Medvedeva, N. K. (2023). Academic entrepreneurship in the University community: world and Russian experience. *Actual Issues of Modern Science. European Scientific e-Journal*, *2(25)*, 32-50. Ostrava: Tuculart Edition, European Institute for Innovation Development.
Медведева, Н. К. Академическое предпринимательство в университетском сообществе: мировой и российский опыт // Actual Issues of Modern Science. European Scientific e-Journal. – 2023. – № 2(25). – С. 32-50. Ostrava: Tuculart Edition, European Institute for Innovation Development. (на англ.)

DOI: 10.47451/ecn2023-06-02

The paper is published in Crossref, ICI Copernicus, BASE, Zenodo, OpenAIRE, LORY, Academic Resource Index ResearchBib, J-Gate, ASCI, ISI International Scientific Indexing, JournalsPedia, ADL, Mendeley, and WebArchive databases.

Natalia K. Medvedeva, PhD student, St. Petersburg State University. St. Petersburg, Russia.

Academic entrepreneurship in the University community: world and Russian experience

Abstract: In modern conditions, the system of higher education is undergoing changes at the national and global levels. The development of innovative areas of economics has led to the fact that higher academic institutions (universities) are now not only preparing specialists for the modern needs of the economy and society, but also becoming centers for innovative research and development. The integration of universities with representatives of the business community is increasing to simplify the process of commercialisation of university innovative developments. The study object was the higher school sector. The study subject was the entrepreneurial activity of universities in Russia and foreign countries. The study purpose was to consider the features of the implementation of the system of academic entrepreneurship in the Russian Federation and in foreign countries and to determine the trends of its development. During the study, the author applied general scientific methods, including comparison, generalisation, comparison, abstraction, deduction and induction. To achieve the purpose and solve the tasks set, regulatory legal acts of the Russian Federation, research materials of Russian and foreign specialists in university environment development were used. The author systematised approaches to the definition of the phenomenon of academic entrepreneurship and analysed the features of academic entrepreneurship in leading and regional Russian universities, as well as in foreign countries, at the level of desk studies.

Keywords: academic entrepreneurship, innovative infrastructure of the university, commercialisation of the results of innovative activity of universities, innovative development of the university.

Наталья Константиновна Медведева, Санкт-Петербургский государственный университет. Санкт-Петербург, Россия.

Академическое предпринимательство в университетском сообществе: мировой и российский опыт

Аннотация: В современных условиях система высшего образования претерпевает изменения на национальном и мировом уровнях. Развитие инновационных направлений экономики привело к тому, что высшие ученые заведения (университеты) теперь не только подготавливают специалистов под современные потребности экономики и общества, но и становятся центрами для проведения инновационных исследований и разработок. Повышается интеграция университетов с представителями бизнес-сообщества в целях упрощения процесса коммерциализации университетских инновационных разработок. Объектом исследования являлся сектор высшей

школы. Предмет исследования являлась предпринимательская деятельность университетов в России и зарубежных странах. Целью исследование было рассмотреть особенности реализации системы академического предпринимательства в Российской Федерации и в зарубежных странах и определить тенденции её развития. При проведении исследования автором были применены общенаучные методы, в том числе сравнение, обобщение, сопоставление, абстрагирование, дедукция и индукция. Для достижения цели и решения поставленных задач были использованы нормативные правовые акты Российской Федерации, материалы исследований российских и иностранных специалистов в области развития университетской среды. Автор систематизировал подходы к определению феномена академического предпринимательства и проанализировал особенности академического предпринимательства в ведущих и региональных российских университетах, а также в зарубежных странах, на уровне камеральных исследований.

Ключевые слова: академическое предпринимательство, инновационная инфраструктура университета, коммерциализации результатов инновационной деятельности университетов, инновационное развитие университета.

Introduction

The acceleration of technological development of the world economy has led to increased competition in the market for innovative products not only from countries that are technological leaders, but also from developing countries. As a result, Russia has a need to develop research and scientific-practical activities to develop competitive innovative goods and services.

Also, at the present stage of social and economic development of society, the role of universities and research institutes is strengthening in training scientific and pedagogical personnel, conducting scientific research and development. Universities and research institutes are being included in the national innovation system and are being integrated with economic entities. The national innovation system is a set of social and economic institutions involved in the process of creating innovation and increasing national well-being based on the application of new knowledge (*Untura, 2021, p. 54*).

Universities and research institutes are acquiring the role of platforms for conducting scientific research and development. The use of material, technical, and financial universities resources allows students and teaching staff to develop and promote innovative projects of national and international importance.

Integration of organisations in the higher education sector with representatives of the business community will, on the one hand, attract additional funding for innovative developments based on universities and research institutes, and on the other hand, provide research personnel for the organisations' projects.

The stated provisions indicate the relevance of the research topic.

The study object was the higher education sector.

The study subject was the entrepreneurial activity of universities in Russia and foreign countries.

The study purpose was to consider the features of the implementation of the academic entrepreneurship system in the Russian Federation and in foreign countries and to determine the trends in its development.

To achieve the study purpose, the following tasks were developed:

- consider the basics of functioning of Russian universities;
- characterise the theoretical foundations of academic entrepreneurship;
- conduct a comparative analysis of academic entrepreneurship in Russian and foreign universities.

When conducting the study, the author used general scientific methods, including comparison, generalisation, juxtaposition, abstraction, deduction, and induction.

The scientific novelty of the study results lies in systematising approaches to defining the phenomenon of academic entrepreneurship. The basis of this concept is the relationship between the academic production of knowledge and the need of society for new technologies and developments. The features of academic entrepreneurship in leading and regional Russian universities, as well as in foreign countries, are analysed at the level of desk study. The key emphasis in this process is on the commercialisation of the results of university innovative activities.

To achieve the study purpose and solve the assigned tasks, regulatory legal acts of the Russian Federation, research materials of Russian and foreign specialists in development of the university environment were used.

The results of the study

Currently, the term "academic entrepreneurship" is entrenched in the scientific literature. It came into use in the second half of the 20th century. The works of scholars and researchers examine various characteristics of academic entrepreneurship. For example, O.V. Sysoeva considers it as a consequence arising from Henry Itzkowitz's triple helix model (*Sysoeva, 2019, pp. 89-90*). E.N. Akimova and O.V. Shataeva focus on attracting external sources of funding for educational organisations (*Akimova & Shataeva, 2020, p. 11*). A.B. Yarygina conducts a comparative analysis of American, European and Asian models of academic entrepreneurship, each of which has its own distinctive features (*Yarygina, 2012, pp. 136-138*). D.A. Shtykhno describes the main stages of the emergence of academic entrepreneurship in Russia. Many scientific works are devoted to the integration of educational organisations with representatives of the business community (*Shtykhno, 2021, p. 505*). Yu.A. Kitsai emphasises that the state has entrusted universities with the role of city-forming centers of regional economic clusters (*Kitsai, 2017, p. 45*). I.A. Yurasov, M.A. Tanina, V.A. Yudin, and E.V. Kuznetsova believe that the system of academic entrepreneurship operates on the basis of the market economy laws and unites the interests of developers of innovations and subjects of their dissemination (*Yurasov et al., 2021, p. 45*).

The activities of higher educational institutions are regulated by federal law No. 273-FZ "On Education in the Russian Federation" dated December 29, 2012. According to the law, an educational institution is a non-profit organisation whose main activity is educational activities performed based on an obtained license (*On Education in the Russian Federation, 2012*).

According to the Great Russian Encyclopedia, a university is a higher educational institution that performs educational and scientific activities in multidisciplinary areas (*The Great Russian Encyclopedia, 2022*). The first universities appeared in Medieval Europe and were an association of teachers and students with the goal of enlightenment and the development of Christian knowledge. The first medieval universities include: the University of Bologna, the University of Oxford, the

University of Cambridge and the University of Paris. In Russia, Moscow University was the first to be founded in 1755.

The main university features include:

- establishment of a university based on current legislation;
- the university activities are performed according to the legislation of the Russian Federation;
- availability of a license to perform educational activities;
- implementation of educational programmes of higher professional education.

According to the legislation of the Russian Federation, there are two types of universities:

- federal university;
- national research university (*On Education in the Russian Federation, 2012*).

Based on the materials in Table 1 in the Appendix, we can conclude that the federal university, although it has a simple organisation, has a complex structure and is most suitable for performing multidisciplinary research, while the research activities of the national research university are concentrated in a specific area of scientific knowledge and has a more coherent structure (*Table 1*).

Separately, it should highlight a special type of university, called the leading classical universities of the Russian Federation. The list includes Moscow State University named after M.V. Lomonosov and St. Petersburg State University. The activities of the represented universities are regulated by separate laws, they have the right to set their own entrance tests and determine which programme of study will be used.

The development programme of a higher educational institution should be aimed at developing scientific and educational activities, modernising the scientific and technical base, improving its own infrastructure, as well as increasing the academic mobility of students and teachers (*On Education in the Russian Federation, 2012*).

The functions of the university in the educational field include:

- development and adoption of local regulations;
- material and technical support of educational activities;
- development and approval of educational programmes;
- development of a university development programme;
- admission of students in basic educational programmes to an educational organisation;
- determination of the list of educational materials for the implementation of educational activities;
- implementation of ongoing monitoring of academic performance and intermediate certification of students in basic educational programmes;
- encouragement of students in basic educational programmes;
- considering individual results of students mastering educational programmes;
- improvement of teaching methods and educational technologies;
- ensuring an internal system for assessing the quality of education;
- providing the necessary conditions for students in basic educational programmes;
- conducting socio-psychological testing of students in basic educational programmes;
- creating conditions for students to engage in physical education and sports;
- promoting the activities of public associations of students;

- organisation of scientific and methodological work (*On Education in the Russian Federation, 2012*).

To create favorable conditions for the development of research activities on the Russian Federation territory, universities train scientific and pedagogical personnel in the main postgraduate educational programmes. Students in the postgraduate programme receive theoretical and fundamental training in a specific field of activity. The result of successful completion of a postgraduate programme indicates the high qualifications of a young specialist and speaks of his ability to conduct research activities. The dynamics of the number of students in postgraduate programmes for 2011-2020 in St. Petersburg is presented in the figure (*Figure 1*) (*Regions of Russia. …, 2023*).

According to Figure 1 in the Appendix, the annual reduction in the number of students in the main postgraduate educational programmes in the period from 2011 to 2019 is traced; in 2020, there is a slight increase in students. In general, during the period the number of students decreased by 35.92% (*Figure 1*). The main reasons to reduce in the number of graduate students include:

- weak scholarship support forces graduate students to look for work;
- the difficulty of combining full-time work with a high educational load;
- formal approach to organising scientific leadership;
- low motivation for study or research career.

The formation of the university's entrepreneurial model occurred with a change in the role of the university as a center for the transfer of accumulated knowledge to an organisation engaged in training highly qualified personnel for the needs of the modern economy. Research activities can generate economic profit, which in turn helps to maintain the material and technical base of educational and research programmes of universities.

The global challenges faced by the world community stimulate the integration of research and educational institutions to solve pressing social and economic problems. Connecting to the development of such a phenomenon as the knowledge economy and the commercialisation of the results of intellectual activity, attention to the development of the system of academic entrepreneurship is increasing. The development of this system is significantly influenced by processes such as globalisation, digitalisation, informatisation, demographic changes, changes in consumer preferences, and the acceleration of the pace of social and economic development.

The phenomenon of academic entrepreneurship is believed to have originated in the late 1970s in the United States due to the need to increase the country's competitiveness in the international market. As an example of interaction between universities, representatives of business and government, the triple helix model is used (*Figure 2*) (*Sysoeva, 2019, pp. 89-90*).

The Triple Helix model was developed by G. Itzkowitz based on an analysis of the activities of the US innovation system in the 1930s. Within this model, the leading role belongs to universities, creating new high-tech enterprises on their basis. The business efforts should have been directed to the development of industry and the economy of the region, as well as to improve their own educational services, taking over some of the functions of the university. The activities of the state in this model were associated with the creation of funds to finance businesses, from which it took over some functions. Figure 2 of the Appendix shows that innovation is at the intersection of three institutional spheres, where venture capital, science parks, high-tech enterprises, and incubators emerge (*Figure 2*) (*Sysoeva, 2019, p. 89*).

The authors of modern studies conclude that successful technology park structures created at universities currently no longer use the triple helix model, but operate based on the fourth helix concept. In this concept, representatives of civil society, who are key users of innovation, are added to the triple helix model (*Molchanov, 2017, p. 434*).

Currently, the state has assigned to universities the function of city-forming centers of economic regional clusters, whose activities are aimed at managing the results of innovation activities and facilitating the functioning of new markets for innovative goods and services (*Kitsai, 2017, p. 45*).

The term "academic capitalism" arose in the 1990s and was the process of attracting external sources of funding by an organisation carrying out educational activities (*Akimova & Shataeva, 2020, p. 11*).

The main reasons for the emergence of academic entrepreneurship include:

- impacting the globalisation process on the world economy structure;
- gradual transition to a knowledge economy (*Medvedev, 2023, p. 236*).

Table 2 in the Appendix presents the main approaches to defining this concept (*Table 2*).

Based on the definitions of the term "academic entrepreneurship" presented in Table 2, it can conclude that the academic entrepreneurship system is an intermediary between the academic production of knowledge and society's need for new technologies and developments.

Therefore, within the framework of this work, the academic entrepreneurship concept can be defined as follows: the activity of research staff of higher educational institutions, regulated by the laws of a market economy, aimed at commercialising the results of research activities in collaboration with business community representatives, as well as providing innovative goods and services (*Medvedev, 2023, p. 234*).

In addition, a new service market has formed, in which the object of commodity-money relations are research resources and innovative developments of higher educational institutions, which also contributed to the development of international competition not only between universities, but also at the level of teaching staff (*Akimova & Shataeva, 2020, p. 10*).

In the academic entrepreneurship system, human intellectual abilities become the main production resource in innovative production, which leads to an increase in the demand for knowledge and the emergence of new professional competencies. The increasing role of private entrepreneurship in the economic relations system and the reduction in government funding of scientific and educational institutions, which occurred in connection with the global financial crisis, also have a significant impact. (*Akimova & Shataeva, 2020, p. 10*).

Due to the reduction in government funding, the implementation of the academic entrepreneurship system is accompanied by the attraction of new sources of funding:

- targeted grants provided on a competitive basis;
- income from the commercialisation of scientific research results;
- income from the transfer of new technologies and developments (*Akimova & Shataeva, 2020, p. 11*).

The development of the higher education and academic entrepreneurship system is influenced by the following factors:

- introduction of virtual technologies into educational processes;

- individual approach to organising the educational process through the use of electronic educational resources;
- reduction in the number of students enrolled in basic postgraduate educational programmes;
- population aging due to changes in the nature of the population reproduction process;
- increasing the duration of active economic life of the population;
- formation of the global educational and research space;
- shifting the focus from the consumption of tangible goods to the consumption of intangible services (*Izmailov, 2019, p. 107*).

In addition to what is listed in the work of A.M. Izmailov, it is necessary to include such a factor as the digitalisation of educational processes as one of the leading directions, or trends, in the development of modern Russian society (*Passport of the national project …, 2019*), on the basis of which the introduction of virtual technologies is implemented.

It should note that the development of the academic entrepreneurship system also entails the emergence of new problems and contradictions in the education system, e.g.:

1. Increasing the workload of teaching staff due to a significant redistribution of working time. Caused by an increase in reporting, the formalisation of indicators characterising the effectiveness of the university's activities and the combination of scientific and pedagogical activities with the commercialisation of the intellectual activity results.
2. University personnel's distribution into employees involved and not involved in academic entrepreneurship, due to the fact that entrepreneurial activity imposes restrictions on the creative component of research activity, and also requires the presence of certain abilities.
3. Deviation of the university's goals from its core activities in search of additional funding and support for the national economy, using resources from the educational process. The initial goal of a higher educational institution is to train specialists whose professional competencies will allow them to actively participate in socio-economic processes and improve national well-being. However, the process of commercialisation of the results of research activities involves university resources that could be involved in the learning process, including human capital, time, premises and other material resources.

Next it should consider the current state of organisations engaged in scientific research and development in St. Petersburg, which also includes special university departments. Data for the period from 2010 to 2020 are presented in the Appendix (*Figure 3*) (*Regions of Russia. …, 2023*).

According to Figure 3 in the Appendix, it can be seen that the number of organisations performing research work in St. Petersburg from 2010 to 2014 remained at approximately the same level, while in 2015 their number increased by 15.84% (*Figure 3*). The growth may be due to the increased importance of innovation activities and the growing interest of organisations in research and development. At the same time, the number of these organisations decreased from 2015 to 2018. This circumstance is due to a decrease in commercial success from conducting and implementing research activities and an increase in the budget burden (*Goncharenko et al., 2017*). The slowdown in economic growth coupled with the transformation of the scientific institutions system has had a negative impact on both the scientific industry as a whole and its human resources potential. Since 2019, there has been a slight increase in research organisations, amounting to 2.6% compared to 2018. This circumstance is due to the introduction of the state programme "Scientific

and Technological Development of the Russian Federation", implemented in the period from 2019 to 2030.

The growth rates of the average volume of funding for fundamental and applied research in the Russian Federation in current prices per organisation for the period from 2011 to 2020 are presented in Appendix (*Figure 4*). According to the figure, we see that the average volume of funding increased from 2010 to 2014. Federal budget expenditures on R&D during this period amounted to approximately 5% of total federal budget expenditures with an upward trend: the share of R&D expenditures in total federal budget expenditures increased from 4.08% in 2010 to 4.96% in 2014 (*Annual monitoring …, 2022*). From 2015 to 2017, negative growth rates are observed, which is due to changes in the budget policy of the Russian Federation in connection with the economic crisis of 2014-2016 and overcoming its consequences. Since 2018, there has been a positive increase in the average financing amount. One of the key reasons for the increase in budget allocations is that the Government of the Russian Federation, within the framework of the national project in science, needs to ensure by 2024 a rapid increase in domestic costs for research and development from all sources compared to the growth of the country's gross domestic product (*On National Goals …, 2018*).

Next, it is necessary to consider the average volume of funding for fundamental and applied research in the Russian Federation per organisation, considering inflation for the period from 2011 to 2020. The figure in the Appendix shows the growth rates of the average volume of financing relative to the base year 2010. The figure shows that a positive increase in the average volume of financing in 2010 prices was observed throughout the period from 2011 to 2015, as well as in 2020. In the period from 2016 to 2019, there was a decrease in this indicator, the reasons for which are indicated above (*Figure 5*).

Based on the data in Figure 5, it can conclude that despite the fact that the volume of funding for science in current prices has increased, the volume of funding, adjusted for inflation to 2010 prices, in the period from 2016 to 2019 was lower than the base year of the analysed period. The growth in funding for fundamental and applied research in 2020 compared to 2010 was about 2%. At the same time, the progressive inflation rate from December, 2010, to December, 2020, amounted to 86.31% (*Inflation calculators. …, 2023*), which indicates that the volume of research funding is not growing enough compared to the growth of inflation.

According to Figure 3, it can be seen that the number of organisations performing scientific research and development in St. Petersburg decreased during 2011-2018. The slowdown in economic growth coupled with the transformation of the scientific institutes system has had a negative impact on both the scientific industry as a whole and its human resources potential (*Figure 3*).

Since 2019, there has been an increase in research organisations, amounting to 7.8% compared to 2018. This circumstance is due to the introduction of the Russian Federation programme "*Scientific and Technological Development of the Russian Federation*", implemented in the period from 2019 to 2030.

When analysing the phenomenon of academic entrepreneurship, three models of academic entrepreneurship can be distinguished: American, European and Asian.

The American model involves the development of entrepreneurial skills in students through educational programmes, competitions for the best business idea and the possibility of internships

in research laboratories. Thematic youth clubs and communities are also being created. As part of creating an infrastructure to support academic entrepreneurship, centers are being created to discuss current problems and ways to solve them with representatives of science and the business community. Particular attention is paid to organisations that allow commercialisation of the results of innovative activities: technology park structures, specialised centers, and offices (*Yarygina, 2012, p. 136*).

The European model is more focused on the operational process than on elements of the innovation infrastructure. The role of science parks created on the basis of universities is increasing. They not only provide rental premises and material services, but also provide project support services throughout the entire life cycle. In addition, universities strive to develop the entrepreneurial abilities of students and involve them in innovative activities (*Yarygina, 2012*). The education sector in Central Europe, on the one hand, experiences strong government intervention in regulating the creation and development of stronger universities from an entrepreneurial point of view, on the other hand, there is a need to reduce market barriers to increase university competition, in order to overcome the shortage of resources such as financial funds, scientific and teaching staff and promising students and graduates (*Audretsch et al., 2014*).

The Asian model, like the previous two models, promotes the development of entrepreneurial qualities in students, but emphasizes the commercialisation of multiple promising ideas. Thanks to partnerships between national universities and foreign universities, laboratories and private foreign business incubators, the export of innovations to foreign markets has been developed. The second key academic entrepreneurship direction in the Asian model is the development of high-tech developments in the university business incubator for the purpose of their further integration into industry (*Yarygina, 2012, pp. 136-137*).

Next it should consider the main characteristics of the academic entrepreneurship system in foreign countries, presented in the Appendix (*Table 3*).

The academic entrepreneurship system in various countries began to actively develop in the second half of the 20th century and is characterised by the creation of an innovative university infrastructure, the interaction of higher educational institutions with business and the development of legislation in this area.

In Russia, academic entrepreneurship began to emerge in the late 2000s in connection with the development and implementation of measures to promote the creation of entrepreneurial infrastructure, including on the basis of higher educational institutions. The next stage in the development of the academic entrepreneurship system was the signing of a declaration on the creation of the Association of Entrepreneurial Universities of Russia within the framework of the 4th St. Petersburg International Innovation Forum, which was signed in 2011. Among the Russian universities that signed the declaration together with the Skolkovo Foundation, it is worth noting such large universities as the St. Petersburg National Research University of Information Technologies, Mechanics and Optics, Moscow Institute of Physics and Technology, National Research Nuclear MEPHI University, Tomsk State University of Control Systems and Radioelectronics (TUSUR) and National Research Technological University MISIS (NUST MISIS). In 2012, the National Research University Higher School of Economics (HSE) joined the Association.

The Association of Entrepreneurial Universities of Russia was created in order to ensure the development of partnership between the state, business and higher educational institutions to include innovations in the production and commercialization. By 2013, about 1,800 small innovative enterprises were created in Russia with an average income of more than 2.7 million rubles (*Shtykhno, 2021, pp. 503-504*).

In 2018, the next stage in the development of Russian academic entrepreneurship began in connection with the development of the national project "*Small and Medium Enterprises and Support for Individual Entrepreneurial Initiatives*", which offered support measures at all stages of innovative business development. The project included five main areas:

- Improving the conditions for doing business;
- Expanding access of SMEs to financial resources, including preferential financing;
- Acceleration of small and medium-sized businesses;
- Creating a support system for farmers and rural development cooperation;
- Popularisation of entrepreneurship (*Shtykhno, 2021, p. 504*).

In addition, the Ministry of Science and Higher Education of the Russian Federation developed the Priority 2030 strategic academic leadership programme, which promotes the formation of an innovative environment within universities, including through the transfer of scientific and technical developments, the issuance of licenses and patents, as well as the creation of small innovative enterprises. However, for humanitarian areas such measures are ineffective, so the most promising projects in them are considered to be consulting services in the field of strategic planning and forecasting the development of organisations, studying competitiveness and market conditions, analysing the effectiveness of the management system and developing the organisational structure, managing innovations, projects, quality, and digitalisation (*Shtykhno, 2021, p. 505*).

The functioning of the academic entrepreneurship system in the Russian Federation is presented in the Appendix (*Table 4*). Summarising the data presented in the table, we can conclude that large Russian higher educational institutions implement academic entrepreneurship through the creation of platforms for joint work of students, employees, and business representatives, execution of orders for the state and entrepreneurs, implementation of innovative programmes focused on the needs of modern business and conducting extra-curricular activities aimed at developing entrepreneurial competencies.

The following prospects for the development of the academic entrepreneurship system can be identified:

- intensifying competition by equalising profits between academic organisations and their areas of activity, as a result of widespread innovation (*Akimova & Shataeva, 2020, p. 11*);
- forming its own business incubator on the basis of the university;
- integration with the techno-park or development of the university's own production site;
- developing centers for collective use of property in accordance with the needs of the market;
- conducting most stages of the innovation process at the university site;
- conducting a marketing analysis of the market for the subsequent sale of innovations to the most suitable production partners;
- developing the university's human capital;

- developing a strategy for the innovative development of a small innovative enterprise according to the needs of the market and the capabilities of the existing center for the collective use of property;
- defining a strategy for interaction with venture investors, as well as attracting federal and regional funds or business angels;
- considering and analysing the most promising options for selling a technology company to a production partner (*Korchagin, 2021, p. 396*).

Understanding the essence of academic entrepreneurship makes us think about changing the goals of modern universities and acquiring new economic functions that contribute to an increase in internal funds. Consideration of foreign experience in the formation of entrepreneurial universities will allow specialists to conclude that it is expedient to develop a system of academic entrepreneurship in Russia and select the most effective practices considering national characteristics and the economic policy of the country. In addition, the question is raised whether the system of academic entrepreneurship meets the modern needs of the national economy or whether a new innovative model of the university – a regional center for research and development – should be developed.

Conclusion

Thus, the university is a non-profit organisation that carries out educational and scientific activities in various fields. There are three types of universities: federal, national research and leading classical universities, divided according to the methods of education, goals and methods of functioning and regulatory regulation. The main functions of the university are aimed at creating and maintaining conditions for the implementation of educational activities, motivation, and evaluation of students, as well as determining the effectiveness of the functioning of an educational organisation. The key factor for the development of research activities is the training of scientific and pedagogical staff of students in the main educational programmes of postgraduate studies. However, during the period from 2011 to 2020, the number of graduate students decreased significantly due to the low level of motivation and financial support of students.

Academic entrepreneurship is a process of attracting additional funding by universities and research organisations by combining the efforts of educational organisations with representatives of the business community in the process of creating and subsequent innovative products to commercialise the results of innovative activities. The system of academic entrepreneurship has emerged in connection with the strengthening of global trends, the reduction of state funding, as well as the strengthening of scientific and practical activities of universities. Trends in the academic entrepreneurship development are associated with the innovative university infrastructure development.

The academic entrepreneurship phenomenon has been developing everywhere since the end of the 20th century. In a broad sense, three academic entrepreneurship models – American, European, and Asian – have been formed. The listed models differ in the degree of state regulation, the partnerships and innovative infrastructures development. The American and Asian models are considered stronger in terms of attracting additional sources of financing for innovation activities. In Russia, the academic entrepreneurship system began to develop in the late 2000s in connection with the development and application of measures to create entrepreneurial infrastructure in

universities. However, the introduction of academic entrepreneurship in the Russian Federation is complicated by the presence of strong centralisation of state regulation of the universities and research institutes activities, including in the field of funding sources.

To develop innovative and entrepreneurial activities of Russian universities, it is advisable to adhere to the American academic entrepreneurship model in terms of a gradual transition to private sources of funding for scientific and practical university activities, the development of entrepreneurial competencies among students, as well as the introduction of innovative infrastructures. At the same time, the practice of developing partnerships with foreign universities, laboratories and private foreign business incubators, which is characteristic of the Asian model, is also appropriate for implementation in the Russian Federation. It follows from this that when creating a national academic entrepreneurship model in the Russian Federation, it is proposed to take the American model as a basis in its positively implemented infrastructures with the introduction of elements of the Asian model.

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Appendix

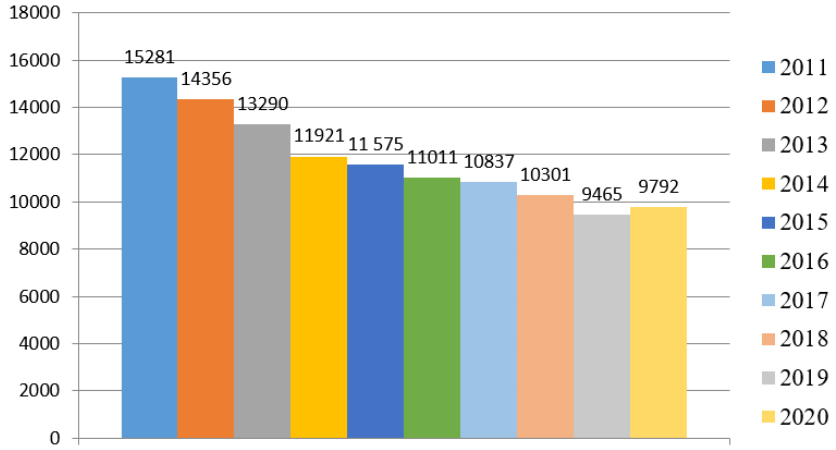

Figure 1. The number of students enrolled in postgraduate programmes in St. Petersburg

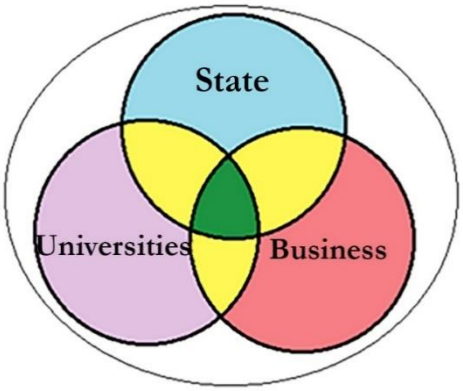

Figure 2. Triple Helix Model

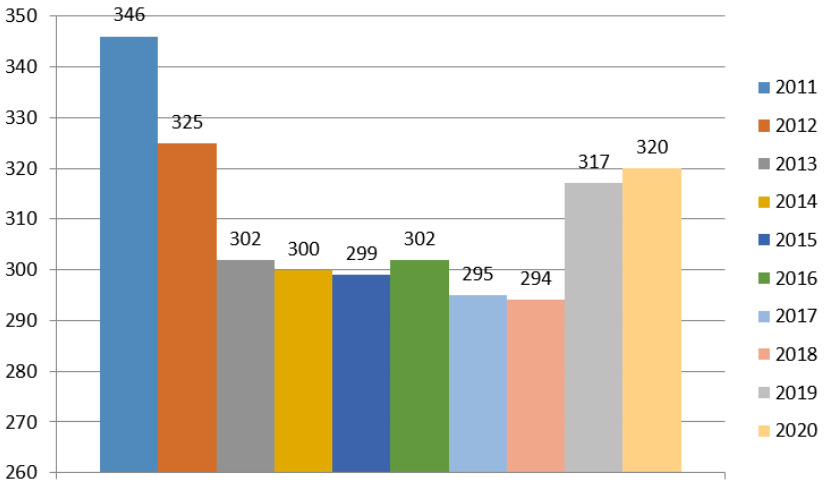

Figure 3. Organisations that considered research and development in St. Petersburg

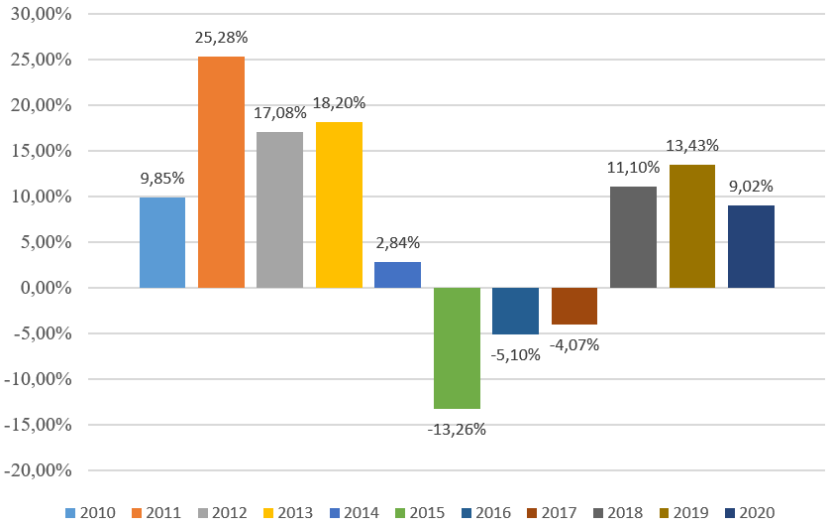

Figure 4. Growth coefficients of the average amount of funding for fundamental and applied research in the Russian Federation per organisation. Developed by the author on the basis of data from statistical collections published by the Higher School of Economics: "Indicators of Science" for 2014-2023

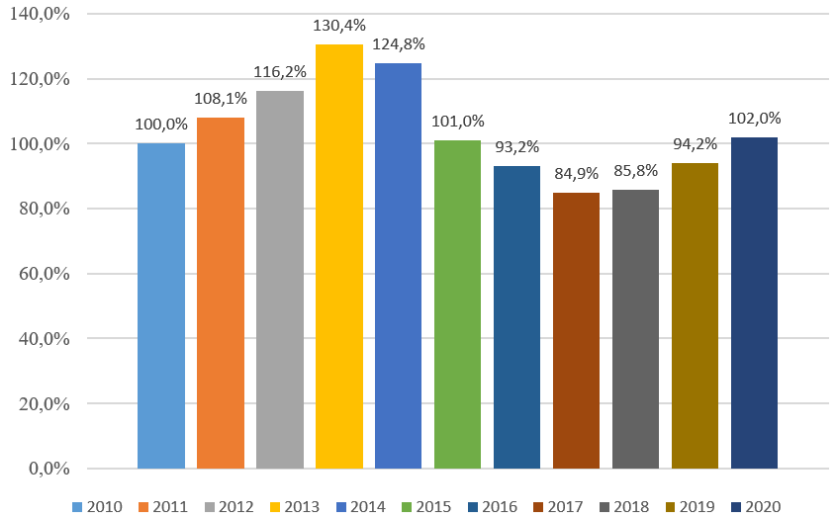

Figure 5. Growth coefficients of the average amount of funding for fundamental and applied research in the Russian Federation, considering inflation in relation to 2010. Developed by the author on the basis of data from statistical collections published by the Higher School of Economics: "Indicators of Science" for 2014-2023

Table 1. Comparative characteristics of federal and national research universities (compiled by the author)

Feature	Federal University	National Research University
Condition for obtaining the status	according to the decision of the founder	is awarded at the end of the competition for ten years
Purpose of creation	to provide training for the integrated development of individual regions	combining scientific research with the educational process
Training profile	multidisciplinary	specialised
Rector position	assignable	elected
University-wide identity	low level because of poorly developed structural units	high level

Table 2. Approaches to the definition of academic entrepreneurship (compiled by the author)

Authors	Definition of the academic entrepreneurship concept
Sysoeva, O. V.	an intellectual organization in which research and educational universities cooperate with representatives of the local business community to transfer the results of research, development, and technology (*Sysoeva, 2019, p. 84*)
Bagchi-Sen, S., Changho, L., Poon, J.	the process of creating economic value through the commercialisation of technologies or research results created by individuals or groups of individuals in academic institutions (*Bagchi-Sen et al., 2015*)
Yurasov, I. A., Tanina, M. A., Yudina, V. A., Kuznetsova, E. V.	a special kind of social and economic system functioning on the basis of a market mechanism and aimed at uniting developers of innovations and subjects of their dissemination (*Yurasov et al., 2021, p. 348*)
Fonseca Ferreira, C., Guerra, P., Sa, T.	the third mission of the university, demonstrating the need for cooperation between scientific institutions and the private R&D sector in order to increase the economic value of the knowledge transfer processes between the university and the business structure and their subsequent application (*Fonseca Ferreira et al., 2018*)
Oguntuase, O.	a process in which a person or group of persons working at a higher education institution or research center creates an enterprise to commercialise the results of their research (*Oguntuase, 2020*)
Barcik, A., Dziwiński, P.	entrepreneurial activity of research personnel of an educational institution: students, graduates, postgraduates, and researchers, as a result of which the university begins to function on a commercial basis, acting as a seller of certain goods and services (for example, specialised courses or modern technologies (*Barcik & Dziwiński, 2016*)

Table 3. Main characteristics of academic entrepreneurship in foreign countries (compiled by the author based on scientific articles)

Страна	Основные характеристики системы академического предпринимательства
USA	Study of business programs at all levels of education. Creation of a venture capital fund at Harvard and Texas Universities. Universities carry out the commercial realisation of the results of intellectual activity. Most US universities have established licensing and technology transfer offices.
Germany	State funding of research activities. The Center for Innovation and Business Creation at the Technological University of Munich provides extensive opportunities for researchers, entrepreneurs and specialists. Educational business programmes (*Sidorova, 2014, pp. 135-142*).
Netherlands	Financing of scientific research at the expense of government grants and subsidies. Cooperation between universities and companies. Creation of special structures that provide large industrial enterprises, small businesses and scientists-entrepreneurs with a wide range of services (Innovation Laboratory of the Technical University of Eindhoven). Marketing and promotion of their technologies through licensing. Development of business education (*Sidorova, 2014, pp. 135-142*).
Estonia	Implementation of programmes to create new jobs for students by joining forces with the business community. The university is engaged in the search and development of the latest knowledge and competencies for business, and entrepreneurs finance the right to use the acquired knowledge and competencies (*Kurakov, 2021, pp. 248-250*).
Catalonia	Most universities have research and development centers, technology transfer units, business incubators, technology parks and affiliated university companies in their infrastructure. The production and transfer of intellectual property results is performed within the framework of a single Network of scientific and technological parks that unites the efforts of universities and the business community. Universities produce highly qualified specialists who are able to work in an innovative economy, and raise the quality of the region's human capital. Catalan universities are involved in major research and development. They account for about 20% of scientific publications in the country and about 16% of patents obtained by Spanish universities.
Portugal	Providing startups with inexpensive, highly qualified graduates of technical universities. As of 2021, about 53% of graduates have received a specialty related to engineering or mathematics and are in demand when implementing startups (*Kurakov, 2021, pp. 248-250*).
Korea	Since the mid-1980s, the government has been funding the formation of business incubators and technology transfer centers at research universities. In 1998, a law was passed legalising the formation of an innovative production infrastructure on the territory of university campuses, rules were developed to attract teaching staff to commercialise innovations without interrupting their educational activities. (*Belkin et al., 2016, p. 106*).
India	In the 20th century, the responsibility for creating innovations was assigned to national research universities and their students. A business incubator must be located on the campus of every research university in India, providing students and university employees with office space, equipment, legal, accounting, marketing and other consultations. Also, educational trainings are held for students to form their ideas about the development of venture business (*Belkin et al., 2016, pp. 103-104*).
China	It originated in the second half of the 1940s and develops in 3 stages. At the first stage, legislation in the field of intellectual property protection was developed, state funding for universities was reduced and innovative infrastructure began to form. At the second stage, there was an increase in the interaction of science and business. The current stage is characterised by the practical orientation of scientific research and development, the development of innovative infrastructure and the transformation of research universities into high-tech enterprises (*Belkin et al., 2016, p. 105*).
Saudi Arabia	A large amount of investment in the research activities of universities, encouraging entrepreneurship among the teaching staff. Activation of the process of transferring new knowledge acquired at the university to the business community and their subsequent implementation into the national economy (*Alshumaimri et al., 2011*). The development of the university entrepreneurship system is caused by a possible reduction in revenues from oil production and export. A study of the entrepreneurial activity of the teaching staff of Saudi Arabia has shown that young scientists are most involved in entrepreneurial activity. The presence of scientific publications has a positive effect on the propensity to entrepreneurship.

Table 4. Main characteristics of academic entrepreneurship in leading Russian universities (compiled by the author)

University	Examples of the functioning of the academic entrepreneurship system
Moscow State University	The Innovative Scientific and Technological Center "Vorobyovy Gory" was created in order to increase the investment attractiveness of research and development, commercialise their results, expand the access of citizens and legal entities to participate in promising, commercially attractive scientific and scientific-technical projects; The Faculty of the Higher School of Business trains specialists who can act in accordance with the challenges of modern business, integrated into the international business environment.
Moscow University of Physics and Technology	Participation in the implementation of the federal project "Platform of University Technological Entrepreneurship" (operator of the event "Trainings of Entrepreneurial Competencies") to reveal the entrepreneurial potential of young people and train professionals in technological entrepreneurship. The Department of Technological Entrepreneurship trains scientists-engineers who understand the needs of the market, and entrepreneurs who are guided by scientific and technical trends.
St. Petersburg State University	The Entrepreneurship Center "Higher School of Management" functions to create, systematize and disseminate knowledge about entrepreneurship through research and teaching, popularise entrepreneurship among students by creating a platform for interaction with experts and mentors. Cooperation with business partners through the creation of research laboratories on the basis of the university, as well as the introduction of the developments of university scientists into real practice.
ITMO University	Acceleration programmes for startups with a high degree of readiness product. Educational events: workshops, lectures, and master classes with business experts. Placement of offices of partner companies in the leading Center of High Technology, Innovation, and Education "ITMO High Park". Thesis in the format of a business project.
National Research University Higher School of Economics	The Mirror Laboratories project is joint scientific research of mutual interest. The Centers of Advanced Research are scientific, educational and expert-analytical platforms involved in relevant areas of research and development, with unique resources for conducting highly competitive scientific research with international labor collectives.
Saratov State University	Creating an "Entrepreneurial Boiling Point" – a space based on universities for the student entrepreneurship development. The opportunity to defend the final qualifying work under the programme "Startup as a Diploma".