$$\text{SPATIAL FEATURES OF SECTORAL DEVELOPMENT}$$

High-Tech Entrepreneurship in the Russian Regions: Conditions for the Emergence of New Companies

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Abstract—The main goal of this study was to identify the environmental factors at the regional level that influence the emergence of high-tech companies and to assess the direction of this impact. The empirical basis of the study was the data on the state of companies in high-tech and knowledge-intensive industries by regions of the Russian Federation contained in the definitive SPARK database, indicators of economic development of the regions published by Rosstat, as well as open information provided by public authorities. The processes of setting up new companies were estimated by the number of firms with nonzero revenue whose age did not exceed 3 years. In addition, the ratio of this number to size of the regional employment was analyzed. The factors of the regional environment were considered in the context of five blocks: i.e., innovation potential, human resources, general characteristics of industrial production, state support for innovation activity, and partnership interactions between innovative companies. Particular attention was paid to the last two blocks. An analysis of the general characteristics of the sample shows that young companies are distributed extremely unevenly throughout Russia; 47.8% operate in five regions. At the same time, 96% of all firms can be rated as microenterprises. The results of econometric calculations reveal that federal financing of innovation activities in general at the regional level is positively significant, as is the involvement of organizations in joint R&D projects. At the same time, the participation of the regional budget and the allocation of federal resources in support of innovative infrastructure for small and medium-sized businesses, as well as the participation of regional firms in clusters and technology parks, have not yet had a significant impact on the emergence of new high-tech enterprises.

Keywords: high-tech and knowledge-intensive business, startup activity, regional differentiation, governmental support, partnership interactions

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INTRODUCTION

The development of high-tech activities is an important condition for the growth of any national economy. The share of the high-tech and knowledge-intensive sector in Russia's GDP in 2020 was 23.5%, which is 1.7 percentage points higher than in 2019[1] but below the desired benchmarks. Prospects for the development of the high-tech sector are determined by both successful steadily growing companies and newly emerging participants in this sector. This research focuses on analyzing the features of the latter. The main purpose of the study was to identify the factors of the external environment at the regional level that influence the emergence of new high-tech companies and to assess the direction of this impact.

The first section of the article provides a brief overview of publications devoted to the analysis of the activities of young companies, discusses the internal and external reasons for the success and failure of such firms, highlights publications that consider the general features of entrepreneurial and innovation ecosystems, and specifies the regional characteristics of their development. Further, a methodical scheme of analysis is presented, a description of the empirical base is given, the choice of the studied factors is explained, and the main hypotheses are formulated. A separate section presents the descriptive characteristics of the sample. The next section discusses the results of econometric calculations; based on the analysis the conclusions set forth in the final part of the article are formulated.

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[1] See: The share of high-tech and knowledge-intensive sectors of the economy in GDP. https://rosstat.gov.ru/storage/media-bank/9CRMrLN7/mac3-okved2.xlsx.

THE MOTIVATION OF THE RESEARCH

The problems faced by business entities depend on the stage of their life cycle; newly created firms in their early years have to overcome formidable barriers. Many experts consider companies that have been operating for no more than 3 years as "new." Their number, specifics of activities, and performance results vary significantly across the regions of the Russian Federation (Natsional'nyi …, 2020). In some federal subjects and cities of the Russian Federation (Moscow, St. Petersburg, Kazan, Novosibirsk, etc.), a significant number of new high-tech enterprises traditionally appear and develop, while in others they are practically absent. The reasons for these differences, as well as the factors of survival and success of such companies, attract the interest of many researchers and experts. Identification and understanding of the features and foundations that provide successful models of their functioning are important both for establishing effective support systems for high-tech entrepreneurship at the national and regional levels, as well as for business development and making sound management decisions.

These problems are often considered in the context of analyzing conditions for the emergence of startups. At the same time, it should be noted that there is no single conventional definition of the term "startup" recognized by all authors. There are various interpretations of this term, which sometimes contradict each other. Most often, the key characteristics of startups include the ability to replicate and scale the business model (Blank and Dorf, 2016), high uncertainty about prospects (Ries, 2018), a clear focus on growth, a small size, the occurrence of a single team, zero (or very little) profit, an innovation-related field of work, and orientation to temporary duration of the company (Blank and Dorf, 2016). The use of the age criterions common to all interpretations of the startup concept: startups, of course, can be considered as young companies or projects (at the same time, there is no clear age limit, most often firms no older than 3 years are considered). High-tech (or technological) startups are assumed to be focused on innovative technologies, products or services, which, as a rule, have specific assets (patents, licenses, expertise, etc.) (Korzyuk and Tekucheva, 2019; Kostin, 2017). An analysis of the key characteristics of such companies and their definitions is beyond the scope of this article; however, technological startups can certainly be classified as a group of "new" young participants in the high-tech sector. The problems and features of such startups are of interest in the context of our study. Since their development is characterized by territorial heterogeneity, the identification of models and results of their interaction with the regional environment is of great interest.

The role of high-tech young companies in the economy and their development trends are studied both at the global level and at the level of the national economy, territorial entity, and individual company.

Wu and Atkinson (2017) show the significant contribution of high-tech startups to economic growth and high competitiveness of the United States, while noting the presence of sectoral and territorial differences. The growth of such companies is facilitated by governmental support at the federal level. Many authors emphasize the need for state support. Thus, Hottenrot and Richstein (2020) explain this necessity by the high uncertainty inherent in the activity of knowledge-intensive companies. Using the example of Germany, they consider the impact of government programs on such companies, highlighting such forms of financial support as grants and subsidies. In this study, as in many others, high-tech startups are considered as a whole; only their assignment to the macro-regions of West and East Germany is singled out as a separate characteristic.

Breschi et al. (2018) considered the characteristics of innovative startups in OECD countries and based their analysis on the premise of significant country differences in the conditions for creating new companies and their role in the economy. By analyzing the information presented in the CRUNCH database they made a list of key factors that determine the behavior of innovative startups including the education and experience of the founder, the presence of intellectual property, and access to venture financing. The location of the company is of great importance, its influence, in the opinion of the mentioned authors, should be studied separately.

Some publications are devoted to identifying factors that contribute to the success of technology startups and barriers that hinder their development. At the same time, many works are based on the data provided by surveys of operating companies. Capelleras et al. (2018) considered the intentions expressed by the management of young business entities to upscale their businesses. For entrepreneurs in Spain, the existence of such plans is compared with a number of characteristics of the external environment (population density) and the individual characteristics of the business founder, which also indirectly depend on the external environment (education, managerial and entrepreneurial experience). Although regional characteristics are not explicitly identified, the factors that appeared significant are largely determined by them.

An objective obstacle for most companies in all countries at the stage of their creation is the lack of funding (Korzyuk and Tekucheva, 2019).[2] This prob-

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[2] See also: From an idea to a unicorn: startups in Russia and the world in 22 figures // RBC: Trends. https://trends.rbc.ru/trends/innovation/5f04aeac9a79479c0727f494; What influences the development of the startup ecosystem in Russia // McKinsey Russia. https://www.facebook.com/notes/mckinsey-россия/что-влияет-на-развитие-стартап-экосистемы-в-россии/2308082942750754/; Why Startups Fail: Top 20 Reasons // CBInsights. https://www.cbinsights.com/research/startup-failure-reasons-top/.

lem is especially acute for Russia. Investors prefer to put money in companies that receive a stable income by operating in a promising growing market. However, due to the specific nature of a startup it often fails to meet such criteria. In the context of the coronavirus pandemic and related restrictions, investors are not inclined to take risks by supporting young companies. Surveys of entrepreneurs and investors in the technology sector in Russia showed significant differences in the preferences of investors and startup founders regarding the areas of business development.[3]

One significant barrier to the development of startups is the lack of an effective well-coordinated team of employees, as well as an insufficient level of competencies in the field of management, finance, and communications (Korzyuk and Tekucheva, 2019).[4] The external institutional environment is often not conducive to the emergence of new high-tech companies.

If these obstacles can be overcome, then the startup becomes successful. Surveys show that many entrepreneurs consider the availability of investment an important factor in the success of their activities. A significant role is played by "relationship capital," the established schemes of connections and partnerships, and "networking."[5] Bringing these factors into play requires an effective team, the presence of which is also perceived by entrepreneurs as a determinant of success alongside market readiness, product or technology uniqueness, availability of equipment, etc. (Barinova et al., 2015a; Kochkina and Kel'chevskaya, 2017; Korzyuk and Tekucheva, 2019).[6]

Individual decisions with regard to management in many cases play a decisive role in the development prospects of a high-tech company. Thus, the timing of launching the product on the market is highly important (Kochkina and Kel'chevskaya, 2017).[7]

The barriers and success factors described in the above-mentioned publications are interconnected; their impact depends on the external environment of high-tech entrepreneurship, which can be both favorable and unfavorable. Some works are devoted to studying the features of these conditions at the national and regional levels as well as the mechanisms of their influence on the development of companies.

The entrepreneurial ecosystem and effective innovation infrastructure tools (accelerators, venture funds, and business angels) contribute to the development of young high-tech companies.[8] Significant beneficial effects can result from the interactions between various actors of the ecosystem, opening opportunities that are not available to individual companies (Barinova et al., 2015a). The importance of the factor of entrepreneurial interactions that affect the success of startups facilitating access to resources, providing reputational effects, etc., is noted by many researchers. At the same time, the direct results of such interactions are difficult to assess by clear quantitative indicators. P. Witt (2004) noted that among the shortcomings of most studies, they fail to take the regional conditions for the development of entrepreneurial networks into account, which, of course, are present and have an impact on their activities.

As noted above, government support programs at the national and regional levels make a significant contribution to sustaining the development of high-tech companies (Barinova et al., 2015b). Numerous support programs for startup activities, as successfully developed in many countries, are clearly tied to certain regional conditions. At the same time, the mutual influence of emerging new companies and the general state of the entrepreneurial ecosystem remains an open question.[9]

R. Brown and C. Mason (2017) provided an in-depth overview of approaches to explaining the entrepreneurial ecosystem phenomenon. Most approaches highlight the regional development environment as an important determinant and emphasize the "localized" nature of any ecosystem. These authors associate some basic characteristics of the proposed typology of entrepreneurial ecosystems with regional players and the mechanisms of their interaction.

The regional context for the development of high-tech companies is of great interest. Often the performance of such companies depends on a combination of the factors discussed earlier, which is determined precisely by regional conditions (Barinova et al., 2015a, 2015b; Tolmachev and Chukavina, 2020).

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[3] Technological Entrepreneurship Market Research in Russia. 2020 // Startup Barometer 2020. 46 p. https://drive.google.com/file/d/1NsSN3e_NkGS1k2dfVb7cx6fXX8jHC-NaA/view?usp=sharing. Accessed March 3, 2021.

[4] See also: Technological Entrepreneurship Market Research in Russia. 2020 // Startup Barometer 2020. 46 p. https://drive.google.com/file/d/1NsSN3e_NkGS1k2dfVb7cx-6fXX8jHCNaA/view?usp=sharing. Accessed March 3, 2021.

[5] Technological Entrepreneurship Market Research in Russia. 2020 // Startup Barometer 2020. 46 p. https://drive.google.com/file/d/1NsSN3e_NkGS1k2dfVb7cx6fXX8jHC-NaA/view?usp=sharing. Accessed March 3, 2021.

[6] See also: Gross B. The single biggest reason why start-ups succeed // TED 2015. https://www.ted.com/talks/bill_gross_the_single_biggest_reason_why_start_ups_succeed/up-next.

[7] See also: Gross B. The single biggest reason why start-ups succeed // TED 2015. https://www.ted.com/talks/bill_gross_the_single_biggest_reason_why_start_ups_succeed/up-next.

[8] Technological Entrepreneurship Market Research in Russia. 2020 // Startup Barometer 2020. 46 p. https://drive.google.com/file/d/1NsSN3e_NkGS1k2dfVb7cx6fXX8jHC-NaA/view?usp=sharing. Accessed March 3, 2021.

[9] Dee, N., Gill, D., Weinberg, C., and McTavis, S., Startup Support Programmes WHAT'S THE DIFFERENCE, February, 2015. https://media.nesta.org.uk/documents/whats_the_diff_wv.pdf.

It should be noted that studies of regional differences in entrepreneurial activity at the early stages have been conducted for a long time, and most of them are aimed at identifying the relationship between regional conditions and the intensity of startup emergence. F. Tödtling and H. Wanzenböck (2003), in two comparable surveys organized in 1990 and 1997, took not only the number of new companies but also their sectoral characteristics into account. They showed that even in a relatively small and homogeneous country like Austria, there are significant differences in startup activity between the area surrounding Vienna and areas that are more distant from the capital.

Applied publications also emphasize the role of regional conditions. Expert practitioner Minh Ha Duong[10] in formulating advice to investors pointed out the objective differences between European and American startups. The differences relate to such aspects as funding opportunities, prospects for rapid growth, speed of entry into the market, focus on local conditions, etc. A. Salamzadeh and K. Kawamorita (2015) emphasized the role of a favorable external environment, considering the stages of startup development and the barriers that arise along the way. Elements of the external environment are largely determined by local economic, financial, and institutional conditions.

Some works are devoted to the experience of individual countries. For instance, Jee et al. (2016) analyzed territorial differences in the creation of high-tech startups in Korea. The researchers showed the presence of positive agglomeration effects and found that the emergence of startups was more likely in regions with highly qualified personnel. At the same time, it appears that the presence of clusters of high-tech companies does not affect the creation of startups. This conclusion seems to be ambiguous, in a number of countries (China, for example) there is a positive effect of the concentration of high-tech business within the relevant clusters, special zones, and other entities.

Thus, numerous studies by domestic and foreign authors have shown that the success or failure of a high-tech startup depends on a number of internal and external factors, whose influence, both positive and negative, is affected by the external environment at the national and regional levels. The uniqueness of each company determines the complexity of the considered problems. The features of such companies, the influence of external conditions on them, and their role in the economy require additional study. Both the strengths and weaknesses of the high-tech sector depend on the regional context, which affects the size of the market (local demand), the possibilities of

attracting resources (financing and personnel), forms of support, and models of interaction.

Our study is related to the development of young high-tech companies at the early stages of the life cycle, for which all the above conclusions obtained as part of the analysis of startups are relevant. However, our focus is broader; we consider "new" high-tech companies in general, many (but not all) of which can be categorized as startups. The novelty of the work is its focus on the role of federal and local state support for high-tech firms and their partnership interactions at the regional level, since these factors are especially significant at the first stages of a company's development when the capabilities of other actors or state assistance can compensate for the lack of experience, resources, competencies, and reputation. The above factors in the publications of other authors are usually only mentioned in passing, while their impact, in our opinion, is significant and deserves separate study.

RESEARCH METHODOLOGY

The empirical basis of the study was the SPARK database and the data of Rosstat official statistics for the regions of the Russian Federation. A sample of private high-tech companies established in the period from 2015 to 2017 was formed and their characteristics for 2017 were analyzed. We selected companies that operate in the following industries, which, according to the Rosstat methodology (Order of Rosstat as of December 15, 2017 no. 832), are classified as high-tech and science-intensive (OKVED2[11] codes are indicated in brackets):

• production of chemicals and chemical products (20);

• production of medicines and materials used for medical purposes (21);

• manufacture of computers, electronic and optical products (26);

• production of electrical equipment (27);

• production of machinery and equipment not included in other groups (28);

• manufacture of motor vehicles, trailers, and semi-trailers (29);

• production of other vehicles and equipment (including the production of aircraft, including space vehicles, and related equipment) (30);

• manufacture of other finished products (manufacture of medical instruments and equipment) (32);

• repair and installation of machinery and equipment (33);

• water transport activities (50);

• air and space transport activities (51);

• activities in the field of telecommunications (61);

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[10] Minh Ha Duong. The 3 Key Differences Between European vs US Startups. 2021. https://www.startupgrind.com/blog/the-3-key-differences-between-european-vs-us-stratups/. Accessed August 1, 2021.

[11] All-Russian Classifier of Types of Economic Activity.

• development of computer software, consulting services in this area and other related services (62);

• activities in the field of information technology (63);

• activities in the field of architecture and engineering design: technical testing, research and analysis (71);

• R&D (72).

Thus, the obtained sample consists of high-tech young companies, which, in accordance with the Rosstat methodology, belong to high-tech and science-intensive industries and whose development we study in the context of the regional environment characteristics.

The state of the selected segment of the high-tech sector was assessed in 82 regions of the Russian Federation (the Khanty-Mansi and Yamalo-Nenets autonomous okrugs were taken into account as part of Tyumen oblast, and the Nenets Autonomous Okrug, as part of Arkhangelsk oblast).

The influence of the external environment was analyzed with a breakdown into groups of factors that reflect the innovative and personnel potential of a federal subject, general indicators of economic development, state support for innovative activities provided at the regional level, and partnership interactions of enterprises. As in most publications, our study takes the factors of the innovative eco-environment into account since it determines the development of the high-tech sector. Its assessment is based on standard indicators (Khalimova and Yusupova, 2019). The peculiarity of our approach lies in the chosen combination of specific indicators and in an emphasis on young companies, as well as in specifying the block of partnership interactions. Since the latter are implemented within the framework of both formal and informal schemes, it is extremely difficult to take them into account in the calculations. We relied on official statistics and open information provided by regional government authorities.

Below is a list of indicators selected to characterize the state of various aspects of the regional environment.

Innovative potential (according to Rosstat data):

• the costs of technological innovation in industry, RUB mln;

• the number of personnel engaged in R&D, people;

• internal spending on R&D, RUB mln;

• the share of domestic R&D costs in GRP, %.

Personnel potential (according to Rosstat data and the Rating of Innovative Development of the RF Federal Subjects compiled by HSE University):

• the share of the employed population aged 25–64 with higher education in the total number of employed population of this age group, %;

• the share of people employed in high-tech industries, %.

General characteristics of industrial production (according to Rosstat data):

• the volume of shipped goods: mining (own production, work performed and services performed in-house), RUB mln;

• the volume of shipped goods: manufacturing (in-house production, work and services performed in-house), RUB mln.

Governmental support for innovation activity (according to Rosstat data, the Rating of Innovative Development of the RF Federal Subjects compiled by HSE University, official data in the public domain):

• the share of the federal budget in the cost of technological innovation, %;

• the share of the regional budget in the cost of technological innovation, %;

• the number of innovative projects that received federal support, units per 1 million people labor force aged 15–72;

• the federal financing of innovative projects, rubles per 1 million rubles GRP;

• the number of innovative infrastructure facilities for the support of small and medium-sized enterprises that received support from the federal budget, units.

Partnership interactions of innovative companies (according to Rosstat data, Association of Clusters and Technoparks, Map of Russian Clusters):

• the share of organizations participating in joint R&D projects, %.

The values of indicators for the federal subjects of the Russian Federation for 2017 were taken into account, all calculations were made for this year. In order to assess the state of new high-tech companies, we used such indicators as the number of firms no older than 3 years (that is, young firms) that operate with nonzero revenue, as well as the ratio between the number of such firms and the number of people employed in the regional economy. Thus, both the absolute and relative characteristics of the considered segment of the high-tech sector in the region were analyzed. The specifics of the life cycle stage and the specifics of the field of activity limit the use of revenue or profit indicators as the main dependent variable. The nonzero revenue criterion made it possible to exclude "fictitious" artificially created companies from the analysis as much as possible. The higher the values of the selected indicators are, the more active the processes of setting up new high-tech companies in the region are. In fact, this also means high startup activity.

Based on the analysis of publications, the following research hypotheses were formulated.

(1) The factors of the regional innovation environment have a significant impact on the high-tech sec-

tor; its favorable state contributes to the emergence of new high-tech companies in the region.

(2) A developed system of state support at the regional level has a positive effect on the emergence of new high-tech companies.

(3) Active partnership interactions between participants in the entrepreneurial ecosystem have a positive effect on the emergence of new high-tech companies.

THE GENERAL CHARACTERISTICS OF THE SAMPLE

The sample included 30904 companies belonging to various branches of the high-tech sector and set up in the regions of the Russian Federation in 2015−2017. Unlike many studies (in particular, our 2019 work), we did not exclude microenterprises from the analysis, since startups often fall into this category, which significantly increased the number of considered companies. High-tech business as a whole is distributed extremely unevenly across the territory of the Russian Federation and this feature of placement is also inherent in young enterprises. Below, we present the data on regions, that is, the leaders and outsiders of the rankings, compiled in accordance with the selected indicators (the number of companies and the ratio of this number to the number of employees in the region).

Regions leading in terms of absolute and relative indicators:

The absolute indicator—the number of companies, units

Moscow	7610
St. Petersburg	3412
Moscow oblast	1425
Sverdlovsk oblast	1241
Novosibirsk oblast	1097

The relative indicator is the ratio between the number of companies and the number of employees, units/thousand people

St. Petersburg	1.14
Moscow	1.07
Tyumen oblast	0.86
Novosibirsk oblast	0.81
Tomsk oblast	0.62

A total of 47.84% of the sample companies operate in the top five regions, and only 0.09% are active in the bottom group. The top five formed by each of the two indicators overlap in many respects. Thus, Moscow, St. Petersburg, and Novosibirsk oblast are included in both groups. Sverdlovsk oblast, which ranks fifth in terms of the number of companies, ranks sixth in terms of the second indicator. At the same time, Moscow oblast, in which many firms operate, occupies only 22nd place in terms of the relative indicator.

Regions with the lowest absolute and relative indicators:

The absolute indicator—the number of companies, units

Republic of Ingushetia	9
Magadan oblast	8
Republic of Kalmykia	7
Jewish Autonomous Oblast	4
Chukotka Autonomous Okrug	1

The relative indicator is the ratio between the number of companies and the number of employees, units/thousand people

Jewish Autonomous Oblast	0.05
Republic of Ingushetia	0.05
Chukotka Autonomous Okrug	0.03
Republic of Dagestan	0.03
Chechen Republic	0.03

The lists of outsiders are similar in many respects: Magadan oblast and Chukotka Autonomous Okrug, which are among the bottom five in terms of the number of firms, are in the last ten in terms of the second indicator.

The sectoral structure of the sample is also uneven (Table 1), which is typical of the sectoral structure of the high-tech sector as a whole. Most young high-tech companies work in the field of architecture and engineering design, as well as software. The same areas turned out to be the most common in the regions leading by the number of companies.

The sample included enterprises of different sizes estimated by the amount of annual revenue. They were divided into four size groups, the boundaries and characteristics of which are shown in Table 2. The groups were selected based on the formal criteria used in the preparation of the national rating "TechUp."[12] The vast majority (96%) were microenterprises with revenues of less than RUB 120 mln per year. A similar distribution by size groups is also observed at the level of regions, that is, the leaders in terms of the number of companies.

Figure 1 shows the structure of revenue by size groups. It should be noted that microenterprises not only dominate in number but also make a significant contribution to the total revenue both in the leading regions and in the Russian Federation as a whole. At the same time, their share in the sample as a whole is slightly higher than in the leading regions. For small and medium-sized companies, the opposite relationship is observed: their contribution in the leading regions is higher than in the sample as a whole. The revealed ratios reflect the influence of regional conditions on startup activity and its results.

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[12]http://ratingtechup.ru/about/.

Table 1. The types of activity that are most and least common among companies in the sample

| Activity type	Number of companies, units	Share in the sample, %
Most common types of activity		
Activities in the field of architecture and engineering design: technical testing, research and analysis	7696	24.9
Development of computer software, consulting services in this area and other related services	7075	22.9
Repair and installation of machinery and equipment	3965	12.8
Activities in the field of information technology	2380	7.7
Production of machinery and equipment not included in other groups	2137	6.9
Least common types of activity		
Production of medical instruments and equipment	170	0.55
Manufacture of other vehicles and equipment	169	0.55
Air and space transport activities	119	0.39
Production of medicines and materials used for medical purposes	102	0.33
Manufacture of aircraft, including space vehicles, and related equipment	33	0.11

Table 2. The size structure of the sample as a whole and by leading regions, 2017

Region	Number of companies in groups by annual revenue, units			
	microenterprise (no more than RUB 120 mln)	small enterprise (from RUB 120 to 800 mln)	medium-sized enterprise (from RUB 800 to 2 000 mln)	large enterprise (more than RUB 2 bln)
Russia as a whole, the number of companies	29677	1104	96	27
Russia as a whole, %	96.03	3.57	0.31	0.09
Moscow	7088	462	47	13
St. Petersburg	3271	132	9	–
Moscow oblast	1352	61	8	4
Sverdlovsk oblast	1213	25	3	–
Novosibirsk oblast	1071	23	3	–
Total by leading regions	13995	703	70	17

Thus, the bulk of young high-tech companies are very small startups. For them, the external development conditions and support opportunities are especially important; their impact was studied in the framework of econometric analysis. It can be assumed that some companies in the sample were created as part of the reorganization processes with certain opportunistic goals and, accordingly, they do not fully meet the criteria of our object of study. However, the unconditional dominance of microenterprises in the sample makes it possible to use it in order to identify factors that influence startup activity, not all of which may be significant for a mature high-tech business.

CALCULATION RESULTS

The hypotheses of this study were tested using the least-squares method; the selected indicators of young high-tech companies were checked for their dependences on the characteristics of the regional environment. The obtained results provide the basis for assessing determinants of startup activity at the regional level. Table 3 presents the mean and median values of all variables employed. The calculations were carried out using two models, in one of which the ratio between the number of young companies with non-zero revenue and the number of employees in the region (relative indicator) was used as a dependent variable, and in the second, this number itself (abso-
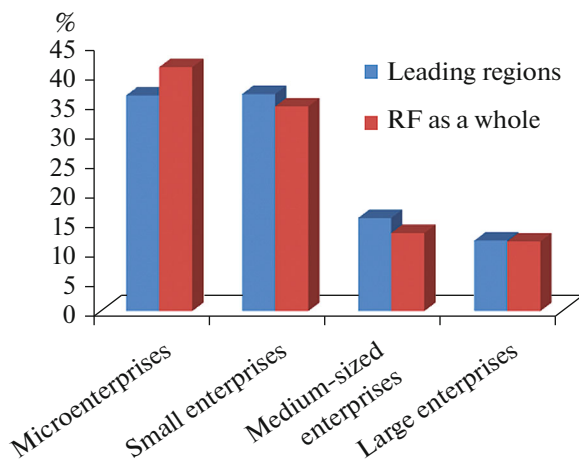
Fig. 1. The share of revenue earned by enterprises from various size groups in the total revenue of young enterprises in the high-tech sector, %.

lute indicator) was employed. Table 4 shows the final results of the calculations.

Table 5 presents the factors that were significant in at least one of the models. The last column of the table shows the variant of the dependent variable repre-

sented by absolute or relative indicators used in the model, in which the considered factor turned out to be significant. Some identified dependencies require further study. As an example, the share of domestic R&D costs in GRP negatively affects startup activity while the value of these costs has a positive impact. It can be assumed that the increase in costs should take the capabilities of the regional economy into account. The considered aspects of the external environment for young companies are important for their development, but not all of the identified factors are significant for startup activity. Thus, the following factors appear insignificant:

—the number of personnel engaged in R&D;

—the costs of technological innovation in industry;

—the share of the regional budget in the cost of technological innovation;

—the number of innovative infrastructure facilities intended for supporting small and medium-sized enterprises that received support from the federal budget.

Table 3. The descriptive statistics of the sample

Variable	Mean value	Median value
The ratio of the number of startups (new high-tech firms with nonzero revenue) in the region to the number of employees in this region, units/thousand people	0.29	0.25
Number of new firms operating in high-tech sectors of the economy with nonzero revenue in the region, units	364	159
Costs of technological innovation in industry, RUB mln	2 636.7	739.0
Number of personnel engaged in R&D, people	8 326.2	1 693.0
Share of the employed population aged 25−64 with higher education in the total number of employed population of this age group, %	32.9	31.6
Share of domestic R&D costs in GRP, %	0.77	0.44
Internal spending on R&D, RUB mln	11 989.1	1768.5
Share of organizations participating in joint R&D projects, %	0.3	0.28
Share of the federal budget in the cost of technological innovation, %	0.21	0.09
Share of the regional budget in the cost of technological innovation, %	0.15	0.0
Number of innovative projects that have been granted federal support, units per 1 million people labor force aged 15−72	0.40	0.39
Share of people employed in high-tech industries, %	37	32
Federal financing of innovative projects, rubles per 1 million rubles GRP	0.34	0.27
Number of innovative infrastructure facilities for the support small and medium-sized enterprises that received support from the federal budget, units	0.47	0.50
The volume of shipped goods—mining (own production, work performed and services performed in-house), RUB mln	163683.5	18260.0
The volume of shipped goods—manufacturing (own production, work performed and services performed in-house), RUB mln	455440.8	199822.0

Calculations were carried out for 82 federal subjects.

Table 4. Calculation results

Variable	Model 1	Model 2
Dependent variable	The ratio of the number of young companies with nonzero revenue to the number of the employed	Number of young companies with nonzero revenue
Constant	−2.360 (0.000)	−3.126 (0.000)
Share of domestic R&D costs in GRP, %	−0.045 (0.630)	−1.090 (0.000)
Share of organizations participating in joint R&D projects, %	0.228 (0.005)	0.006 (0.953)
Internal spending on R&D, RUB mln	0.087 (0.022)	1.122 (0.000)
Share of the federal budget in the cost of technological innovation, %	−0.012 (0.640)	0.089 (0.024)
Number of innovative projects that received federal support, units per 1 million people labor force aged 15–72	0.308 (0.022)	0.437 (0.062)
Share of people employed in high-tech industries, %	−0.007 (0.844)	0.020 (0.832)
Federal financing of innovative projects, rubles per 1 million rubles GRP	−0.115 (0.054)	0.230 (0.004)
The volume of shipped goods—mining (own production, work performed and services performed in-house), RUB mln	−0.006 (0.725)	−0.076 (0.006)
The volume of shipped goods—manufacturing (in-house production, work performed and services performed on their own), RUB mln	0.079 (0.047)	0.170 (0.059)
R^2	0.65	0.86
F-test (p-value)	30.455 (0.000)	70.32 (0.000)

The obtained values of the coefficients are indicated; the corresponding p-values are in parentheses.

Table 5. The factors of the regional environment that are significant for startup activity in the region

Factor	Character of the impact	Activity indicator
Innovative potential		
Share of domestic R&D costs in GRP, %	Negative	Absolute
Internal spending on R&D, RUB mln	Positive	Absolute, relative
Personnel potential		
Share of people employed in high-tech industries, %	Positive	Relative
General characteristics of industrial production		
The volume of shipped goods—mining (own production, work performed and services performed in-house), RUB mln	Negative	Absolute
The volume of shipped goods—manufacturing (own production, work performed and in-house services), RUB mln	Positive	Relative
Governmental support		
Share of the federal budget in the cost of technological innovation, %	Positive	Absolute
Federal financing of innovative projects, rubles per 1 million rubles GRP	Positive	Absolute
Number of innovative projects that received federal support, units per 1 million people labor force aged 15–72	Positive	Relative
Partnership interactions		
Share of organizations participating in joint R&D projects, %	Positive	Relative

CONCLUSIONS

High-tech entrepreneurship is unevenly developed across the regions of the Russian Federation. Our research has shown that this feature is also characteristic of the sector of young companies, most of which are microenterprises. Their appearance in the region and, accordingly, growth and contribution to the economy, are determined by many factors, including the favorable conditions of the external regional environment. They largely shape the directions, opportunities, and features of the high-tech sector develop-

ment. Our study, which was aimed at identifying the factors that are significant for the emergence of young high-tech companies, confirmed the presence of regional characteristics.

It has been shown that young high-tech companies are concentrated in several regions of the Russian Federation, which we classified as leaders, that offer favorable conditions for creating high-tech startups. Thus, Moscow, St. Petersburg, and Novosibirsk oblast are in the top five in terms of both the number of new companies and their ratio to the number of employees. At the same time, there are federal subjects in which the creation of a high-tech business is much less noticeable.

This sample includes rather specific companies. Many of them, even if they were successful later, were not able to show impressive performance results and to make a significant contribution to the economy of the region and the country as a whole in the first years of their life cycle, due to objective reasons. Therefore, indicators of the number of firms were used as dependent indicators in our calculations. An analysis of the size characteristics of the sample showed that it mainly included microenterprises. Young companies are extremely vulnerable to the adverse effects of the external environment; formal and informal support is especially important for them. On the other hand, their successful development is the potential of the high-tech sector, whose growth contributes to the competitiveness of the economy.

The analysis shows that startup activity is influenced by all blocks of the characteristics of the regional environment considered in the framework of this study i.e., innovative potential, personnel potential, general characteristics of industrial production, governmental support, and partnership interactions of innovative companies. Our earlier publications show that the structure of the industry is associated with the contribution of the high-tech sector to the GRP, that a high share of the manufacturing has a positive impact, and that the mining has an adverse effect (Khalimova and Yusupova, 2019). This conclusion was also confirmed for startup activity. It should be noted that the set of blocks and factors of the regional environment that actually influence the emergence of new firms is much wider than what was considered in this paper. Our focus was on forms of state support and partnership interactions. One important result was that federal financing of innovation activities in general at the regional level turned out to be positively significant, as was the involvement of organizations in joint R&D projects. At the same time, the employed indicators relate to the regional innovation system as a whole; they are not only relevant to startups and to young high-tech firms. It can be assumed that the general environment that creates conditions for active interaction and support of various actors contributing to the development of entrepreneurial activity in general has a beneficial effect on the considered segment. The development of various elements of the innovation system and the formation of ecosystems at the regional level will have a beneficial effect on setting up companies and the growth of the high-tech segment. Effective partnership interactions of innovative actors activate the processes of emergence of new high-tech firms. The positive impact of financing the costs of technological innovation and innovative projects has been identified. At the same time, the participation of the regional budget and the allocation of federal resources to the support of innovative infrastructure for small and medium-sized businesses, as well as the participation of regional firms in clusters and technology parks, turned out to be insignificant for startup activities. The tools of regional innovation and industrial policy used in these areas need to be refined and improved.

It is not possible to evaluate formal and especially informal interaction partnerships based on data from open sources and official statistics. The search for objective indicators of such relationships and their effectiveness is a complex task, which should be solved taking the uniqueness of every particular firm into account. Further research is planned to be based on a special survey of companies and analysis of individual cases.

The empirical base of the study was the data of 2017, which reflect the conditions for relatively favorable economic development. Currently, in the context of restrictions associated with sanctions that significantly affect the innovative activities of Russian enterprises, the need to understand the factors that contribute to the creation and growth of high-tech companies and tools for their effective motivation has are even more relevant. High uncertainty in the prospects for overall economic development and a significant narrowing of the possibilities for external interactions determine the growing role of state support, both at the national and at the regional level. On the other hand, high-tech startups relying on their own technological solutions and original developments could contribute to solving a number of significant problems associated with import substitution. This appears possible due to the flexibility of management schemes and the absence of burdensome obsolete assets. We believe such a development is highly probable. There are already some examples of companies successfully developing the output of high-tech products (e.g., the innovative company Sibbiopharm, which offers a range of hydrolytic enzyme preparations based on recombinant producers used in the agro-industrial complex). However, this practice applies to mature and successfully developing growing firms with significant capacities and rich production experience; startups that do not have financial resources will, of course, need government assistance.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

REFERENCES

Barinova, V.A., Bortnik, I.M., Zemtsov, S.P., Infimovskaya, S.Yu., and Sorokina, A.V., Analysis of competitiveness factors of domestic high-tech companies at early stages, *Innovatsii*, 2015, no. 3 (197), pp. 25−31.

Barinova, V.A., Eremkin, V.A., and Zemtsov, S.P., Factors of development of innovative companies in the early stages, *Gos. Upravl. Elektron. Vesnt.*, 2015b, no. 49, pp. 27−51. https://www.iep.ru/files/text/nauchnie_-jurnali/. Cited March 7, 2021.

Blank, S. and Dorf, B., *Startap: nastol'naya kniga osnovatelya* (Startup: The Founder's Handbook), Mityushin, N., Antipov, I., Ovchinnikova, E., Ushakova, M., et al., Eds., Moscow: Al'pina, 2016, 3rd ed. https://biblioclub.ru/index.php?page=book&id=279605. Cited March 3, 2021.

Breschi, S., Lassébie, J., and Menon, C., A portrait of innovative start-ups across countries, OECD Science, Technology and Industry Working Papers, Paris: OECD, 2018.
https://doi.org/10.1787/f9ff02f4-en

Brown, R. and Mason, C., Looking inside the spiky bits: A critical review and conceptualisation of entrepreneurial ecosystems, *Small Bus. Econ.*, 2017, no. 49, pp. 11−30. https://doi.org/10.1007/s11187-017-9865

Capelleras, J-L., Contín-Pilart, I., Larraza-Kintana, M., and Martin-Sanchez, V., Regional and individual determinants of entrepreneurial growth aspirations, *J. Evol. Stud. Bus.*, 2018, vol. 3, no. 1. pp. 17−53. https://doi.org/10.1344/jesb2018.1.j036

Hottenrott, H. and Richsteinc, R., Start-up subsidies: Does the policy instrument matter? *Res. Policy*, 2020, vol, 49, no. 1.
https://doi.org/10.1016/j.respol.2019.103888

Jee, S., Lee, J., and Oh, H-Y., An empirical analysis on the geography of Korea's high-tech jobs and start-ups, KDI School of Public Policy and Management Working Paper Series 2016. http://www.kdischool.ac.kr/new/eng/faculty/working.jsp.

Khalimova, S.R. and Yusupova, A.T., Influence of regional conditions on the development of high-tech companies in Russia, *Reg.: Ekon. Sots.*, 2019, no. 3, pp. 116−142. https://doi.org/10.15372/REG20190306

Kochkina, A.V. and Kel'chevskaya, N.R., Innovative startups in Russia: Problems of functioning and main success factors, *Innovatsii*, 2017, no. 2 (220), pp. 48−54. https://cyberleninka.ru/article/n/innovatsionnye-startapy-v-rossii-proble-my- funktsionirovaniya-i-osnovnye-faktory-uspeha. Cited March 5, 2021.

Korzyuk, D.I. and Tekucheva, S.N., Start-ups in Russia: Topical development issues, *Int. J. Profess. Sci.*, 2019, no. 7, pp. 15−39. https://cyberleninka.ru/article/n/startapy-v-rossii-aktualnye-voprosy-razvitiya-1. Cited March 1, 2021.

Kostin, K.B., Drivers for the development of high-tech start-ups on the example of Finland, *Ross. Predprinim.*, 2017, no. 18, pp. 2706−2718. https://cyberleninka.ru/article/n/drayvery-razvitiya-vysokotehnologichnyh-startapov-na-primere-finlyandii. Cited March 5, 2021.

Natsional'nyi doklad "Vysokotekhnologichnyi biznes v regionakh Rossii". 2020 (National Report "High-Tech Business in the Regions of Russia". 2020), Zemtsov, S.P., Ed., Moscow: Ross. Akad. Narod. Khoz-va Gos. Sluzhby, Assots. Innov. Reg. Ross., 2020.

Ries, E., *The Startup Way: How Modern Companies Use Entrepreneurial Management to Transform Culture and Drive Long-Term Growth*, Sydney: Currency, 2017.

Salamzadeh, A. and Kawamorita, K., Startup companies: life cycle and challenges, *Proceedings of the 4th International Conference on Employment, Education and Entrepreneurship (EEE)*, Belgrade, 2015.

Tödtling, F. and Wanzenböck, H., Regional differences in structural characteristics of start-ups, *Entrepreneurship Reg. Dev.: Int. J.*, 2003, vol. 15, no. 4, pp. 361−370.

Tolmachev, D.E. and Chukavina, K.V., Technological entrepreneurship in Russian regions. Educational and geographic trajectories of startup founders, *Ekon. Reg.*, 2020, vol. 16, no. 2, pp. 420−434.

Witt, P., Entrepreneurs' networks and the success of start-ups, *Entrepreneurship Reg. Dev.: Int. J.*, 2004, vol. 16, no. 5, pp. 391−412.

Wu, J., and Atkinson, R., How technology-based start-ups support U.S. economic growth, Information Technology & Innovation Foundation, November 2017. https://itif.org/publications/2017/11/28/how-technology-based-start-ups-support-us-economic-growth.

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