Financing Patterns of Russian Innovative Enterprises: Empirical Evidence

O.N. Korableva, A. Maarouf
St. Petersburg State University, St. Petersburg, Russian Federation

ABSTRACT

Different financial resources are used to finance the operational and innovative activities of enterprises, forming the structure of their capital. Many studies have been conducted on the topic of businesses' access to external financial resources, such as loans. However, the topic of the relationship of financing patterns with the results of innovation activity and the innovative potential of enterprises is still insufficiently studied. **The aim** of this article is to identify patterns of financing Russian enterprises, as well as the specifics of financing innovative enterprises. As the main research method, we used cluster analysis, which was conducted for two groups of Russian enterprises — large and small and medium-sized (SMEs) businesses. The study is based on data from a survey of Russian companies conducted by the World Bank. **The results** show that large enterprises use five financial patterns: equity, trading, loans, mixed financing, and government subsidies. SMEs, on the contrary, are limited to the first four patterns. Special attention was paid to innovative companies, among which most large enterprises rely on their own funds as the main source of financing. At the same time, small and medium-sized innovative enterprises demonstrate a more flexible financial strategy, using a wider range of sources to ensure their innovation activities. The data obtained is of great importance for the development of effective tools to support innovation. Taking into account the identified features of the financial structure of companies, it is necessary to develop measures aimed at stimulating innovation, taking into account the specifics of various types of enterprises. This will not only increase the innovative potential of Russian companies, but also strengthen their positions in the domestic and global markets.

Keywords: capital structure; financial resources; financial patterns; cluster analysis; innovation activities; Russian enterprises; large enterprises; small and medium enterprises

Паттерны финансирования российских инновационных предприятий: эмпирические данные

О.Н. Кораблева, А. Мааруф
Санкт-Петербургский государственный университет, Санкт-Петербург, Российская Федерация

АННОТАЦИЯ

Для финансирования операционной и инновационной деятельности предприятий используются различные финансовые ресурсы, формирующие структуру их капитала. Изучению доступа предприятий к внешним финансовым ресурсам, в том числе кредитам, посвящены многие исследования. Однако тема взаимосвязи паттернов финансирования с результатами инновационной деятельности и инновационным потенциалом предприятий все еще недостаточно изучена. **Целью** данной статьи является определение паттернов финансирования российских предприятий, а также особенностей финансирования инновационных предприятий. В качестве главного **метода** исследования применяется кластерный анализ, проведенный по двум группам российских предприятий — крупным и малым и средним (МСП). В основу исследования легли данные опроса российских компаний, проведенного Всемирным банком. Результаты показывают, что крупные предприятия используют пять финансовых паттернов: собственные средства, торговые операции, кредиты, смешанное финансирование и государственные субсидии. МСП, напротив, ограничены первыми четырьмя паттернами. Особое внимание было уделено инновационным компаниям, среди которых большинство крупных предприятий полагаются на собственные средства как основной источник финансирования. В то же время малые и средние инновационные предприятия демонстрируют более гибкую финансовую стратегию, используя более широкий спектр источников для обеспечения своей инновационной деятельности. Полученные данные имеют большое значение для разработки эффективных инструментов поддержки инноваций.

Учитывая выявленные особенности финансовой структуры компаний, необходимо разработать меры, направленные на стимулирование инноваций с учетом специфики различных типов предприятий. Это позволит не только повысить инновационный потенциал российских компаний, но и укрепить их позиции на внутреннем и международном рынках.

INTRODUCTION

New products and services are essential for competitiveness and growth of businesses. Therefore, companies carry out various innovation activities in order to release new products [1]. Increasing innovation activities in national companies could have an impact on the growth of the national economy in general [2, 3]. Therefore, enlarging the share of innovative enterprises and their support are considered to be the main objective in plans and strategies to achieve the transformation to the innovation economy [4].

The Russian economy is one of the emerging economies where the government has developed many strategies to increase the innovation activity of Russian enterprises [5]. However, the share of innovative enterprises in Russia remains tiny. Expenditure on research and development (R&D) forms around 1% of the national gross domestic product (GDP).[1] Moreover, only 9.1% of Russian enterprises were engaged in innovative activities in 2021. The share of small and medium enterprises (SMEs) that engaged in innovative activities in 2019 is around 5.8%.[2] Nevertheless, SMEs account for around 22% of the Russian GDP[3] with government strategies to enlarge their share to 40% by 2030.[4]

Innovative activities require many human, financial and technological resources. Access to finance is considered to be one of the main resources that could foster innovative projects in enterprises. However, innovative enterprises' access to external financial resources could be hindered by many factors. The main reason for hindered access is the high risks inherent in innovative activities. These risks are caused by the sunk cost of innovative projects and the lag between investing the resources and getting a return on them. Another kind of risk is related to the nature of the results of innovative activities. Innovative projects end mainly with intangible assets that could not be used as collateral for credits and could be used by rivals in case of no protection of intellectual property [6, 7].

All the aforementioned factors could influence innovative access of enterprises to external financial resources. Correspondingly, these factors influence the enterprises' capital structure which reflects the share of different internal and external resources in enterprise capital. Therefore, understanding the capital structure of enterprises and its relationship with their innovative performance and innovation potential could boost the development of government strategies by decision-makers that work on enhancing the access of enterprises to external financial resources and their innovation activities.

This article is dedicated to identifying different patterns in the capital of Russian large enterprises and SMEs and the distribution of innovative enterprises on these patterns. This is a relevant issue for Russian businesses, where credit financing is seen as one of the main external financial resources [8]. Therefore, it is critically important to develop effective financial measures to stimulate the innovation activity of the Russian enterprise [9, 10]. Our article contributes to the economic literature by first defining the financing patterns of Russian enterprises and differentiating between the financing patterns of large enterprises and those of Russian SMEs. Moreover, the distribution of innovative enterprises on these patterns was identified. Hence, it is possible to develop related policies and measures to support access of enterprises to external financial resources and to stimulate their innovation activity.

The research starts by introducing a literature review of the major works in this field and their approaches to defining the capital structure of enterprises. Further, a clustering analysis has been conducted to define Russian enterprises' financing patterns is explained in the methodology. The results of this analysis were

---

[1] Ditkovskiy K., Evnevich E., Fridlyanova S. et al. Data Book. National Research University Higher School of Economics. Moscow: HSE; 2021:352.

[2] Ditkovskiy K., Evnevich E., Fridlyanova S. et al. Data Book. National Research University Higher School of Economics. Moscow: HSE; 2021:276.

[3] OECD, Financing SMEs, and Entrepreneurs 2020: An OECD Scoreboard, OECD Publishing. Paris; 2020.

[4] PWC, doing business and Investing in the Russian Federation. February 2017.

discussed and compared to the results of other studies in different countries in the discussion.

LITERATURE REVIEW

In recent years, there has been a growing interest in studying capital structure. More studies were dedicated to exploring the structure of different resources (internal funds, credits, and equity) that form the enterprise capital. Some studies focus on the determinants of capital structure [11], while others focus on the specifics of different sectors or different countries by making a cross-country comparison [12]. Another aspect of research studies the influence of financial systems on the financing patterns of enterprises [13, 14].

Many articles were dedicated to the problem of restricted access of innovative enterprises to finance, its rationales, and consequences on the innovative development of enterprises. Fewer studies aimed to analyze the demand for external financial resources and the influence of national economic development on choosing the external financial resource [15–19]. Other studies have examined the capital structure of innovative enterprises to different identify enterprises financing patterns and their relationship with enterprises characteristics, such as enterprise size, sector, and age [20–23].

Cluster analysis is one of the main methods to study the capital structure of enterprise. This method is used to identify a few groups (clusters) that differ from each other by the share of external financial resources. These clusters form different financing patterns of enterprises. The characteristics of enterprises in each cluster are also identified to understand their relationship with enterprise capital structure. Mortiz et al. [24] studied the capital structure of European SMEs and identified six financial patterns. These patterns are (mixed financed SMEs, state-subsidized SMEs, debt-financed SMEs, flexible debt-financed SMEs, trade-financed SMEs, and internally financed SMEs). Around 40% of European SMEs are internally financed and 20% are debt-financed. The results of the following research confirmed Mortiz's results and identified an additional financing pattern — active financed enterprises. Furthermore, the results confirmed the use of credits among SMEs to a greater extent compared to the use of equity sales in enterprises' capital [25].

The financial patterns of R&D in German companies were studied by Belitz and Lejpras in their papers [26, 27], where they identified four clusters. The majority of German enterprises finance their R&D activities with their internal resources. Mainly, they are large enterprises that conduct R&D in-house and do not cooperate with other sides. Further research by Masiak et al. confirms that small enterprises' access to government grants and other financial resources (credits and equity) is restricted in comparison with large enterprises' access. Small enterprises depend mainly on their internal resources even in comparison with medium enterprises. However, they receive short-term credits more than the last [28].

The relationship between SMEs' financing patterns and enterprises' innovation activities in Europe was studied by Błach et al. [29]. The results confirmed that loans are the main external financial resources of European SMEs. However, the research has not explored the relationship between the kind of innovative results and the financial resources. SME dependence on loans as the main external financial resource contradicts the results of Hall and Lerner [30] which implies that equity is the main external financial resource of SMEs. However, their findings are consistent with those of Kerr and Nanda [31] who noted the growing importance of loans as a source of innovation financing.

This article can contribute to economic literature by exploring the difference in financing patterns between large enterprises and SMEs in Russia and by comparing the financing patterns of Russian and European SMEs. Furthermore, the financing patterns of enterprises with elements of innovation potential, for instance, using foreign technologies or purchasing intangible assets are discovered.

METHODOLOGY

To study the relationship between innovation activities, innovation potential, and enterprise capital structure cluster analysis has been conducted. The analysis was carried out in two stages. Firstly, hierarchical clustering (ward algorithm) was applied to identify the cluster number [32]. In addition, k-means clustering was used to divide the enterprises into clusters and define the main characteristics of each cluster. Thus, it is possible to conduct a taxonomic analysis of Russian enterprises' capital structure and its relation to the results of innovation activities and innovation potential [33]. Our data are the results of the World Bank enterprises survey that has been conducted in Russia in 2019.[5] The sample includes 1283 observations of large, medium, and small Russian enterprises. The sample was divided into 2 groups: large enterprises and small and medium-sized enterprises (SMEs) differ in their financing methods, as suggested by economic literature. Analysis variables contain active clustering variables which are

---

[5] World Bank, Enterprise Survey 2019. The Russian Federation. URL: https://microdata.worldbank.org/index.php/catalog/3564 (accessed on 19.11.2022).

Clustering Analysis Passive and Active Variables

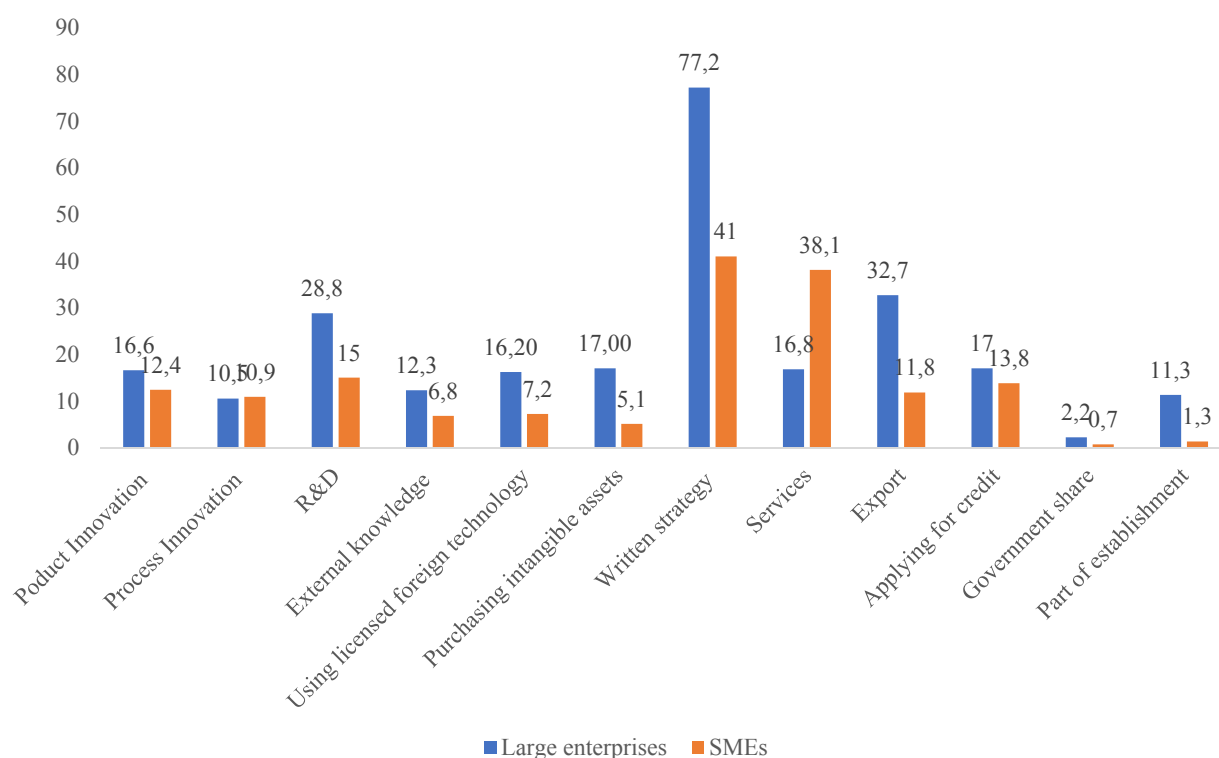| Variable	Description
Passive clustering variables	
Control variables	
Sector	Variable takes 2 values — 0 for manufacturing enterprises and 0 for service enterprises
Part of a multi-establishment Firm	Variable takes 2 values — 1 if the enterprise is a part of a multi-establishment Firm and 0 otherwise
Owned by government	Variable takes 2 values — 1 if the government owns 10% of the enterprise or more and 0 otherwise
Exporting enterprise	Variable takes 2 values — 1 if enterprise export its products to other countries and 0 otherwise
Applying on credits	Variable takes 2 values — 1 if enterprise applies on credit in the last fiscal year and 0 otherwise
Innovation activities results variables	
Product innovation	Variable takes 2 values — 1 if the enterprise developed a product innovation in the last 3 years and 0 otherwise
Process innovation	Variable takes 2 values — 1 if the enterprise developed a process innovation in the last 3 years and 0 otherwise
Innovation potential variables	
Written business strategy	Variable takes 2 values — 1 if the enterprise has a written business strategy and 0 otherwise
Acquisition of external knowledge	Variable takes 2 values — 1 if the enterprise spent on acquisition of external knowledge and 0 otherwise
R&D	Variable takes 2 values — 1 if the enterprise spent of R&D in-house or out-house in the last 3 years and 0 otherwise
Using of foreign technology	Variable takes 2 values — 1 if the enterprise uses technology licensed from a foreign-owned company and 0 otherwise
Buying intangible assets	Variable takes 2 values — 1 if the enterprise has purchased any trademarks, copyrights, patents, or other intangible assets in the last fiscal year and 0 otherwise
Active clustering variables	
Capital structure variables	
Internal funds share	% of working capital financed from internal funds/retained earnings
Bank financing share	% of working capital borrowed from banks
Non-bank financial institutions share	% of working capital borrowed from non-bank financial institutions
Suppliers/customers funds share	% of working capital purchased on credit/advances from suppliers/customers
Government grants share	% of working capital in government grants
Bonds share	% of working capital in issued bonds

Source: Compiled by the authors.

Fig. **1. Descriptive Statistics of Large Enterprises and SMEs Participating in the Survey, %**
Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

the variables that are used in clustering and passive clustering variables which are used to describe the clusters' characteristics. Active variables reflect the capital structure of enterprise, while passive variables reflect the enterprise's innovation potential and results of innovation activities.

Passive variables include control variables that describe the enterprise's general characteristics, for instance, sector, government share, and holding membership. A full list of active and passive clustering variables is in *Table 1*.

Result Analysis
Descriptive Statistics

Our sample includes 1,283 observations which have been divided into two groups. The first group consists of large enterprises (382 observations), and the second group contains small and medium-sized enterprises (SMEs) (901 observations). The descriptive statistics for each group are presented in *Fig. 1*.

Characteristics of SMEs and large enterprises are different in many aspects though we had to divide the sample into two groups before clustering. More large enterprises tend to have written strategies and obtain external knowledge than SMEs. Moreover, 28.8% of large enterprises spent on R&D in the last 3 years while this figure for SMEs is 15%. Regarding the results

of innovation activities, large enterprises that have participated in the survey tend to introduce product innovation more than the participating SMEs, while for process innovation activity the difference is small. Correspondingly, the share of large enterprises that obtained external knowledge is two times more than that for SMEs. Furthermore, around 11% of large enterprises are part of establishments, while this figure is only 1.3% among SMEs. Also, government share is more popular among large enterprises than among SMEs. SMEs that operate in the service sector are twofold more than large enterprises.

The main financial resource for Russian large enterprises and SMEs remains their internal funds. This resource on average consists of more than 73% of the capital structure of large enterprises and more than 78% of SMEs' capital structure. However, the standard deviation of financial resources share is large. Thus, enterprises are different in their capital structure. The second main resource is the credits from suppliers and customers. This resource forms around 13% of the capital structure for both enterprises type. Large enterprises' access to credits from the bank and non-bank institutions is better than SMEs' access, which compiles the mainstream economic literature. Other external financial resources (government grants and bonds) consist of a tiny share of the capital structure of

Capital Structure of Russian Large Enterprises and SMEs (%)

Type of Recourses	Large enterprises		SMEs	
Financial resource	mean	standard deviation	mean	standard deviation
Internal funds	73.8	23.4	78.8	22.3
Bank credits	9.1	14.6	6.3	11.6
Non-bank financial institutions	1.3	6.4	0.5	4.5
Suppliers/ customers	12.6	16.8	13.0	17.2
Government grants	0.9	4.5	0.2	2.1
Bonds	0.9	4.4	0.1	1.4
Other	1.4	6.6	1.1	5.4

Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

enterprises (*Table 2*). Clustering large enterprises and SMEs enable us from defining different groups of capital structure in both enterprise types and reveal their main characteristics.

Clustering Results

Depending on the results of hierarchical clustering large enterprises are distributed onto five financing patterns (clusters), while SMEs are distributed on 4 patterns. The distribution of both large enterprises and SMEs among the patterns is not even which means that there are dominant financing patterns for both types of enterprises. To obtain a more representative image of the Russian enterprises the observations' weights were taken into account when calculating the distribution of enterprises on clusters and cluster characteristics.

Large Enterprises

Most of the large enterprises 57.5% are internally financed enterprises. The internal financial resources equal more than 92% on average for internally financed enterprises. Internal resources for the four other clusters consist of around half of their financial resources on average. The second large cluster (27.5% of all Russian large enterprises) is trade-financed enterprises. These enterprises depend on loans they get from suppliers and customers as their main external financial resources (36%). The third large group is the credit-financed enterprises, and which consist of around 12.5% of large businesses. Credits from financial and non-bank financial institutions form more than 41% of their financial resources (*Fig. 2*).

The other two clusters contain around 2.8% of Russian large enterprises. These clusters consist of state-subsidized and mixed-financed enterprises. Mixed financed enterprises use different external financial resources. For these enterprises, bonds form 18.8% of financial resources, while credits from banks and non-bank financial resources form more than 22% of financial resources. State-subsidized enterprises depend on government subsidies for 23% of their financial resources on average, while bank credits form the main part of external financial resources (*Fig. 3*).

SMEs

Most of the Russian SMEs (around 60%) are internally financed where the internal funds consist of around 94% for these enterprises on average. Other SMEs' clusters depend on internal resources for more than 50% of their financial resources.

The other two main clusters are credit-financed and trade-financed enterprises. Trade-financed SMEs depend in around 39% of their financial resources on credits from customers and suppliers. Bank and non-bank credits in credit financed SMEs for more than 31% of their financial resources. The smallest cluster is the mixed-financed SMEs that depend on a mix of external financial resources including bonds (7.5% on average) (*Fig. 4, 5*).

Large Enterprises Clusters Description

1. **Internally-financed:** the largest cluster of large enterprises that contain more than 57% of them. More than 60% of service large enterprises are internally financed and around half of the enterprises have a government share. This cluster contains more than 70% of enterprises that introduced product innovations in the last three years and more than 83% of those that introduced process innovation. Regarding the
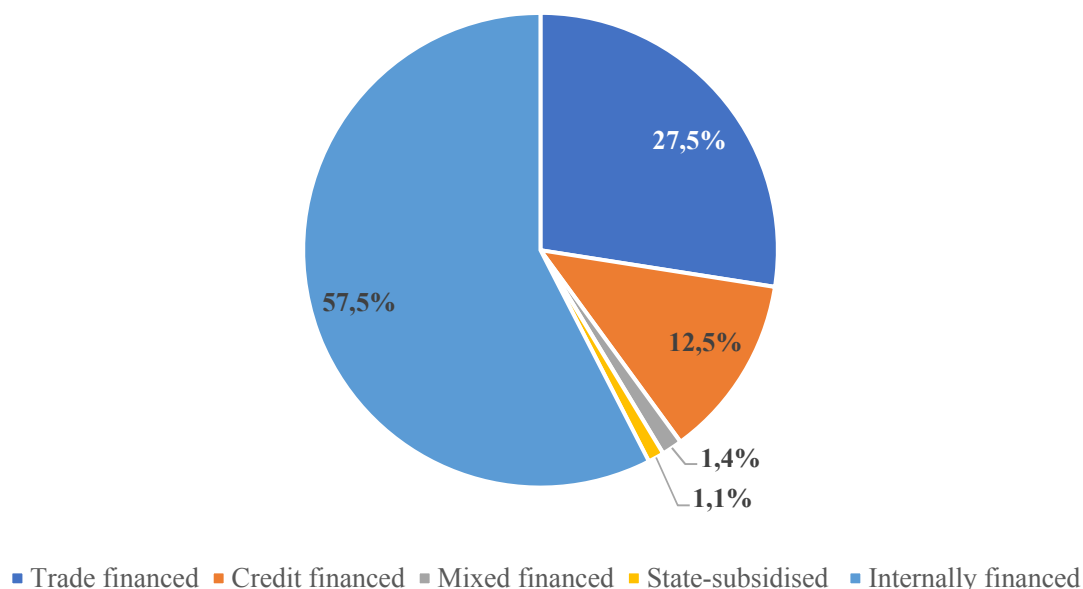
Trade financed ■ Credit financed ■ Mixed financed ■ State-subsidised ■ Internally financed

Fig. 2. **Large Enterprises Distribution on Clusters**
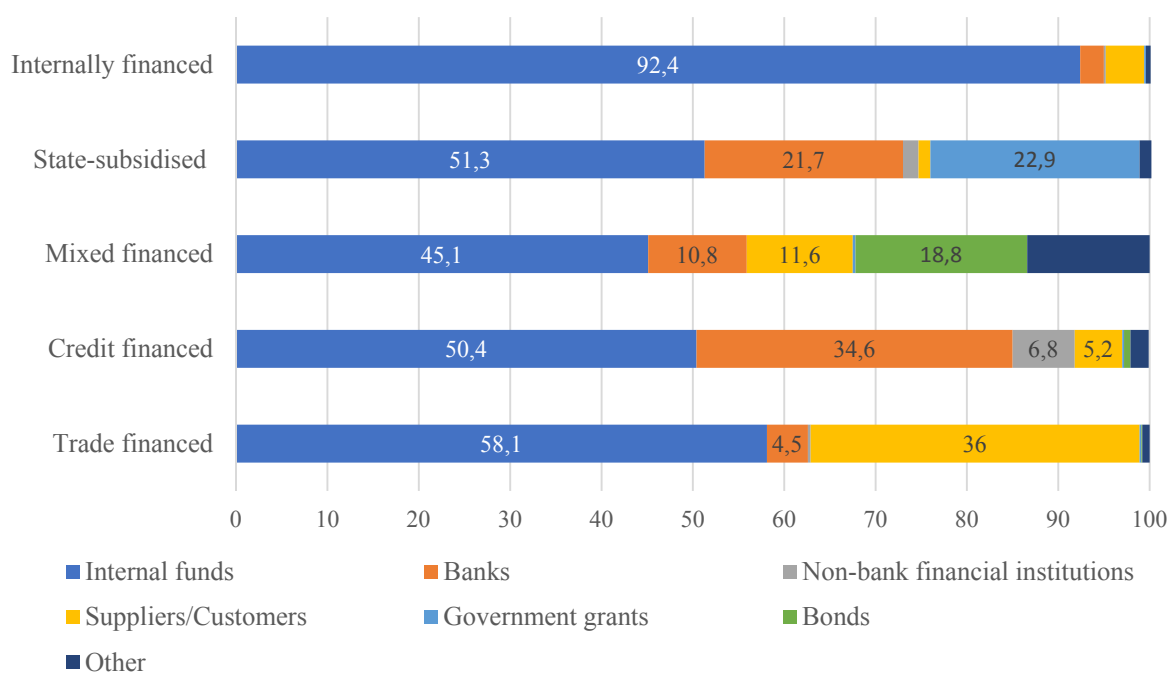*Source:* Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

■ Internal funds   ■ Banks   ■ Non-bank financial institutions
■ Suppliers/Customers   ■ Government grants   ■ Bonds
■ Other

Fig. 3. **Large Enterprises Financing Resources, %**
Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

innovation potential, this cluster includes more than 81% of enterprises that spent on R&D in the last three years, 65% of enterprises that obtained external knowledge, and more than 71% of enterprises that have written strategy.

2. **Trade-financed**: the second largest cluster, which contains more than 8% of innovative product enterprises and more than 6% of innovative process enterprises. Around 39% of government-owned enterprises and 25% of large service enterprises have this funding pattern. This pattern is typical for around 12% of companies that spend on R&D, 20% of large companies with a written strategy, and 27% of those who obtain external knowledge

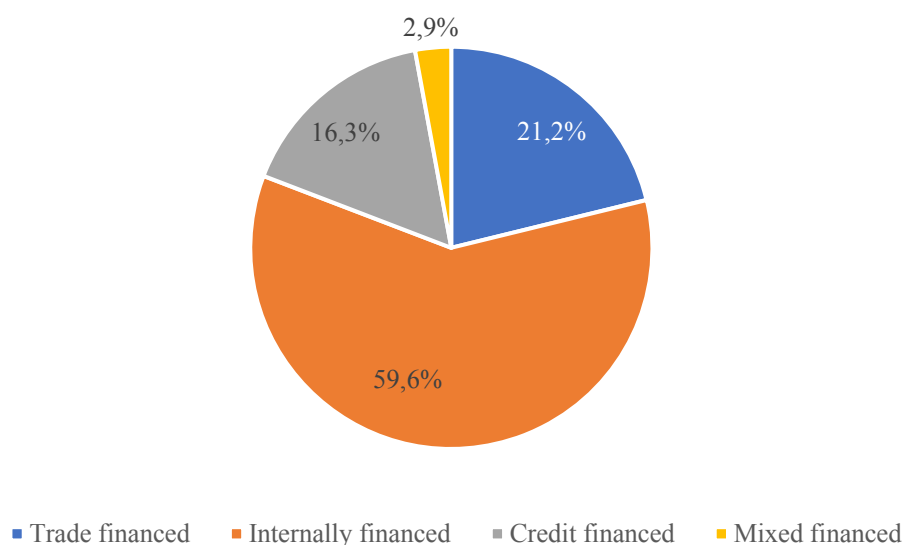3. **Credit-financed:** more than 12% of large enterprises are credit financed. The number of

- Trade financed ■ Internally financed ■ Credit financed ■ Mixed financed

Fig. 4. **SMEs Distribution on Clusters, %**
Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

- Internal funds ■ Banks ■ Non-bank financial institutions
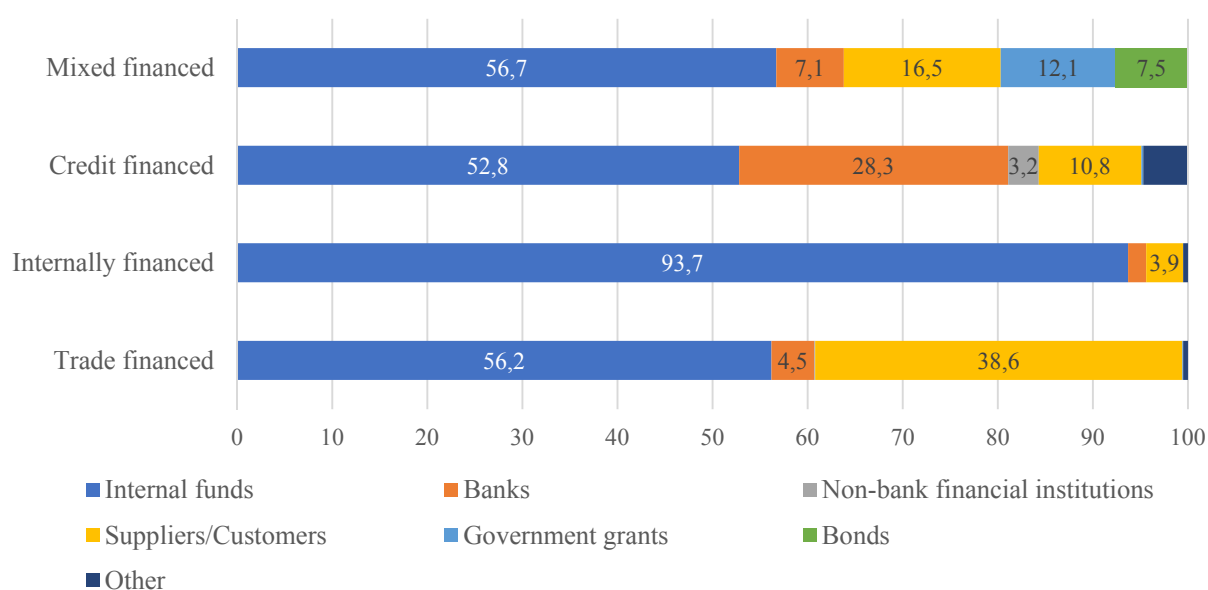- Suppliers/Customers ■ Government grants ■ Bonds
- Other

Fig. 5. **SMEs Financing Resources, %**
Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

enterprises that introduced product innovation in this cluster is comparable to that of trade-financed large enterprises (around 8%). Less than 5% of large enterprises with process innovation have this financing pattern. Around 13% of service large enterprises are in this cluster. However, the cluster does not contain any enterprises with government shares. Regarding innovation potential, less than 3% of large enterprises that spend on R&D are in this cluster. Additionally 4% and 5% of large enterprises that obtain external knowledge and have written strategies, respectively.

4. **Mixed-financed:** these enterprises are few (around 1.4% of large enterprises). Enterprises in this cluster are manufacturing enterprises that do not have a government share. Around 4% of large enterprises that obtained external knowledge have this financing pattern. More than 8% of enterprises that introduced product innovation and 5.6% of those that introduced process innovation are in this cluster.

5. **State-subsidized:** the smallest group of large enterprises for which government grants consists of 23% of their capital structure on average. 13.2% of enterprises
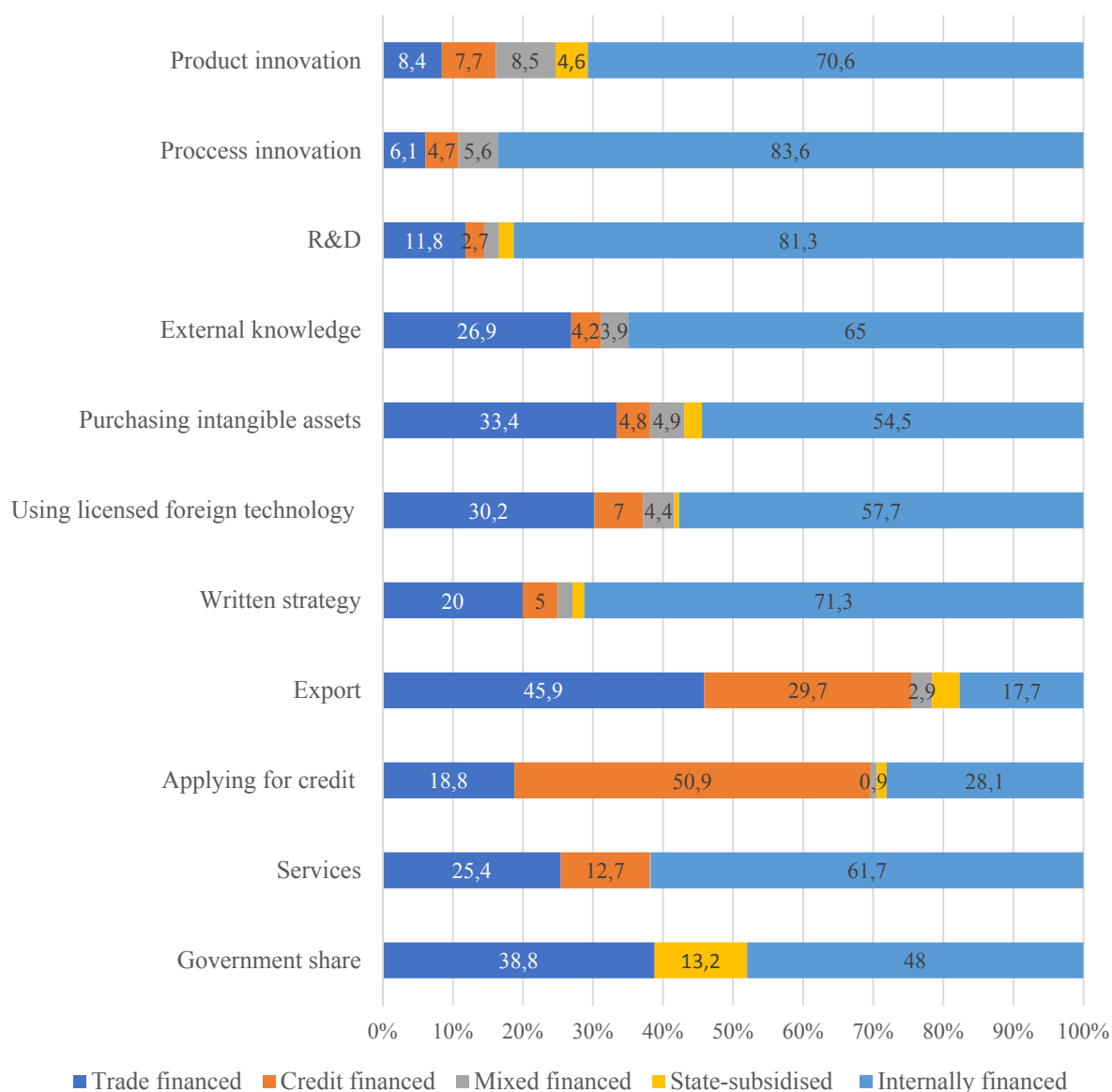
Fig. 6. **Large Enterprises Characteristics Distribution on Clusters, %**
Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

with this financial pattern are with government share. Less than 5% of enterprises with product innovations are in this cluster. Nevertheless, only around 2% of enterprises that spent on R&D and that have written strategies are in the state-subsidized cluster (*Fig. 6*).

SMEs Clusters Description

1. **Internally-financed**: the largest cluster for Russian small and medium-sized enterprises (SMEs). Approximately 60% of SMEs use this financing scheme. It is worth noting that more than 62% of SMEs in the service sector are part of this cluster. With regard to the results of innovation activities, approximately 35% and 50% of SMEs that have introduced product and process innovations, respectively, use this funding model. Less

than half of SMEs that have spent on research and development (R&D) in the past three years are part of this group. Moreover, around 60% of both SMEs with written strategy and that have obtained external knowledge is internally financed.

2. **Trade-financed:** the second large cluster for SMEs, in which present around 19% of SMEs in the service sector. 15% of both SMEs with written strategy and that have spent on R&D in the last three years are trade financed. Furthermore, 20% of product innovative SMEs and 23% of process innovative SMEs use this financing pattern.

3. **Credit-financed:** this cluster includes around 16% of SMEs in the service sector. The share of product innovative SMEs in this cluster is more than that in
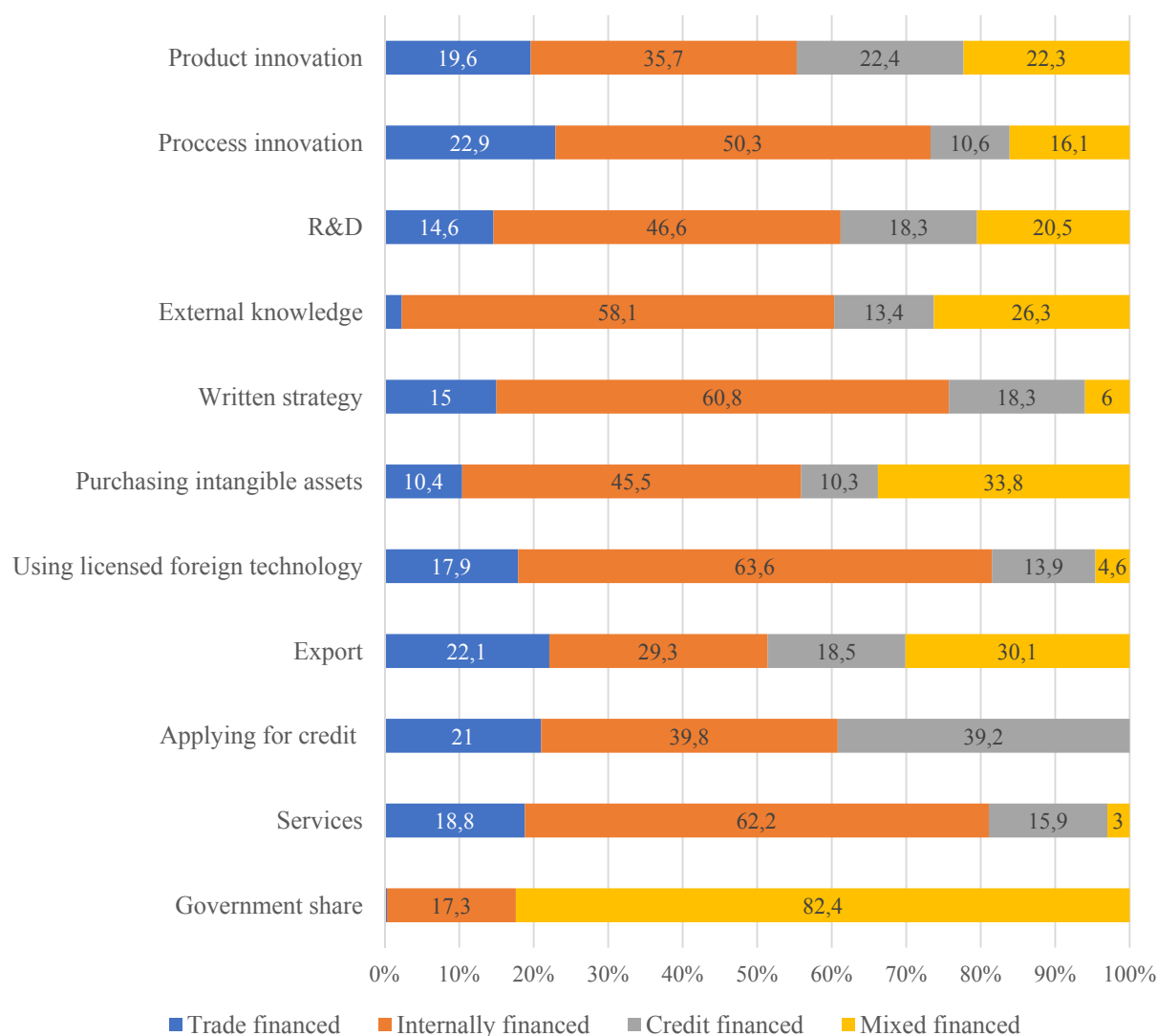
Fig. 7. **SMEs Characteristics Distribution on Clusters, %**
Source: Compiled by the authors using the data of WB Enterprise Survey 2019 — the Russian Federation.

trade financed clusters (more than 22%), while process innovative SMEs are two folds less in this cluster than in trade financed SMEs. More than 18% of SMEs that spent on R&D and developed written strategies have these financing patterns. However, 13.4% of SMEs that obtained external knowledge are credit financed.

4. **Mixed-financed:** SMEs in this cluster are mainly manufacturing firms with government shares. Many of them introduced product and process innovation in the last three years (22.3% of SMEs with product innovations and 16% of SMEs with process innovation). Furthermore, 20% of SMEs that spent on R&D have this financing pattern (*Fig. 7*).

DISCUSSION

Russian large enterprises and SMEs differ in their capital structure. The financing patterns of large enterprises are more diverse than those of SMEs. Nevertheless, Russian SMEs have fewer financing patterns than European SMEs. Internal funding remains the main pattern for Russian enterprises. However, more Russian large enterprises and SMEs (around 58% and 60%, respectively) have this pattern while only 40.6% of European SMEs are internally funded [33]. Russian enterprises are more reliant on loans from their suppliers and customers than Europeans. More than 20% of large enterprises and SMEs are financed through trade.

Other patterns of financing, mainly, credits and bonds are less familiar for Russian enterprises than Europeans. This could mean that these two instruments are less developed and the access of Russian enterprises to these instruments is limited. Regarding the relationship between innovation results and financing patterns, most

of the large innovative enterprises and internally funded. It is noteworthy that around 30% of large enterprises with product innovation are not internally funded while this figure is around 20% for large enterprises with process innovation. However, innovative SMEs have more diverse financing patterns. Only 35% of SMEs with product innovation are internally financed, while this figure is more than 50% for SMEs with process innovation.

Although the largest share of Russian innovative large enterprises is internally funded, most internally funded enterprises that have enough resources did not introduce product or process innovation in the last three years. This is also the case for Russian SMEs. European innovative enterprises are better represented in the internally funded pattern (34%). Furthermore, the share of European SMEs that are credit-financed is more than credit-financed Russian SMEs [24].

Regarding the innovation potential elements larger share of not internally financed large enterprises and SMEs in Russia have elements of innovation potential, in particular purchasing intangible assets and using foreign licensed technology. These companies could potentially become innovative enterprises and they should be encouraged to introduce product and process innovations.

Large enterprises that purchased intangible assets or use foreign licenses are mainly distributed on internally financed and trade financed clusters. Enterprises of other financing patterns are less represented among these enterprises. The situation is different for Russian SMEs where around 45% of not internally financed or trade-financed enterprises purchased intangible assets. However, this figure is lower for SMEs that use foreign licensed technology (approximately 18%).

It is noteworthy that around 50% of large enterprises and 60% of SMEs that applied for credits in the last financial year were not credit-financed. Russian enterprises with different financing patterns require external financial resources for their activities from banks even if these resources are not their primary source of funding.

CONCLUSION

The financing patterns of enterprises reveal their capital structure and the main financial resources that they use. The financing patterns of large Russian enterprises and SMEs were discovered using cluster analysis. This method is used to divide enterprises into groups based on their similarities in their capital structure.

Most Russian large enterprises and SMEs, almost 58% and 60% respectively, are in the group of internally funded enterprises. This means that internal funds consist, on average, for more than 90% of their capital structure. The second large cluster for both large enterprises and SMEs are trade funded enterprises. These enterprises depend on loans from suppliers and customers, on average, in more than 35% of their capital structure. More than 12% of large enterprises and 16% of SMEs are credit financed. Enterprises of this cluster use bank and non-bank credits as a resource for more than 40% of their capital for large enterprises and for more than 31% of their capital structure for SMEs. Other financing patterns, for instance, bond-financed and mixed financed are not popular. They consist of no more than 3% of large enterprises and SMEs' capital structure.

Studying the distribution of innovative enterprises on clusters reveals that the majority of large enterprises with product innovation and with process innovation are internally funded. However, this is not the case for Russian SMEs, where internally funded SMEs that have introduced product innovation in the last three years account for around 35% of all Russian innovative SMEs. However, innovative large enterprises and SMEs consist of a tiny part of internally funded enterprises. Furthermore, it is important to stimulate innovative activities in Russian SMEs mainly by financial instruments while this is not the case for large enterprises that need other kinds of instruments to stimulate them to introduce new products. This conclusion is supported by the fact that more than 50% of Russian SMEs that have spent on R&D over the last three years have not been internally funded.

Stimulating the innovativeness of not internally funded large enterprises could be done by supporting them in purchasing intangible assets of foreign licenses. These instruments that enhance enterprises' innovation potential are mainly used by large enterprises that are internally financed or trade-financed. However, many credit-financed and mixed-financed SMEs use these instruments. This fact could partially explain their innovative activities.

REFERENCES

1. Aghion P., Blundell R., Griffith R., Howitt P., Prantl S. The effects of entry on incumbent innovation and productivity. *The Review of Economics and Statistics.* 2009;91(1):20–32. DOI: 10.1162/rest.91.1.20
2. Law S.H., Sarmidi T., Goh L.T. Impact of innovation on economic growth: Evidence from Malaysia. *Malaysian Journal of Economic Studies.* 2020;57(1):113–132. DOI: 10.22452/MJES.vol57no1.6
3. Lomachynska I., Podgorna I. Innovation potential: Impact on the national economy's competitiveness of the EU developed countries. *Baltic Journal of Economic Studies*. 2018;4(1):262–270. DOI: 10.30525/2256–0742/2018–4–1–262–270

4. Gokhberg L., Kuznetsova T. Strategy 2020: New outlines of Russian innovation policy. *Forsait.* 2011;5(4):8–30. (In Russ.). DOI: 10.17323/1995–459X.2011.4.8.30

5. Ivanov D., Kuzyk M., Simachev Yu. Fostering innovation performance of Russian manufacturing enterprises: New opportunities and limitations. *Forsait.* 2012;6(2):18–41. (In Russ.). DOI: 10.17323/1995–459x.2012.2.18.41

6. Spielkamp A., Rammer C. Financing of innovations — thresholds and options. *Management & Marketing*. 2009;4(2):3–18. URL: http://www.managementmarketing.ro/pdf/articole/132.pdf

7. Czarnitzki D., Hottenrott H. Financing constraints for industrial innovation: What do we know? *Review of Business and Economics*. 2010;(3):346–362. URL: https://www.researchgate.net/publication/315387638_Financing_Constraints_for_Industrial_Innovation_What_Do_We_Know

8. Guriev S., Lazareva O., Rachinsky A., Tsukhlo S. Corporate governance in Russian industry. *Problems of Economic Transition*. 2004;47(3):6–83. URL: https://core.ac.uk/download/pdf/11870268.pdf

9. Manshilin S.A., Leshchinskaya A.F. Model of financial incentives for innovation activity in industrial sector: Development and forecasting of efficiency. *Finance: Theory and Practice*. 2022;26(2):74–87. DOI: 10.26794/2587–5671–2022–26–2–74–87

10. Shestak V.P. Incentive funding for innovative activities. *Finansy: teoriya i praktika = Finance: Theory and Practice.* 2017;21(5):40–49. (In Russ.). DOI: 10.26794/2587–5671–2017–21–5–40–49

11. Czerwonka L., Jaworski J. Capital structure determinants of small and medium-sized enterprises: Evidence from Central and Eastern Europe. *Journal of Small Business and Enterprise Development.* 2021;28(2):277–279. DOI: 10.1108/JSBED-09–2020–0326

12. Kumar S., Sureka R., Colombage S. Capital structure of SMEs: A systematic literature review and bibliometric analysis. *Management Review Quarterly*. 2020;70(4):535–565. DOI: 10.1007/s11301–019–00175–4

13. Poutziouris P., Markou D., Glyptis L., Hadjielias E. Capital structure of UK SMEs: An integrated understanding. *International Journal of Entrepreneurship and Small Business*. 2022; 46(1):64–95. DOI: 10.1504/IJESB.2022.123986

14. Oliynyk-Dunn O., Wasilewski M., Kvasha S., Adamenko V. Financial system development and financing patterns of firms: Evidence from Ukraine. *Journal of East-West Business*. 2020;26(1):1–16. DOI: 10.1080/10669868.2019.1630045

15. Beck T., Demirgüç-Kunt A., Martinez Peria M.S. Banking services for everyone? Barriers to bank access and use around the world. *The World Bank Economic Review*. 2008;22(3):397–430. DOI: 10.1093/wber/lhn020

16. Beck T., Demirguc-Kunt A. Small and medium-size enterprises: Access to finance as a growth constraint. *Journal of Banking & Finance*. 2006;30(11):2931–2943. DOI: 10.1016/j.jbankfin.2006.05.009

17. Hanousek J. Shamshur A. A stubborn persistence: Is the stability of leverage ratios determined by the stability of the economy? *Journal of Corporate Finance.* 2011;17(5):1360–1376. DOI: 10.1016/j.jcorpfin.2011.07.004

18. Jõeveer K. Firm, country and macroeconomic determinants of capital structure: Evidence from transition economies. *Journal of Comparative Economics*. 2013;41(1):294–308. DOI: 10.1016/j.jce.2012.05.001

19. Maarouf A., Korableva O.N. Credit constraints and innovation activities: Empirical evidence on Russian enterprises. *International Journal of Technology.* 2022;13(2):254–263. DOI: 10.14716/ijtech.v13i2.4835

20. Di Pietro F., Bontempi M.E., Palacín-Sánchez M.J., Samaniego-Medina R. Capital structure across Italian regions: The role of financial and economic differences. *Sustainability*. 2019;11(16):4474. DOI: 10.3390/su11164474

21. Bragoli D., Cortelezzi F., Marseguerra G. R&D, capital structure and ownership concentration: Evidence from Italian microdata. *Industry and Innovation*. 2016;23(3):223–242. DOI: 10.1080/13662716.2016.1145573

22. Serrasqueiro Z., Nunes P.M., da Rocha Armada M. Capital structure decisions: Old issues, new insights from high-tech small- and medium-sized enterprises. *The European Journal of Finance*. 2016;22(1):59–79. DOI: 10.1080/1351847X.2014.946068

23. Mancusi M.L., Vezzulli A. R&D and credit rationing in SMEs. *Economic Inquiry*. 2014;52(3):1153–1172. DOI: 10.1111/ecin.12080

24. Moritz A., Block J.H., Heinz A. Financing patterns of European SMEs — an empirical taxonomy. *Venture Capital*. 2016;18(2):115–148. DOI: 10.1080/13691066.2016.1145900

25. Masiak C., Block J.H., Moritz A., Lang F., Kraemer-Eis H. Financing micro firms in Europe: An empirical analysis. EIF Working Paper. 2017;(44). URL: https://www.econstor.eu/bitstream/10419/176674/1/eif-wp-44.pdf

26. Belitz H., Lejpras A. Financing patterns of R&D in small and medium-sized enterprises and the perception of innovation barriers in Germany. *Science and Public Policy*. 2016;43(2):245–261. DOI: 10.1093/scipol/scv027

27. Belitz H., Lejpras A. Financing patterns of innovative SMEs and the perception of innovation barriers in Germany. DIW Discussion Papers. 2014;(1353). URL: https://www.econstor.eu/bitstream/10419/90900/1/77707947X.pdf

28. Masiak C., Block J.H., Moritz A., Lang F., Kraemer-Eis H. How do micro firms differ in their financing patterns from larger SMEs? *Venture Capital.* 2019;21(4):301–325. DOI: 10.1080/13691066.2019.1569333

29. Błach J., Wieczorek-Kosmala M., Trzęsiok J. Innovation in SMEs and financing mix. *Journal of Risk and Financial Management.* 2020;13(9):206. DOI: 10.3390/jrfm13090206

30. Hall B.H., Lerner J. The financing of R&D and innovation. In: Hall B.H., Rosenberg N., eds. Handbook of the economics of innovation. Amsterdam: North Holland; 2010;1:609–639. DOI: 10.1016/S 0169–7218(10)01014–2

31. Kerr W.R., Nanda R. Financing innovation. *Annual Review of Financial Economics.* 2015;7:445–462. DOI: 10.1146/annurev-financial-111914–041825

32. Backhaus K., Erichson B., Plinke W., Weiber R. Multivariate Analysemethoden: Eine anwendungsorientierte Einführung. Berlin, Heidelberg: Springer Gabler; 2016. 647 p. DOI: 10.1007/978–3–662–46076–4

33. Masiak C., Moritz A. Lang F. Financing patterns of European SMEs revisited: An updated empirical taxonomy and determinants of SME financing clusters. EIF Working Paper. 2017;(40). URL: https://www.econstor.eu/bitstream/10419/176670/1/eif-wp-40.pdf

ABOUT THE AUTHORS / ИНФОРМАЦИЯ ОБ АВТОРАХ

Olga N. Korableva — Dr. Sci. (Econ.), Prof. in the Department of Enterprise Economics, Entrepreneurship and Innovation, Faculty of Economics, St. Petersburg University, Saint-Petersburg, Russian Federation

Ольга Николаевна Кораблева — доктор экономических наук, профессор кафедры экономики предприятия, предпринимательства и инноваций экономического факультета, Санкт-Петербургский государственный университет, Санкт-Петербург, Российская Федерация

https://orcid.org/0000-0002-2699-8396

Corresponding author / Автор для корреспонденции:
o.korableva@spbu.ru

Ali F. Maarouf — Graduate of the Postgraduate scientific and pedagogical training program in Economics, St. Petersburg State University, Saint-Petersburg, Russian Federation

Али Файсал Мааруф — выпускник программы подготовки научно-педагогических кадров аспирантуры по направлению «Экономика», Санкт-Петербургский государственный университет, Санкт-Петербург, Российская Федерация

https://orcid.org/0000-0001-7498-9040
alimaarouf1996@gmail.com

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.
Конфликт интересов: авторы заявляют об отсутствии конфликта интересов.