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**GRANT AND EQUITY FINANCING OF HIGH-TECH SMALL AND  
MEDIUM ENTREPRISES IN RUSSIA**

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Entrepreneurship and the entrepreneurial ecosystem are often considered as drivers of national economic growth [Acs, Estrin, Mickiewicz, Szerb, 2018; Van Stel, Carree, Thurik, 2005; Thurik, Wennekers, 2004]. Recent academic research identifies the effects on innovation development, job creation and the impact on big businesses and society as main contribution of entrepreneurship to the economy [Barringer, Ireland, 2019].

In particular, small innovative enterprises in green technologies industries were found to be 16 times more productive than large innovative enterprises in terms of patents per employee in the company [Breitzman, Thomas, 2011]. In terms of job creation in developing countries, it is small enterprises (less than 20 people) that create the most significant number of jobs [Ayygari, Demirguc-Kunt, Maksimovic, 2014]. At the same time, there is a similar trend in developed countries: in the United States, firms with fewer than 500 employees were involved in creating 2/3 of private-sector jobs in 2014 [Barringer, Ireland, 2019]. Moreover, the business models of many ventures are often built around existing product and service production, thereby providing competition and helping large firms become more efficient. New products and services provided by SMEs have also a major impact on society by improving quality of life, health, productivity.

Meanwhile, among all types of SMEs, technology companies can create products and innovations with significant economic value that impact everyone's lives [Portincaso, de la Tour, Soussan, 2019].

Russian startups in advanced tech industries represent only 0,4% of the total number of startups globally, which is way less than the share of startups in developed countries and BRICS (excl. South Africa) [Салтанова, 2021]. According to Barinova et al., the number of new high-tech companies in Russia decreases from 2016 and during the first year of pandemic, number of newly-registered Russian high-tech companies decreased by 16,8% [Баринова и др., 2020; Земцов и др., 2021]. Moreover, according to the recent survey of 620 tech entrepreneurs in Russia, 49% of startup founders identified the need for investments, and 26% named other types of support as a primary need for business development [Startup Barometer, 2020].

The specificity and opacity of SMEs in high-tech industries complicate the capital raising, especially in the emerging markets where asymmetric information leads to credit rationing [De Wet, 2004]. This explains the motivation of government participation in a startup's support. Many developing markets recognize the need to foster young tech companies by introducing liberalization of tax and customs regimes for such companies, funding of government venture funds and other venture initiatives, and building technoparks with significant infrastructure equipment. The Russian government also allocates significant budget money to create a favorable environment for startups by establishing various government institutions for innovation development.

Does such government support positively contribute to high-tech SMEs performance and effectively substitute other sources of venture financing in Russia? The lack of information and the difficulty of obtaining the data complicates such analysis and can explain the insufficient evidence from academic research on new venture performance in Russia. At the same time, a significant period since the establishment of the government institutions provides an opportunity to identify and compare the efficiency of financing available to Russian startups.

Therefore, **the aim of the research** is to determine the relationship between financing and performance of high-tech SMEs in Russia, with a particular focus on equity and grant financing from government institutions.

**The objectives of the research** are as follows:

- To systemize the results of empirical studies of the influence of financing provided by government institutions, venture capital funds, financial institutions, family, friends, management, and entrepreneurs on SMEs performance;
- To describe a landscape of Russian high-tech SMEs and analyze ownership and management characteristics of startups in Russia;
- To determine the relationship between equity financing from various sources and high-tech SME's performance with particular focus on government institutions' investments;

- To investigate the impact of government institutions' grant financing on tech companies' performance in Russia with regard to life-cycle of the companies.

**The database for the research** was collected in several steps. To describe the landscape of Russian high-tech SMEs we used the list of SMEs downloaded from the Register of Small and Medium Enterprises (*rmssp.nalog.ru*). The list of companies was significantly enlarged by an automated collection of the names from *Startuplist.ru* (digital platform of interaction between government institutes for development) to identify companies that were supported by government intuitions for innovation development.

To estimate the effect of equity financing, the list of startups for nuclear and space industries was manually collected from the Skolkovo website. Information about startups' characteristics (e.g., age, location, size), ownership structure (number, gender of owners, management ownership), and financial statements of the companies were accessed from Spark-Interfax and/or Ruslana (Bureau van Djik). This information was traced during 2010-2017 for 416 companies.

To estimate the impact of grant financing, we collected second database, which includes information about SMEs which participated in competitions organized by FASIE. 764 startups participated in competition for program «Start» and 1296 more experienced firms applied for “Razvitie-NTI” program in 2016-2017. We collected data about the operational and financial performance of these companies during 2015-2021.

The **object of the research** is a Russian high-tech SME, with a particular focus on the companies which interacted with government institutions in the form of equity and grant financing. Therefore, we study companies which are defined as SME according to Federal Law of July 24, 2007 № 209-FZ “On the development of small and medium-sized businesses in the Russian Federation”. However, in this research the affiliation of the company with high-tech industries is based either on the rules of government institutions or Russian National Classifier of Types of Economic Activity.

According to academic literature startups are often defined as companies with a short history of operations [Coleman, Cotei, Farhat, 2016; Huyghebaert, Van De

Gucht, 2007; Cassar, 2004] or as young high-tech firms [Wasserman, 2017; Davila, Foster, Gupta, 2003]. In this research, we do not limit the age of small and medium technology companies included in our sample. However, we use the term “startup” for high-tech SME associated with institutes for innovation development similar to Bruton and Rubanik [Bruton, Rubanik, 2002], as due to the peculiarities of emerging markets, it may take longer time for the company to succeed.

Our **research methodology** includes steps as follows:

1) Application of automated data collection methods as well as manual data collection for the construction of the database.

2) Statistic and correlation analysis of variables which characterize ownership structure, management, the operational and financial performance of startups in Russia;

3) Econometric analysis of the relationship between startups’ characteristics, type of financing and performance:

- For estimation of the effect of equity financing we used random effect regression model (with key independent variables lagged by 1 period).
- For the evaluation of the effect of grant financing for seed companies, on the first step we estimated probit model to predict probability of receiving a grant. We used debt as a key independent variable, being an effective signal about the company to external investors [Epure and Guasch, 2020], while the impact of debt size on a startup’s future is ambiguous [Andrieu et al., 2021]. On the second step, in line with Heckman's methodology [Heckman, 1976] for adjusting for selection bias we included these predicted probabilities as independent variables in estimation of Cox proportional hazard model of company survivorship.
- For the effect of grant for more experienced firms, on the first step we identified factors which influence decision making of grant financing by estimating a binary choice model. Second, we use these factors for propensity score matching with a sample of the companies that did not receive grant. Third, fixed-effects regression models are estimated on the sample of companies after matching.

### **Current academic research.**

In line with resource-based view of a new venture company [Coleman, Cotei, Farhat, 2013] we considered major resources which can contribute to firm performance, including equity and debt financing, grant, physical and social capital.

A significant difference between small and privately owned firms and big public corporations concerns the level of information opacity [Coleman, Cotei, Farhat, 2016, p.11]. Information opacity is reflected in the respective barriers for debt financing. Therefore, the pecking order hypothesis for high-tech companies is different: the primary source of startup financing is expected to be owners' resources; external equity is predicted to be the secondary source; and external debt is used as the last option for startup financing [Minola, Cassia, Criaco, 2013; Mann, Sanyal, 2010; Mac an Bhaird, 2010; Sjögren, Zackrisson, 2005].

Additionally, to overcome an information asymmetry and secure external funding, firms extensively use various mechanisms and signals [Connelly et al., 2011]. For high-tech and small businesses government grants were found to be an important signal for outside investors [Islam et a., 2018].

Most studies about SME characteristics and their performance focused on firms in a developed market. However, studies of developing markets show that high-tech firms face additional difficulties: for example, administrative barriers are higher for such firms [Баранов, Долгопятова, 2012]. Therefore, the role of equity investments and grants as key sources of financing for high-tech SMEs in Russia merits particular attention.

The research on SME and innovation companies in Russia mainly analyzed the influence of macroeconomic factors [Образцова и Чепуренко, 2020; Баринова, Еремкин, Земцов, 2015; Chadee, Roxas, 2013; Molz, Tabbaa, Totskaya, 2009; Aidis, Adachi, 2007; Hartarska, Gonzalez-Vega, 2006; Долгопятова, 1999] or firms on later stages of life-cycle [Земцов, Чернов, 2019; Iwasaki, Muzabata, Muravyev, 2018; Yusupova, Khalimova, 2017].

Additionally, the stream of academic research of Russian SMEs focuses on the specificity of managerial and entrepreneurial characteristics and styles of such firms in Russia, as well as their significance for firm performance [Shirokova et al., 2020; Salienko, Baev, Klyueva, 2020; Pletnev, Barkhatov, 2016; Pletnev, Nikolaeva, 2016; Mikhailitchenko, Lundstrom, 2006; Batjargal, 2003].

Despite the significant volume of government subsidies for Russian institutions for innovation development, the empirical and quantitative research on the efficiency of such support for high-tech business is limited and controversial. Based on the survey of 75 Russian medium tech companies, Medovnikov et al. showed that only for 17% of companies that used government support responded that it accelerated their development [Медовников и др., 2016]. However, survey of 245 CEOs of companies that received grants from FASIE showed that 80% of CEOs found this support to be useful [Дежина, Медовников, Розмирович, 2019].

Simachev and Kuzyk also showed that support from state development institutions, direct financing and tax reliefs contributed to the firm revenue growth [Симачев и Кузык, 2020]. At the same time, the effect of government support to SMEs during the pandemic was also found to be heterogeneous and mostly ineffective [Чепуренко и др., 2021; Земцов и др. 2020].

**Contribution.** This research contributes to the understanding of effect of different forms of financing on performance of high-tech SMEs in countries with limited private investments and significant government support. Based on the analysis of the existing literature on financing of high-tech SME, we contribute to scientific research by (1) revealing characteristics Russian high-tech SMEs; (2) demonstrating the role of equity financing provided by the government and private sources on Russian tech companies; (3) analyzing the effect of grant financing for companies on seed stage and more experienced firms.

*1. Government institutions are major stakeholder of high-tech SMEs in Russia, that provides financial and non-financial resources to companies.*

During 2006-2020 more than 965 billion rubles of government funding were directed specifically into government institutions for innovation development

[Соколов, 2021]. Based on the data collected from *Startuplist.ru* (digital platform of interaction between government institutes for development), we confirmed that at least 10,430 companies were supported by government institutions for innovation development in recent years.

Although the scope of services provided by different government institutions is similar, there exist patterns in type of services provided by particular organization and the company's life-cycle. Therefore, to analyze the effect of grant financing we focused on the companies which interacted with FASIE as its main instrument of support is grant financing. The equity investments and peculiarities of ownership and management characteristics were studied on the sample of Skolkovo participants.

To reveal specific characteristics of startups supported by government institutions we focused on the Skolkovo participants from Nuclear and Space industries, in which Russian participation is more pronounced and in which government affiliated companies play significant role.

Although the primary sources of equity financing in Russian startups are similar to those observed in the developed markets, Russian technology firms have a unique set of ownership structure characteristics, including higher participation of government institutions and corporate investors.

We found that ownership concentration is different for companies with different types of owners. The presence of government development institutes tends to decrease ownership concentration, while the presence of a corporate investor tends to increase the size of the most significant share. We identified positive relationship between the support of corporate and government investors, which can indicate the connection between government and corporate activities and/or be a signal of risk-sharing behaviors of such institutions.

*2. The effect of equity financing of Russian SME depends on the source: government-related organizations negatively influence startup performance, while the impact of private venture capital on startup performance is industry-specific.*

In the research, performance of a company was estimated based on several metrics, including financial (revenue, presence of revenue, ROA, profitability, revenue

growth, productivity, and labor productivity) and operational (number of patents and number of employees).

We found no evidence of the positive effect of the share of government-related organizations in ownership on firm performance proxied by ROA, profitability, and revenue growth. Such results can be explained by the fact that such organizations could be more interested in investments in strategically important startups rather than in companies that provide high returns. Additionally, we should take into consideration the specific features inherent in government institutions and identified by Alperovych, Groh, and Quas [Alperovych, Groh, Quas, 2020]: focus on underdeveloped regions, exposure to political interference, and lack of managerial competence. Such features can prevent government development institutions from competing with private venture capital.

In line with previous studies, we found evidence of a significant contribution of venture capital considered as a private source of financing to firm performance in Russia; however, the effect is industry-specific: positive and significant for startup performance profitability for the Space cluster startups.

While family equity contributions were not found to have a significant impact on startup performance, we identified a positive relationship between the owner or CEO change and future startup performance.

Although CEO share is negatively correlated with the age and size of the company, the relationship between the share of CEO in ownership structure and performance was not confirmed.

*3. Grant financing was confirmed to positively influence on survival of high-tech SMEs in Russia, while we found no evidence of grant contribution to financial and operational performance for more experienced high-tech firms.*

In this research we showed that grants of up to 2 million rubles given on a competitive basis to startups at the seed stage can increase the probability of survival of a young company by more than 50%.

However, we found no evidence that grants significantly improve the financial and operational performance of more experienced high-tech firms, although the

companies with grant financing were observed to survive longer and attract more debt later. Such results are in line with findings of Rodionov, Semenov, and Oskin that grant financing can be a determinant of future venture capital investment in Russia [Rodionov, Semenov, Oskin, 2021].

To sum it up, the findings of this research indicate that in the setting of emerging markets, government support cannot fully substitute the expertise and capital of private investors but can complement it and help eliminate the institutional voids by using different channels.

**Limitations.** A standard limitation of research of SMEs especially in technological industries concerns the data availability. Although we use various methods to control for endogeneity, unobserved characteristics which could not be captured from available data can lead to biases in the results.

Moreover, we should pay a particular attention to the specificity of our sample. In the empirical section of our research, we focused on companies which were participants of Skolkovo innovation system or of FASIE competition. Although we were able to get the significant results about the effect of equity and grant financing on firm performance for particular companies, such self-selection of the firms limits the possibility of making pronounced conclusions about the general population of Russian high-tech SME.

**Theoretical implications.** Our research contributes to the stream of academic literature on entrepreneurship and entrepreneurial finance. In particular, this study provides an overview of existing research about possible sources of entrepreneurship financing and their influence on specific measures of firm performance; and discusses the peculiarities of the pecking order and signaling theories for young tech companies. We contribute to the research on the impact of private and government financing in the form of a grant and equity, with the evidence from Russia as the country with significant government participation in the economy.

**Practical implications.** This research also provides insights for public authorities to design an effective system of entrepreneurship support using appropriate instruments concerning policy goals. The findings of this research provide strategic

management insights for startup entrepreneurs looking for support for their business to enhance the firm's performance.

**The results of the research are published** in the papers:

1. Guseva, O., & Stepanova, A. (2019). Owners and CEOs of startups: Evidence from Russia. *Journal of Corporate Finance Research*, 13(1), 107-119
2. Guseva, O. A., & Stepanova, A. N. (2021). Startups in Russia: Ownership and performance. *Journal of the New Economic Association*, 52(4), 67-97
3. Guseva, O. (2021). Support of State and Private Institutions for Biomedical Start-ups in Russia. *Journal of Corporate Finance Research/Корпоративные Финансы* | ISSN: 2073-0438, 15(2), 27-41.
4. (*Work in progress*) Guseva, O., Stepanova A. (2022). Evaluation of the effectiveness of the grant policy of government institutions for innovative development. – research supported by Center for Advanced Governance.

**The results of the research were presented and discussed** at Russian and international conferences and workshops:

1. Report on XXI April International Academic Conference on Economic and Social, section L-25, 23 Apr 2020
2. Report on REMI 1-st Annual Workshop, 30 Sep 2019, NRU HSE, St Petersburg, Russia
3. Report on XX April International Academic Conference on Economic and Social, section L-04, 9 Apr 2019
4. Report on 6th annual Ph.D. workshop "Financial Markets and Corporate Strategies: Comparative Studies", 13 Apr 2019
5. Report on RENT XXXII – Research in Entrepreneurship and Small Business, Toledo, Spain, 15 Nov 2018
6. Report on Analytics for Management and Economics Conference 2018, 21 Sep 2018
7. Report on the Ph.D. workshop, Analytics for Management and Economics Conference, 19 Sep 2018

The results of this dissertation were presented and discussed in seminars organized by the Doctoral School of Economics in the Higher School of Economics.

Research findings are also used in the teaching process of course “Entrepreneurial Finance” for master students in the NRU HSE master program “Strategic Corporate Finance” and for academic supervisory of term papers and theses of master and bachelor students NRU HSE.

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