identify why the best performers are better and which actionable steps for improvement can be implemented in the lagging ones
- Visual divergence – how the countries differ from average in particular indicators (CEE average and European average)

To meet the second part of the research's target, hierarchical cluster analysis has been applied. Cluster analysis is a quantitative form of classification. It serves to help develop decision rules and then to apply these rules to assign a heterogeneous collection of objects to a series of related data subsets (clusters). This is almost entirely an applied rather than a theoretical methodology. The final result of cluster analysis is a graphical display of classifications, and a set of decision rules for the assignment of new members into the classifications. The classification procedures used in cluster analysis are based on either density of population or distance between members [30].

The most straightforward and generally accepted way of computing distances between objects in a multidimensional space is to compute Euclidean distances or the squared Euclidean distance (in order to place progressively greater weight on objects that are farther apart). Euclidean (and squared Euclidean) distances are usually computed from raw data, not from standardized data. In the case of p variables $x_1, x_2, \dots, x_p$ measured on a sample of n subjects, the observed data for subject i can be denoted by $x_{i1}, x_{i2}, \dots, x_{ip}$ and the observed data for subject j by $x_{j1}, x_{j2}, \dots, x_{jp}$ while the Euclidean distance between these two subjects is given by [31]:

$$d_{ij} = \sqrt{(x_{i1} - x_{j1})^2 + (x_{i2} - x_{j2})^2 + \cdots + (x_{ip} - x_{jp})^2}$$

When carrying out a hierarchical cluster analysis, the process can be represented on a diagram known as a dendrogram. This diagram illustrates which clusters have been joined at each stage of the analysis and the distance between clusters at the time of joining. If there is a large jump in the distance between clusters from one stage to another then this suggests that at one stage clusters that are relatively close together were joined whereas, at the following stage, the clusters that were joined were relatively far apart. This implies that the optimum number of clusters may be the number present just before that large jump in distance [32].

To systematically connect the descriptive data on the sharing economy with the structural quantitative data, this study conceptualizes the SME financial environment—derived from the SAFE dataset—as the foundational 'institutional substrate' required for sharing economy platforms to scale. We methodologically integrate these two domains by positing that the structural readiness of a country to nurture sharing economy startups is directly measurable through its cluster assignment. The variables reflecting financial frictions and innovation capacity in the SAFE survey act as critical predictors for the viability of platform-based, low-asset business models. To overcome this limitation and provide a more robust classification, we introduce a Comprehensive Concept of Cluster Analysis of the Innovation and Startup Environment in EU Countries Based on SAFE Data (Project name (data source: "Survey on the Access to Finance of Enterprises (SAFE) commissioned by the European Central Bank and the European Commission", wave: "36th wave", Fieldwork: "August-October 2025"). This hierarchical approach enables the integration of macroeconomic indicators with the microeconomic perceptions of enterprises, segmenting member states into homogenous groups based on their innovation capacity, growth potential, and financial barriers.

The analysis of the business environment quality in the context of startups and innovation represents a multidimensional challenge, requiring the integration of macroeconomic indicators with the microeconomic perceptions of the enterprises themselves. The Survey on the Access to Finance of Enterprises (SAFE), conducted in cooperation between the European Central Bank and the European Commission, provides one of the most detailed datasets for this purpose. The 36th wave of this survey, focusing on the third quarter of 2025, captures the dynamics of small and medium-sized enterprises (SMEs) during a critical period of economic transformation and tightening monetary conditions.

To identify structural similarities between EU countries, hierarchical cluster analysis serves as the most appropriate tool, enabling the segmentation of member states into homogeneous groups based on their innovation capacity, growth potential, and financial barriers. This approach allows not only for a taxonomic classification, but also for the revelation of strong associative patterns between capital availability and the innovation output of firms.

SAFE data are weighted by firm size and industry (industry weighting) to ensure that the results reflect the entire population of enterprises in the country, rather than just the survey respondents. In cluster analysis, it is essential to work with percentage shares (Vertical %), which already incorporate these weights, to ensure that the resulting clusters are not skewed by the size of the country.

To construct a robust cluster analysis model, it is imperative to select data that represent the fundamental determinants of the startup ecosystem. Startups are characterized not merely by their size or maturity, but primarily by their ambition to scale and their capacity for generating breakthrough innovations. Consequently, the selection of indicators encompasses three strategic domains: innovation activity, growth dynamics, and institutional barriers to access to finance.

1. "Innovation activity" variables
a. Innovation Index (tab ”131”, Table title "T3. Innovativeness": Total ratio of firms which implemented at least 1 type of innovation
b. Product Innovation (tab “94”, Table title “Q1_a”): The percentage of enterprises that have introduced a new or significantly improved product or service to the market. This serves as a key indicator of the market orientation of startups.
c. Process Innovation (tab “95”, Table title “Q1_b”): Focuses on the implementation of new or improved production methods, reflecting the technological sophistication and operational efficiency of the ecosystem.
d. Organizational Innovation (tab “96”, Table title “Q1_c”): Tracks changes in management practices and work organization, which is essential for high-growth startups undergoing the process of professionalization.
e. Marketing Innovation (tab “97”, Table title “Q1_d”: The capacity of firms to explore new sales methods and customer communication channels, which is critical during the initial phases of market expansion.
f. R&D Financing (tab “61”, Table title “Q6A_4”): The percentage of firms utilizing external funding for the development of new products, thereby linking financial accessibility with innovation capacity.
2. "Growth dynamics" variables
a. High-growth Enterprises (tab “121”, Table title "T1. High-growth enterprises"): Monitors firms, regardless of age, that exhibit a consistent increase in turnover or employee headcount.
b. Expected Substantial Growth (tab ”100”, Table title “Q17”): Reflects the optimism and expansionary plans of enterprises for the 2025–2027 period. High values indicate a dynamic market environment.
c. Historical Employment Growth (tab ”98”, Table title"Q16A"): Measures the capacity of firms to generate new employment opportunities, which is a primary objective of startup support frameworks.
d. Historical Turnover Growth (tab “99”, Table title “Q16B”): Provides a retrospective insight into the financial performance of the ecosystem prior to the current survey wave.
3. "Access to finance"
a. Importance of Access to Finance (tab “9”, Table title “Q0b”): The subjective perception of the significance of this issue
b. Insufficient Collateral or Guarantees (tab”105”, Table title “Q22”: The percentage of enterprises for which this represents the primary limitation
c. Confidence in Negotiating with VC Investors (tab “102”, Table title “Q19B”): Measures the maturity of the relationship between firms and venture capital investors, which lies at the heart of startup financing
d. Preferred Type of External Financing (tab “103”, Table title “Q20”): Indicates whether firms prioritize equity investment over debt, a preference typically associated with innovative enterprises
e. Irrelevance of Bank Loans – High Interest Rates (tab “42”, Table title “Q32”): Explores the reasons why firms do not utilize bank financing (e.g., sufficiency of internal funds versus prohibitive costs), serving as an indicator of the market’s financial structure

To facilitate a robust cross-country comparison and mitigate the confounding effects of disparate economic scales inherent in the SAFE survey data, a two-stage data transformation process was implemented prior to the cluster analysis. First, the raw weighted counts were normalized by adopting a compositional approach, utilizing relative row percentages (vertical % row). This transformation shifts the analytical focus from the absolute volume of enterprises to the proportional economic profile of each jurisdiction, ensuring that the resulting clusters reflect structural similarities in financial access patterns rather than the mere size of the national economies.
Subsequently, to address the sensitivity of the clustering algorithm to varying measurement scales and variances, the data were standardized using the "Scale features" functionality within the JASP statistical environment. This procedure involves Z-score transformation, centring each variable at a mean of zero with a unit standard deviation (mu = 0, sigma = 1). By performing this standardization, we ensured that each indicator contributes equally to the Euclidean distance calculations, preventing variables with larger absolute ranges from disproportionately influencing the cluster membership and ensuring a unit-free comparison across all dimensions of the analysis.

For the structural identification of country-level entrepreneurial conditions, hierarchical agglomerative clustering offers distinct methodological advantages over partitioning alternatives such as k-means. First, it eliminates the necessity of a priori cluster specification (k), a critical constraint when analysing a constrained sample size where the true number of macroeconomic archetypes is theoretically unknown. Second, the resulting hierarchical tree (dendrogram) preserves the multi-layered, nested relationships among economies, allowing researchers to observe not just discrete groups, but the precise degrees of historical and institutional proximity between specific states. Furthermore, by employing Ward’s linkage method with Euclidean distance, the algorithm minimizes intra-cluster variance at each fusion step, which effectively isolates subtle, non-linear variations in the Survey on the Access to Finance of Enterprises (SAFE) net percentages. Consequently, this framework avoids the random initialization instabilities inherent in iterative partitioning algorithms, ensuring a deterministic, highly reproducible taxonomy of European entrepreneurial environments.

Cluster analysis followed by ANOVA and post hoc tests was used as an analytical framework to examine following research questions and hypotheses:
1. Research Question: Innovation vs. Financial Maturity
Research Question: To what extent does the maturity of a country’s financial ecosystem (as measured by collateral and internal fund sufficiency) dictate its capacity for high-growth, innovation-driven entrepreneurship?
Hypothesis (H_1): Countries characterized by higher levels of self-financing (low reliance on external debt) and lower collateral requirements will demonstrate significantly higher levels of innovation activity, suggesting that "capital

flexibility" is a stronger predictor of innovative capacity than "access to credit" alone.

2. Research Question: The CEE "Institutional Divergence"

Research Question: Are there distinct "CEE-specific" entrepreneurial archetypes that defy the traditional Western European convergence model, and what role do administrative barriers play in their formation?

Hypothesis (H_2): Despite regional proximity, the CEE countries will bifurcate into two distinct clusters—one "innovation-integrated" (aligned with Western European standards) and one "institutionally constrained"—where the latter's growth is fundamentally stifled by banking sector risk-aversion rather than lack of firm-level ambition.

3. Research Question: The Resilience of High-Growth Firms

Research Question: Does the prevalence of high-growth enterprises within a cluster correlate with a higher institutional capacity to mitigate the "finance gap" during economic fluctuations?

Hypothesis (H_3): Clusters with a higher density of "high-growth enterprises" will exhibit statistically lower sensitivity to interest rate fluctuations, indicating that structural business vitality provides an institutional hedge against banking sector instability.

Implementation of cluster analysis on SAFE data performed in JASP can be summarised as:

A. Import and variable type check

1) Data import (xls or csv file format)

2) Variable type check – after successful data import, variables are assigned with variable type to be checked (SAFE indicators as "scale", country column as "nominal")

B. Navigation and model setup

1) Choosing the analysis type – module machine learning ➔ clustering ➔ hierarchical clustering (explained in previous section)

2) Assigning variables to fields (Variable (SAFE indicators) vs labels (country))

3) Export results – analytical indicators to be displayed (Within sum of squares, Silhouette score, cluster means, t-SNE cluster plot, dendrogram etc.)

C. Configuration of training parameters – setting key mathematical details of the analysis that determine the final shape of the clusters

1) Distance measure – Euclidean (explained in previous section)

2) Linkage criterion – Ward (explained in previous section)

D. Standardization and treatment of different units of measurement - since the input file combines percentages (e. g. 0% to 100% of innovative firms) and average scores (e. g. 1 to 10 for the importance of finance), there is a problem of different scales. Without adjustment, an indicator with a larger range (percentage) would have up to ten times more weight in the algorithm than an indicator on a scale of 1–10.4

In the JASP settings, it is necessary to check the Scale variables (Standardize). This step transforms the data into a so-called Z-score.

E. Diagnosis and interpretation of results in JASP - The clustering process needs to be validated using statistical criteria and visual tools.

1) Visual analysis – t-SNE plot and Dendrogram (tree structure that visualizes the gradual agglomeration of countries into clusters - the higher the branches are connected, the less similar the countries in a given cluster are)

2) Validation – model validation based on output table with fitness metrics (Silhouette score, Total Sum of Squares (TSS) and Between Sum of Squares (BSS) - Ratio BSS/TSS expresses how much of the variability in the data is explained by the clustering. The higher the ratio is, the better separated the clusters are from each other.

Central and Eastern Europe (CEE) is emerging as a vibrant hub for startups and innovation. The best countries of the CEE region supporting startup ecosystems are Romania, Estonia, Serbia, Poland, Croatia, Czech Republic, Hungary, Slovenia, and Lithuania. There are over 26,000 startups in the CEE region and their combined enterprise value has more than doubled in the past five years, soaring from €89 billion in 2019 to €213 billion in 2023. Poland leads with nearly 8,000 startups, followed by Romania and Czechia with over 3,000 each. The CEE region boasts 52 unicorns, collectively valued at €129 billion, representing 60% of the ecosystem's total enterprise value [33]. Also, 50% of Venture Capital (VC) investments in 2023 were concentrated in the top 3 markets of the CEE region, as we can also see in Figure 3. These countries were Estonia, Lithuania and Poland, where most of the VC funding went to Tallinn (364 million EURO), which was almost twice as much as VC funds received by Vilnius (193 million EURO) and Warsaw (191 million EURO). Despite mentioned distribution, these are still among the top three cities with the highest share of VC funding. The top 5 cities are concluded by Sofia and Prague both with the amount of 170 mil. EURO of VC funding. Based on these, we can see that in 2023, Estonia, Lithuania, Poland, Bulgaria and Czech Republic had the best VC-funded hubs in the CEE region. The top VC and Accelerators for startups in CEE are in Romania, Estonia, Bulgaria, Latvia, Serbia, Poland, Czech Republic, Hungary, Slovenia, and Lithuania.

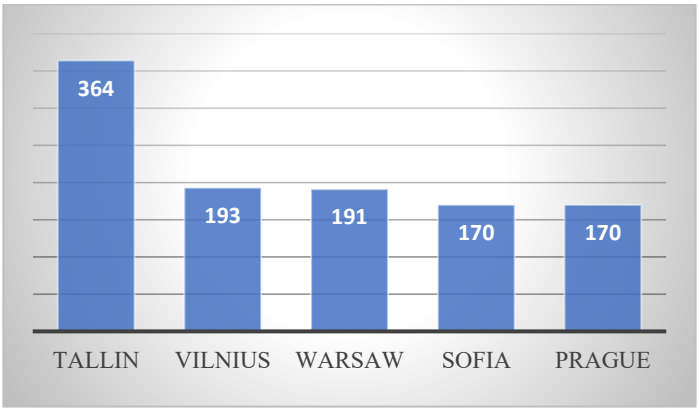

Figure 2. Top Hubs in CEE – Venture Capital Funding in 2023 (in million EURO) [34]

As visible from Figure 3, the CEE average growth in combined enterprise value in the last 5 years was at a level of 2.4, whereas the European average growth reached value 2.1. We can also see that Croatia, Lithuania and Latvia have shown the highest relative growth in combined enterprise value in the past five years, closely followed by Ukraine and Serbia. Other countries from the top 10 countries with the highest combined enterprise value growth in CEE did not reach the 2.5 growth rate. Slovakia and Estonia with their growth rates (1.9 and 1.8) are also under the European average combined enterprise value growth rate of 2.1. This significant divergence in enterprise value growth suggests that early-stage capital in the CEE is unevenly absorbed. Countries like Croatia and Lithuania outpace the European average not merely due to funding volume, but likely because of agile regulatory frameworks and high digitalization that allow startups to scale rapidly. This early dynamic visually foreshadows the characteristics of the 'Innovation Leaders' cluster, where market momentum overcomes traditional financing costs.

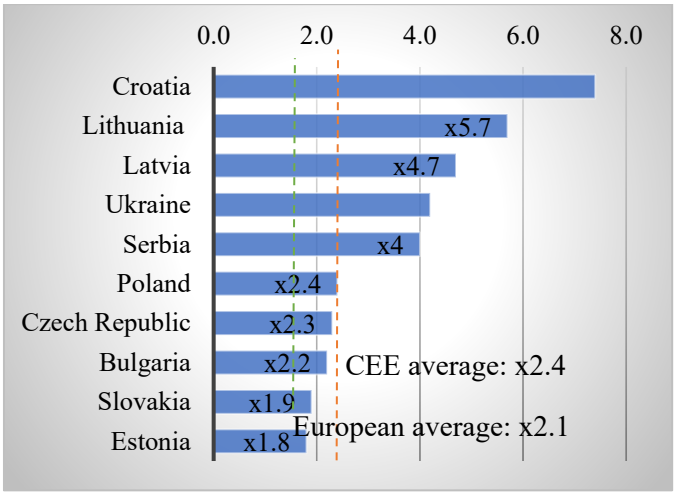

Figure 3. 5-year growth, combined enterprises value in CEE [34].

In Figure 4, we can see that Croatia, Ukraine and Estonia stand out, with over twice the number of unicorns per funded startup than the European average. It is also known, that just over 40 startups from Croatia raised more than €1M in funding, but 3 already became unicorns. Further, we can see that also Poland with 3.5% of startups, which became unicorns, is over the CEE average which is set by 3.2%. CEE countries with a percentage of >€1M funded startups which later become unicorns that is higher than the European average are: the Czech Republic at 3.1%, Romania at 2.5%, Slovenia at 2.3% and Lithuania at 2.2%. Latvia, Bulgaria and Hungary have not reached the 2% of such a kind of startups.

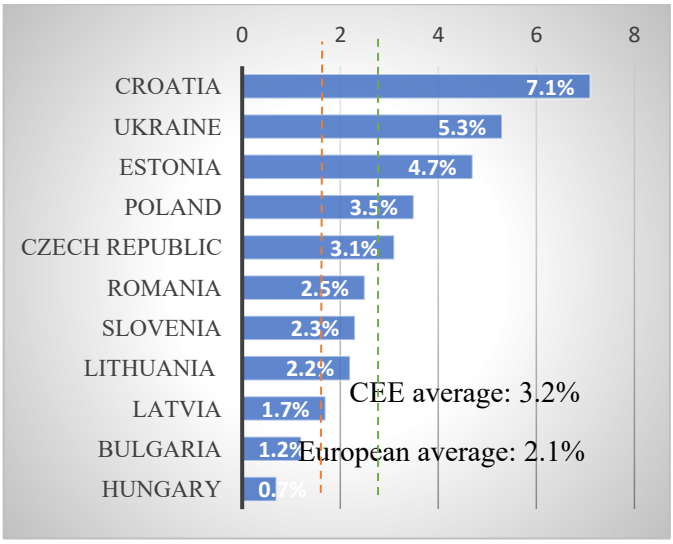

Figure 4. Percentage of > €1M funded startups that become unicorns in CEE countries [34].

The exceptional unicorn-to-funded-startup conversion rates in Estonia and Croatia demonstrate superior capital efficiency. It implies that in these specific hubs, venture capital is highly concentrated and paired with global market orientation from day one, mitigating the 'valley of death' phase more effectively than in traditional, bank-reliant economies where latent innovation potential fails to scale.

Figure 5, attached below, represents amount of money invested in the startup ecosystem per capita in 2023. We can see that the highest VC investment of €310 was funded in Estonia, which is almost three times higher than in Lithuania with €112. These two are the only countries which exceeded the European average value of €78 per capita and only Latvia (€37), Bulgaria (€27) and Slovenia (€25) exceeded the €20 per capita of investment threshold. The Czech Republic (€17) and Romania (€16) invest more € per capita than the CEE average of €12 per capita. Slovakia with its VC funding of €12 per capita is on the same amount of investment as the CEE average. Countries below the CEE average are Poland and Hungary, both of €7 per capita. The stark contrast in VC per capita between the Baltic states and the rest of the CEE region directly correlates with the institutional frictions identified in our subsequent SAFE analysis. Lower per capita investment in lagging countries highlights a systemic reliance on traditional bank debt, where stringent collateral requirements naturally depress the volume of high-risk, equity-based venture funding necessary for startup ecosystems.

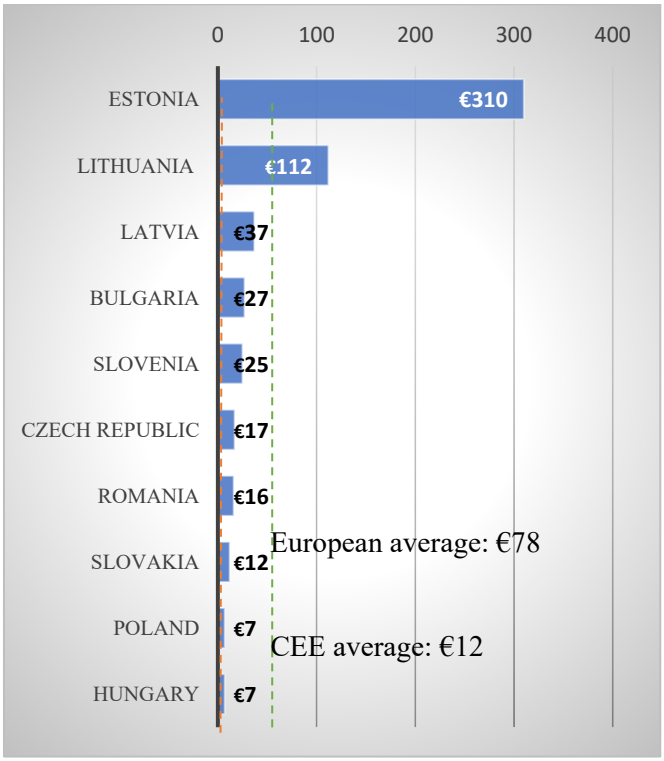

Figure 5. VC investment per capita in CEE countries in 2023 [34].

65 startups founded in 2024 across the Central and Eastern Europe managed to secure almost €61 million in investment. Globally, when we take a look at the country of origin all over the world, most of the startups in 2024 were produced in Finland (16 startups). These startups received over €34 million, which is more than half of the total investments in our list. The second and third places go to two CEE countries - Romania (8 startups) and Lithuania (7 startups). Romanian startups managed to secure €1.9 million and Lithuanian - €3.6 million in 2024. Estonia, Austria and Ukraine nurtured 7 startups in 2024, the Czech Republic had 4 new tech startups, Poland and Hungary had 3, Bulgaria - 2 and Serbia – 1 [35].

Interesting connection can be found when we take a look at the list called "Europe's Leading Start-Up Hubs" which is published on yearly basis by UK edition of Financial Times. In the list published on February 26, 2025, attached below (Table 1), we can clearly see the quality of several CEE startup hubs which managed to become a part of 150 TOP ranked startup hubs all over the Europe. A total of 15 CEE startup hubs from Romania, Croatia, Poland, Czech Republic, Bosnia &Herzegovina, Slovenia and Lithuania reached significant successes, all with overall ranking higher than 70. The best score from CEE startup hubs group belongs to InnovX startup hub from Romania oriented on technology – with 82,64 score, the hub placed 16th from the total of 150 within the whole list. Second place from CEE list (35th place within the whole Europe's list) belongs to ISE Group from Poland with overall score 79, 91. Rubik Hub ranks third among the top CEE startup hubs, again from Romania (39th place in whole 150 European list) with score at the level of 78, 96.

Table 1. Europe's Leading Start-Up Hubs

Country	Average overall score	No. of Startup hubs in the list
Luxembourg	80,86	1
Romania	80,81	2
France	79,51	11
Germany	78,88	19
Portugal	78,77	7
Sweden	78,58	7
Croatia	78,44	2
Poland	78,28	4
Switzerland	78,15	8
Ireland	77,85	4
Czech Republic	77,56	2
Bosnia & Herzegovina	77,44	1
United Kingdom	77,40	29
The Netherlands	77,39	6
Italy	76,75	9
Spain	76,59	17
Slovenia	76,18	2
Denmark	76,14	3
Cyprus	75,54	1
Norway	75,07	3
Belgium	74,81	5
Lithuania	74,55	2
Iceland	74,12	1
Greece	74,06	3
Austria	72,76	1

When we look back at the values of investments into startup ecosystems, correlation between investments and the quality of these ecosystems presented by ranking lists like the one presented below, is undeniable. In general, investments dedicated to support creation of appropriate business environment within the country (through the startup ecosystem) have a key role in developing the competitive and sustainable environment for economic growth. The Sharing Economy in Eastern Europe comprises 850 companies, including 82 funded companies having collectively risen $186M in venture capital money and private equity. Out of these, 17 are Series A+ funded where companies that are included in the sharing economy belong to Ride-Hailing Platforms, On-Demand Staffing Platforms, Freelancer Marketplaces, P2P Rental Marketplaces, P2P Lending Platforms, Crowdfunding, Co-working Spaces [34].

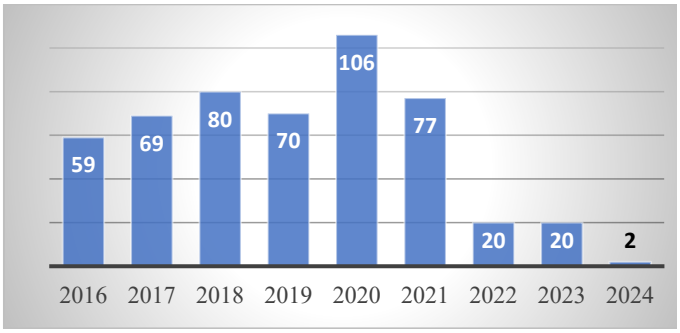

Figure 6. Total number of companies founded year-on-year in the Sharing Economy sector in Eastern Europe [37]

In Figure 6 below, the total number of companies founded year-on-year in the Sharing Economy sector in Eastern Europe is visible. In 2020, the highest number of companies has been founded (106) in the sharing economy in Eastern Europe – this is the greatest number of startups founded in any year within the last 10 years period. In 2024, only 2 sharing economy companies were founded in Eastern Europe. Parallel to the founding rates, the capital allocation trajectory is depicted in Figure 7, which illustrates the total year-on-year funding directed toward the Sharing Economy sector. This financial data further emphasizes the fluctuation in investor confidence and capital availability over the observed period.

When we look at the sharing economy startups, we can see, that companies such as Bolt (Estonia), Veriff (Estonia), Rimac Automobili (Croatia), Infobip (Croatia), Rohlik Group (Czech Republic), Vinted (Lithuania), and Nord Security (Lithuania) can be found among the unicorn companies (a private company with a valuation over $1 billion) [38]. Other sharing economy startups coming from CEE countries are Taxify (Estonia), Cyrcl (Bulgaria), JSC RENT BOUTIQUE (Lithuania), and Puzl CowOrKing (Bulgaria).

While the descriptive comparative framework presented above highlights the leading and lagging entities in terms of venture capital investment and enterprises value, it does not fully capture the underlying structural patterns of the innovation environment.

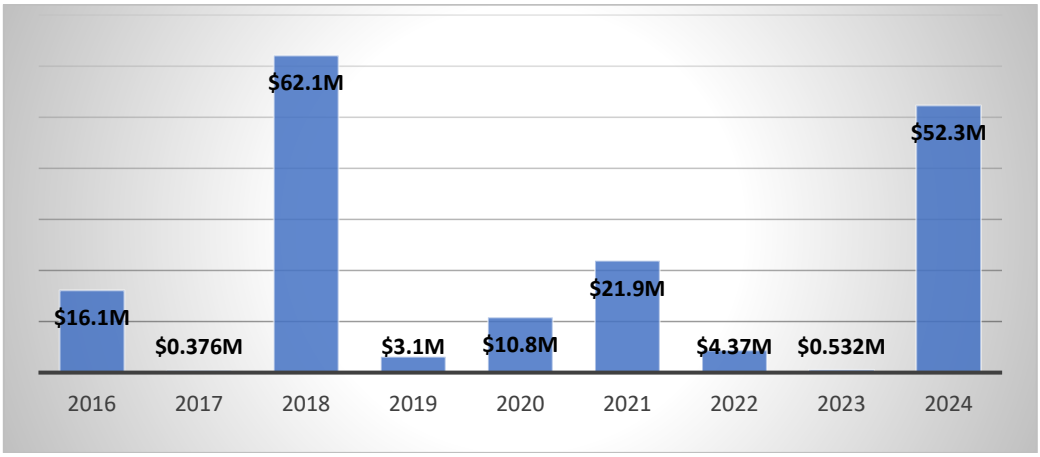

Figure 7. Total funding year-on-year in the Sharing Economy sector in Eastern Europe [37]

Following hierarchical framework was created for analysing the innovation and startup environments across EU member states using integrated SAFE data. This approach uniquely synthesizes macroeconomic indicators with micro-level firm perceptions, segmenting countries into distinct, homogeneous archetypes based on innovation capacity and financial friction. By utilizing this taxonomy, we move beyond descriptive categorization to reveal underlying structural associations between capital accessibility and firm-level innovative performance. Beyond the general startup landscape, the emergence and scalability of the sharing economy are intrinsically linked to the underlying institutional and financial conditions identified in our cluster analysis. The segmentation of EU states into distinct archetypes reveals that sharing economy platforms require a specific 'entrepreneurial substrate' - characterized by high digital innovation capacity and flexible financial barriers - to move beyond niche adoption. Consequently, our cluster results serve as a strategic diagnostic tool, highlighting which member states possess the structural readiness to foster sharing economy innovations and which remain hindered by rigid financial or administrative bottlenecks. By mapping these clusters against sharing economy penetration rates, we can identify whether the barriers to entry for platform-based businesses align with the broader systemic constraints identified in our research. Ultimately, this approach provides policymakers with a targeted framework to adapt regional strategies, ensuring that the sharing economy flourishes as a sustainable component of the wider innovation ecosystem.

The descriptive data presented earlier (Figures 6 and 7) regarding the fluctuating funding and founding rates of

sharing economy startups in Eastern Europe directly mirror the institutional realities captured by our clustering model. The segmentation of EU states into distinct archetypes reveals that the emergence of companies like Bolt or Vinted is not random; they originate from the 'Innovation Leaders' cluster, which possesses the requisite 'entrepreneurial substrate'—high digital innovation capacity and flexible financial barriers. Conversely, the sharp decline in newly founded sharing economy platforms by 2024 (Figure 6) may plausibly be interpreted as a consequence of the tightening monetary conditions and collateral constraints identified in our 'Financial Risk Zone' and 'Stable Core' clusters. While our clustering framework provides strong theoretical grounds for this association, further longitudinal firm-level data would be required to definitively confirm this causality.

Table 2. Cluster analysis parameters

Clusters	R^2	BIC	Silhouette
3	0.285	455.8	0.210

Cluster Information

Cluster	1	2	3
Size	21	3	3
Explained prop within-cluster heterogeneity	0.800	0.101	0.099
Within sum of squares	238.2	30.06	29.31
Silhouette score	0.241	0.111	0.135

Model Performance Metrics

	Value
Maximum diameter	7.760
Minimum separation	3.945
Pearson's γ	0.581
Dunn index	0.508
Entropy	0.684
Calinski-Harabasz index	4.775

Source: Authors' analysis

Explained Variability (R2 = 0.285): The coefficient of determination indicates that the model accounts for approximately 28.5% of the total variance within the data. While this value may appear modest, it represents an acceptable result within the context of EU member state economic indicators, which are influenced by a broad spectrum of non-quantifiable factors (e.g., geopolitics, national legislation). Rather than providing an exhaustive description of reality, the model aims to identify key structural trends. The strength of the model is primarily concentrated in Clusters 1 and 2. Although a majority of the EU exhibits mixed characteristics, the model has, with high precision, isolated the group of "Innovation Leaders" and the "Financial Risk Zone." These extremes are critical for policymaking (e.g., directing EU strategic assistance). The model's validity is further supported by the correlation between these results and real-world economic developments, such as the impact of interest rates in the Baltic states versus the stability of the Eurozone.

Silhouette Score (0.210): This value indicates a "weak" to "moderate" separation structure between clusters. From an economic interpretation standpoint, this confirms that the boundaries between countries' innovation profiles are not discrete but rather form a continuous spectrum. Despite the partial overlapping of clusters, the model successfully identified specific anomalies and extremes (Clusters 1 and 2) that deviate significantly from the European average (Cluster 3).

Within-Cluster Sum of Squares (WSS) - Homogeneity of Small Clusters: The strength of the model lies not in global averages, but in the exceptionally low internal heterogeneity of the smaller clusters. The "Innovation Predators" and "Risk Zone" clusters exhibit a high degree of similarity among their members, providing substantial diagnostic value for the formulation of targeted economic policies.

The last indicators in the Table 2 quantify the internal quality of our clusters - specifically, how compact the clusters are and how well-separated they are from each other.

The internal quality and stability of the clustering solution were evaluated using a multi-metric approach based on Euclidean distances. The Dunn Index (0.508) and the Calinski-Harabasz index (4.775) confirm a favorable balance between cluster compactness and inter-cluster separation, indicating that the identified country archetypes are structurally distinct. Furthermore, the Pearson's \gamma coefficient (0.581) provides empirical validation of the correspondence between the underlying data distances and the final cluster assignments. These metrics, in conjunction with the low entropy (0.684), collectively substantiate the reliability of the taxonomic framework and mitigate concerns regarding arbitrary grouping.

To validate the statistical robustness of the identified country archetypes, a one-way ANOVA was conducted to assess whether the mean values of the constitutive SAFE indicators varied significantly across the generated clusters. ANOVA method was chosen based on applying homogeneity test on our SAFE indicators (Test for Equality of Variances – Levene's), which confirmed homogeneity of variances within clusters for all SAFE indicators except "Insufficient Collateral or Guarantees" (p value Levene's = 0.002) and for "Irrelevance of Bank Loans – High Interest Rates" (p value Levene's = 0.009) for which Welsch's ANOVA has been interpreted.

Table 3. Parameters' variance through clusters

Variable	F	p value	Post hoc - p Tukey
innovation_index	9.508	<0.001	1 vs 2 (0.018), 1 vs 3 (0.005)
product_innovation	8.162	.002	1 vs 2 (0.007), 1 vs 3 (0.035)
marketing_innovation	15.58	< .001	1 vs 2 (<0.001), 1 vs 3 (0.002)
high-gr_enterprises	4.278	.026	1 vs 2 (0.024)
employment_growth	3.339	.05	1 vs 2 (0.05)
access_finance	8.712	.001	1 vs 3 (<0.001), 2 vs 3 (0.04)
insufficient_collateral	7.888	.002	1 vs 2 (0.002)
sufficient_internal_F	10.55	< .001	1 vs 3 (<0.001), 2 vs 3 (0.025)
high_interests_rates	8.225	.002	1 vs 3 (0.002), 2 vs 3 (0.007)

Source: Authors' analysis

The analysis confirmed significant inter-cluster heterogeneity for the primary financial and operational variables listed below. Post hoc comparisons using the Tukey HSD test further corroborated these findings, pinpointing the specific clusters driving the observed disparities. These results substantiate that the clustering framework successfully captures statistically distinct entrepreneurial environments, thereby validating the taxonomic classification against the null hypothesis of no inter-cluster differentiation.

Model interpretation

Cluster 1: "Financial Risk Zone" (Greece, Malta, Romania) - This cluster comprises nations exhibiting above-average innovation ambition, as evidenced by a mean product innovation index of 0.902. However, these economies encounter significant systemic barriers within their financial markets. Defining characteristics include the lowest recorded levels of investor confidence (–1.411) and an acute deficiency of collateral (1.493). These variables function as structural constraints, impeding the effective transformation of latent innovation potential into sustained macroeconomic growth.

Cluster 2: "Innovation Leaders" (Finland, Latvia, Lithuania) - Identified as the most dynamic cohort in this analysis, the countries within this cluster achieve the highest innovation index (1.528). They demonstrate a clear dominance in turnover growth indicators and a high prevalence of high-growth enterprises (HGEs). Notably, these economies maintain their trajectory despite exposure to elevated interest rates, successfully neutralizing higher financing costs through the high value-added nature of their innovations and robust market dynamics.

Cluster 3: "Stable Core" (Remaining EU Member States, including the Czech Republic) - The most populous cluster represents the foundational stability of the European market. It is characterized by the lowest interest rate burdens and the most consistent conditions for capital access. In comparison to the high-growth cohort in Cluster 2, innovation activity here is more moderate and conservative. The classification of the Slovak Republic within this cluster indicates successful integration with advanced EU economies regarding financial stability and the mitigation of barriers, although it continues to exhibit lower momentum in innovation processes relative to the leaders in Cluster 2.

To confirm the quality of our cluster analysis, the analysis was conducted repeatedly with manual adjustments to the number of clusters. While a 2-cluster model appeared optimal based on the Silhouette score (SC = 0.23), its percentage of explained variance was lower (0.209). Considering a comparison of available statistical indicators across all versions with varying cluster counts, alongside the economic and geopolitical context of the examined data, the 3-cluster model was selected as the most appropriate. We consider the difference in Silhouette scores (0.21 vs. 0.23) to be negligible; however, the practical economic difference in terms of interpreting individual clusters is significant. From an analytical perspective, the 3-cluster model is considerably more logical, as it successfully isolated what was merely suspected in the 2-cluster model: the distinction between 'high growth driven by innovation' and 'high risk due to a weak institutional environment. 'Beyond the fact that the 3-cluster model possesses higher explanatory power ($R^2 = 0.285$—an increase from 21% in the 2-cluster model, which represents a significant quality improvement in social sciences), it is essential to focus on the 'within-cluster sum of squares' statistic. For Clusters 2 and 3, these values are very low (~30), indicating that the countries within these smaller clusters are extremely similar. The transition from a 2-cluster to a 3-cluster model demonstrated that innovation in the EU is not solely about ideas, but also about the cost of capital. We have identified a group of countries where innovation thrives despite expensive credit (e.g., Finland, the Baltics); a group where innovation is stifled by investor mistrust (e.g., Greece, Romania); and a group characterized by stability, yet marked by innovation-related 'complacency' (the remainder of the EU). From the perspective of Slovakia, its inclusion in the 'remainder of the EU' cluster is logical: although Slovakia belongs to the Eastern bloc, its financial indicators are closer to the EU core than to Romania or Latvia, thanks to its Eurozone membership.

Implications for CEE Economies - The analysis suggests that the primary economic cleavage within the European Union is no longer defined by the traditional "East–West" dichotomy. Instead, the differentiation is predicated on a nation's capacity to provide financing for high-risk innovation projects. While Slovakia and its regional counterparts currently occupy a "safe harbour" of financial stability, transitioning toward the innovation leadership seen in the Baltic states will require accelerating process dynamics and diversifying away from a reliance on conservative financing models.

Based on the results described in previous sections, we are able to analyse and evaluate the research questions and their hypotheses with following logic:

Table 4. Cluster analysis – RQs and hypotheses

Hypothesis	Required Evidence
H_1: Financial Maturity - Innovation	Correlation/Significant diff in Innovation between "Finance-constrained" and "Finance-fluid" clusters.
H_2: CEE Institutional Divergence	Identification of CEE countries in different clusters (e.g., some in the "Core," some in the "Constrained").
H_3: High-growth Firms as Resilience	Significantly higher high-growth enterprises in the most financially stable cluster.

Source: Authors' analysis

H_1: Our empirical results support the hypothesis that institutional financial flexibility acts as a primary catalyst for innovation-driven enterprises, as evidenced by the statistically significant positive correlation between internal fund sufficiency and the innovation index across our identified archetypes.

H_2: The clustering results reveal a bifurcation within the CEE landscape, suggesting that regional convergence is incomplete. The divergence between clusters indicates that administrative and banking-sector constraints, rather than a lack of entrepreneurial intent, remain the defining barrier for the lower-performing CEE economies.

H_3: Regarding the resilience hypothesis, our results confirm that the prevalence of high-growth enterprises varies significantly across clusters ($F=4.278$, $p=0.026$), with the most financially stable archetypes exhibiting a higher density of these firms. This evidence suggests that a robust core of high-growth enterprises acts as an institutional hedge, providing the structural vitality necessary to mitigate the impact of banking sector instabilities. Consequently, these findings validate the premise that high-growth capacity is not merely an outcome of an ecosystem but a key driver of its overall resilience against financial friction.

4. Conclusions

Viewed through the lens of the Entrepreneurial Ecosystem Theory, startups and the sharing economy share a fundamental commonality—both thrive on disruptive innovation facilitated by dynamic, interdependent regional networks. Our analysis demonstrates that most successful sharing economy platforms within the CEE region began as startups that capitalized on the specific institutional configurations of their local ecosystems. Drawing on Institutional Theory, the data reveals that the CEE region's capacity to support these ecosystems is not uniform; rather, it is highly contingent on structural financial flexibility. Successful sharing economy startups emerge disproportionately from environments where institutional barriers to venture funding and technological development have been minimized.

To continue supporting innovative startup companies across different areas, including the ones from the sharing economy, it is important to pay attention to the development of a stimulating national and regional business environment.

Based strictly on the systemic frictions identified in our cluster analysis, the support for sharing economy and startup ecosystems must focus on structural financial and institutional interventions:

- Targeted Financial Flexibility: Expanding irreversible financial support mechanisms and alternative equity-based financing (Venture Capital, Business Angels) to circumvent the prohibitive bank interest rates identified in the 'Stable Core' and 'Financial Risk Zone'.
- Collateral Deficiency Mitigation: Implementing state-backed credit guarantee schemes specifically designed for the intangible assets typical of digital and sharing economy platforms, directly addressing the core barrier identified in Cluster 1.
- Regulatory Sandboxes: Creating dedicated institutional environments where sharing economy creators can test innovative, peer-to-peer business models with lowered administrative friction, bridging the gap between traditional corporate regulation and agile platform economies.
- Streamlined Administrative Scaling: Implementing a One-Stop-Shop principle and standardizing cross-border IP protection to build investor confidence, which the model identified as a critical missing link for high-growth enterprises in lagging clusters.

Based on the findings of the cluster analysis, in particular the identification of the "Financial Risk Zone" and Slovakia's position in the "Stable Core", also the following points are proposed:

- Mitigation of Systemic Risks in the Financial Risk Zone: For countries identified within the "Financial Risk Zone" (e.g., Romania), policy focus must shift from general startup promotion to

addressing systemic financial fragility. This includes implementing credit guarantee schemes specifically designed for intangible assets to alleviate the acute collateral deficiency that currently blocks credit flow to innovative firms.

- Escaping the "Stable Core" Trap: CEE countries categorized within the "Stable Core" (e.g., Slovakia and Czechia) must proactively diversify their financial ecosystems to increase innovation momentum. This can be achieved by incentivizing a shift from conservative bank-loan reliance towards equity-based financing and venture debt, which are better suited for high-growth, high-risk technological projects.
- Closing the Confidence Gap: To transition towards the "Innovation Leaders" cluster, it is imperative to rebuild investor confidence through improved regulatory quality and the simplification of cross-border scaling procedures. The implementation of "regulatory sandboxes" and the adoption of the proposed EU "28th regime" for company law could significantly reduce administrative burdens and foster the trust necessary for large-scale international investments.

The identified country archetypes provide a critical diagnostic lens for evaluating the scalability of sharing economy platforms, which typically require high digital maturity and flexible financial structures. Our cluster analysis reveals that member states within the "Innovation Leaders" (Cluster 2) possess the necessary structural substrate—namely, superior innovation capacity and lowered credit frictions—to act as primary adopters and scaling hubs for platform-based business models. Conversely, for states categorized within the "Financial Risk Zone" (Cluster 1), the sharing economy offers a strategic alternative for economic activation. By leveraging low-asset business models that utilize existing resources, these platforms can potentially bypass the rigid collateral requirements and capital barriers that our analysis identified as the primary impediments to traditional entrepreneurial growth.

Furthermore, the integration of these findings facilitates a transition from generalized policy support to cluster-specific institutional interventions. Rather than pursuing uniform regulatory frameworks, policymakers in constrained ecosystems should prioritize platform-enabling regulations—such as simplified gig-economy taxation and digital trust protocols—to mitigate the specific systemic constraints identified. Consequently, our taxonomy functions not only as a classification of current states but as a roadmap for targeted digital integration. By aligning sharing economy initiatives with the specific financial and structural realities of each cluster, policymakers can effectively foster a more resilient innovation ecosystem that accounts for the diverse developmental trajectories across the EU.

This research has successfully demonstrated that the entrepreneurial landscape across the European Union is defined by profound structural heterogeneity rather than regional convergence. Through a robust hierarchical clustering framework utilizing integrated SAFE data, we identified three distinct country archetypes: "Innovation leaders", "Stable Core," and a "Financial Risk Zone". Our empirical findings, validated by ANOVA and Tukey HSD post-hoc testing, confirm that the propensity for innovation is inextricably linked to institutional financial maturity. Specifically, we observed highly significant disparities in the innovation_index ($F=9.508$, $p<.001$) and sufficient_internal_funds ($F=10.55$, $p<.001$) across these clusters, substantiating the hypothesis that capital flexibility - rather than mere credit availability - acts as the primary catalyst for high-growth entrepreneurship. Beyond traditional startup dynamics, our analysis highlights a critical diagnostic pathway for the sharing economy. We found that while the "Innovation Leaders" provides a natural ecosystem for the scaling of sharing platforms, the "Financial Risk Zone" may paradoxically benefit most from their adoption. By utilizing low-asset, platform-based business models, firms in constrained economies can bypass the systemic barriers of high collateral requirements and limited external financing identified in our study. Consequently, this research advances a shift from monolithic EU policy to cluster-specific institutional interventions. We propose that policymakers transition toward "platform-enabling" regulations in constrained regions, focusing on digital trust protocols and simplified taxation to leverage the sharing economy as a strategic hedge against structural capital gaps. By aligning regional development strategies with these empirically derived clusters, the EU can foster a more resilient and inclusive innovation ecosystem that recognizes and addresses the diverse developmental realities of its member states.

References

[1] Stam E. Entrepreneurial Ecosystems and Regional Policy: A Sympathetic Critique. *European Planning Studies*. 2015;23(9):1759-1769. Available from: https://doi.org/10.1080/09654313.2015.1061484

[2] North DC. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press; 1990. Available from: https://doi.org/10.1017/CBO9780511808678

[3] Blank S. Why the lean start-up changes everything. *Harvard Business Review*. 2013;91(5):63-72. Available from: https://hbr.org/2013/05/why-the-lean-start-up-changes-everything

[4] Spender JC, Corvello V, Grimaldi M, Rippa P. Startups and open innovation: a review of the literature. *European Journal of Innovation Management*. 2017;20(1):4-30. Available from: https://doi.org/10.1108/EJIM-12-2015-0131

[5] Ries E. *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. New York: Crown Books; 2011.

[6] Ghezzi A, Cavallo A. Agile Business Model Innovation in Digital Entrepreneurship: Lean Startup Approaches. *Journal of Business Research*. 2020;110:519-537. Available from: https://doi.org/10.1016/j.jbusres.2018.06.013
[7] Wise S, Feld B. *Startup Opportunities: Know When to Quit Your Day Job*. 1st ed. New Jersey: John Wiley & Sons, Inc.; 2015.
[8] Köseoğlu SD, Patterson A. Introduction to Startup Valuation: From Idea to IPO. In: *A Practical Guide for Startup Valuation: An Analytic Approach*. 1st ed. Switzerland: Springer Nature Switzerland AG; 2023.
[9] Greco F. *Startup Ecosystems: Components for an Interpretative Model and International Benchmarks*. 1st ed. Cham: Springer International Publishing AG; 2023.
[10] Startup Commons. What Is Startup Ecosystem? [Internet]. Startup Commons; c2025 [cited 2025 Jan 23]. Available from: https://www.startupcommons.org/what-is-startup-ecosystem.html
[11] Teves G, Muralla-Palustre H, Saulo ChM, Pajutan J. *The Philippines' Ecosystem for Technology Startups (Ecosystems for Technology Startups in Asia and the Pacific)*. India: Asian Development Bank; 2023.
[12] Diggiwal A. *Startup Ecosystem - Is it worth?* 1st ed. India: Bluerose Publishers Pvt. Ltd.; 2022.
[13] Sharma R, Yu P, Mehta K. *Fostering Innovation in Venture Capital and Startup Ecosystems*. 1st ed. United Kingdom: IGI Global; 2024.
[14] Mitra N, Braña Y, Routray S, Ćorić G, Sen K. *Diversity and Inclusion in the Start-Up Ecosystem*. 1st ed. Singapore: Springer Nature Singapore; 2023.
[15] Oskam JA. *The Future of Airbnb and the 'Sharing Economy': The Collaborative Consumption of Our Cities*. 1st ed. Bristol: Channel View Publications; 2019.
[16] Sigler T, Corcoran J. *A Modern Guide to the Urban Sharing Economy*. 1st ed. Cheltenham: Edward Elgar; 2021.
[17] Wruk D, Oberg A, Maurer I. *Perspectives on the Sharing Economy*. 1st ed. Cambridge: Cambridge Scholars Publishing; 2019.
[18] Eckhardt GE, Bardhi F, Belk RW. *Handbook of the Sharing Economy*. 1st ed. Cheltenham: Edward Elgar Publishing; 2019.
[19] Zygmunt J. The effect of changes in the economic structure on entrepreneurial activity in a transition economy: the case of Poland. *Equilibrium. Quarterly Journal of Economics and Economic Policy*. 2020;15(1):49-62.
[20] Albinsson PA, Perera BY. *The Rise of the Sharing Economy: Exploring the Challenges and Opportunities of Collaborative Consumption*. USA: Bloomsbury Publishing USA; 2018.
[21] Umukoro IO, Onouha RO. *Africa`s Platforms and the Evolving Sharing Economy*. USA: IGI Global; 2021.
[22] Aref M. Sharing Economy from the Sustainable Development Goals Perspective: A Path to Global Prosperity. *Journal of Internet and Digital Economics*. 2024;4(2):116-138. Available from: https://doi.org/10.1108/JIDE-02-2024-0007
[23] Strømmen-Bakhtiar A, Vinogradov E. *The Impact of the Sharing Economy on Business and Society: Digital Transformation and the Rise of Platform Businesses*. 1st ed. Oxon: Routledge; 2020.
[24] Grieco C. *Consumer Behavior in the Sharing Economy*. 1st ed. Cham: Springer Nature Switzerland AG; 2024.
[25] Zhang J, Javakhishvili-Larsen N. Asymmetries of Local Economic Impacts of Digital Entrepreneurship in Denmark: The Case of Airbnb. In: Vinogradov E, Assadi D, Leick B, editors. *Digital Entrepreneurship and the Sharing Economy*. Oxon: Routledge; 2022.
[26] Belk RW, Eckhardt GM, Bardhi F, editors. *Handbook of the Sharing Economy*. Cheltenham: Edward Elgar Publishing; 2019. Available from: https://doi.org/10.4337/9781788110549
[27] Sundararajan A. *The Sharing Economy: The End of Employment and the Rise of Crowd-Based Capitalism*. 1st ed. Cambridge: MIT Press; 2016.
[28] Govender K. *The Rise of the Sharing Economy: Access is the New Ownership*. 1st ed. Bryanston: Tracey McDonald Publishers; 2021.
[29] Martos-Carrión E, Miguel C. The Sharing Economy: History, definitions and related concepts. In: *The Sharing Economy and the Tourism Industry: Perspectives, Opportunities and Challenges*. Oxford: Goodfellow Publishers Limited; 2022. p. 7-22.
[30] Haschek WM, Rousseaux CG, Wallig MA, editors. *Haschek and Rousseaux's handbook of toxicologic pathology*. 3rd ed. San Diego: Academic Press; 2013. Available from: https://doi.org/10.1016/C2010-1-67850-9
[31] Roy K, Kar S, Das RN. Selected statistical methods in QSAR. In: Roy K, Kar S, Das RN, editors. *Understanding the Basics of QSAR for Applications in Pharmaceutical Sciences and Risk Assessment*. San Diego: Academic Press; 2015. p. 191–229. Available from: https://doi.org/10.1016/B978-0-12-801505-6.00006-5
[32] Cornish R. *Cluster analysis* [Internet]. Mathematics Learning Support Centre; 2007 [cited 2025 Jan 24]. Available from: http://www.statstutor.ac.uk/resources/uploaded/clusteranalysis.pdf
[33] Duamentes. *CEE startup landscape* [Internet]. Duamentes; 2024 [cited 2025 Jan 24]. Available from: https://www.duamentes.com/2024/05/16/cee-startup-landscape/
[34] Dealroom. *Dealroom CEE Report 2024* [Internet]. Dealroom; 2024 [cited 2025 Jan 24]. Available from: https://dealroom.co/uploaded/2024/03/Dealroom-CEE-Report-2024-Uniqa-Cogito.pdf
[35] CBInsights. *Research unicorn companies* [Internet]. CBInsights; [cited 2025 Jan 24]. Available from: https://www.cbinsights.com/research-unicorn-companies
[36] Olekhova O, Sobachynskyi R. Top CEE startups founded in 2024. How many are there, and what have they achieved in just one year? [Internet]. AIN.UA; 2025 [cited 2025 Jan 24]. Available from: https://en.ain.ua/2025/01/09/top-cee-startups-founded-in-2024/
[37] Tracxn. *Sharing economy startups in Eastern Europe* [Internet]. Tracxn; [cited 2025 Jan 24]. Available from: https://tracxn.com/d/explore/sharing-economy-startups-in-eastern-europe/ FMs4oNU2zUdjWyHvvfrLVX3SyGrrkmNIPXg03rF9Sa0#top-companies
[38] Rankings.ft.com. *Europe's leading start-up hubs 2025* [Internet]. Financial Times; 2025 [cited 2025 Jan 24]. Available from: https://rankings.ft.com/incubator-accelerator-programmes-europe/ranking/europes-leading-start-up-hubs