Today’s research university is valued not only as a provider of education and research, but as a center of innovative activity and a generator of new knowledge and technologies. And while education and research remain the most important functions of the research university, some institutions have taken steps to encourage entrepreneurship, to promote regional development, and to engage in what is known as technology commercialization.1

Technology commercialization is the act of turning the research results of a university (ideas, inventions, new technologies) into products that can be sold in the marketplace. The development of technology commercialization is connected with the emergence at universities of new functions—scientific and technical entrepreneurship, business incubation, the creation of new companies, and the implementation of innovative projects.

Who benefits from technology commercialization? All stakeholders in the process: universities, businesses, professors, students, investors, government, society, the local and national economy. The outcome of technology commercialization is especially evident in the United States where there are major research universities (Boston, Silicon Valley, etc.).

Today, universities in many countries, following the lead of US universities, successfully engage in technology commercialization and act as an important channel for knowledge and technology transfer to the private sector. One country in which technology commercialization has not been fully successful, however, is Russia.

In Russia, technology commercialization struggles for several reasons. Through recent policy initiatives, coupled with investment in physical infrastructure, Russia has built the components of an innovation ecosystem. But it lacks many things that would encourage technology commercialization such as an entrepreneurial culture and innovative environment, strong project teams and skilled inventors in business, and entrepreneurship education. What is more, as we have learned from our own experience and from conversations with colleagues, in Russia the state and the universities are highly centralized, intellectual property is poorly protected and the patent process is a mere formality with little or no standards, and there is an excessive concentration on formal procedures, on filling out statistical reports and observing indicators, etc. As a result, Russia has yet to find a way to consistently convert the knowledge and technologies developed by its universities into saleable products.

Fortunately, Russia can examine the experience of technology commercialization at leading US universities and implement steps to improve the process. In this paper, we thus propose that Russia can improve its technology commercialization by studying the example of the leading US entrepreneurial universities and implementing proper procedures. Although we make several policy recommendations at the end of this paper suitable for Russian society,
the important overarching point is that Russian universities need to improve their collaboration with industry, and they need to develop new standards of administrative, research, and business activity that will promote innovation and entrepreneurship.

Before we turn to our policy recommendations, we will examine the history and state of technology commercialization in the United States, best American practices, and challenges in Russia; we will also compare the situation in the United States with the situation in Russia.

1. Technology Commercialization in the United States

In the United States, the successful development of innovations in the last decades of the twentieth century was related to the increased attention of government and universities to the management of intellectual property (IP). The beginning of university entrepreneurship can be attributed to the passage of Bayh-Dole Act (1980), which enabled technology commercialization at US universities. According to the act, a university became the legal owner of any IP that was created at that university as a result of publicly funded research (Bremer 1998). The law identified the fundamental rules for marketing, licensing, and selling the IP. Moreover, universities established special technology transfer offices and offices of technology licensing. Consequently, in the years since Bayh-Dole was passed, there has been a dramatic increase in technology transfer from research institutions and universities to industry and an increase in the efficiency of technology commercialization. The income earned by US universities from licensing increased from $7.3 million in 1981 to $3.4 billion in 2008 (Tieckelman, Kordal, and Sanga 2010).

Thus, research universities have become the foundation for successful technology commercialization as well as boosters of the regional economy. The growth points for the US economy were chosen by the government extremely well: universities have all the necessary resources—laboratories, equipment, professors, students, etc. Those resources were supplemented with physical infrastructure, support programs for innovations, and industry involvement in technology commercialization at universities, as well as a high-quality entrepreneurship education and methods for developing the entrepreneurial culture.

Today, US universities have a distinct system of partnership between science, business, government, and sources of capital, clear actions to guide their innovation projects and technology commercialization, and institutes for training a new generation of technological entrepreneurs.

The physical infrastructure as well as the approaches to technology commercialization at US universities is extremely flexible. In figure 1, we present the idealized process of technology commercialization at US universities. Successful R&D begins the process of commercialization. If it results in an invention, the invention is made known to the university’s technology transfer office (TTO) via a completed information form. An expert from the TTO, which coordinates work on the invention, is appointed, and the technology is assessed. If the assessment deems that the invention is not commercially viable, the invention is sent back to the R&D process for refinement (if it is not abandoned); if the invention is, on the other hand, judged to be commercially viable, then the assessment determines what kind of IP protection will be sought and if a patent should be applied for, as well as establish the appropriate model of technological commercialization. Because it costs about $10,000 to $25,000 to patent an invention in the United States, universities patent only commercially advanced inventions. Generally, US universities do not have their own patent experts and instead hire outside experts, which has proven to be effective. Experts in TTOs can have a technical or business education, degrees in science, and experience in industry, marketing, and licensing agreements. Thereafter market research is conducted, and a business proposal is prepared. Negotiations with
companies interested in the new technology begin, and the commercialization model is completed.

In the United States, there are two basic models of technology commercialization:
1. License agreement with an existing company that is interested in a new technology;
2. Start-up company using the university’s IP (the university can license with an existing company, or with a new company started with a technology license).

In both cases, a license agreement between the university and an existing or start-up company is concluded. According to the license agreement, the licensee (the company that obtained the license) pays the licensor (the university) fixed payments—a royalty. If the license agreement is concluded with a start-up company that cannot afford to pay a royalty, often the university becomes the owner of a new company share.

Creating a start-up company at a university has a number of advantages: a university provides necessary administrative and consulting support as well as opportunities for raising capital; in addition, a new company can benefit from the expertise of researchers at a university.

A university’s success at creating a start-up company depends mostly on the level of the inventor’s skill and talent in technological entrepreneurship and his or her desire to develop a business, an innovative regional ecosystem and the availability of capital, the policy and institutional structure of a university, and its intellectual potential, among others.

According to American practices, 80% of license agreements are concluded with a licensee who is familiar to the inventor (professor). After signing a license agreement, TTOs control and monitor its execution.

The best American practices of licensing in technology commercialization call for the following:
• Standardizing licensing guidelines (except financial) for exclusive and nonexclusive licenses as well as for patented and unpatented innovations and other cases.
• Assessing potential licensees for the ability to commercialize and develop a specific technology.
• Providing (if possible) nonexclusive rights to the licensees or providing separate licenses for restricted areas to ensure ample access to technology.
• Assigning the rights to use the licensed technology for non-commercial purposes to the universities (i.e., education and research).
• Closely monitoring the execution of a license agreement.

As an example, we can consider the experience of the University of Maryland, College Park. The key institutions contributing to technology commercialization include the Office of Technology Commercialization (OTC) and the Maryland Technology Enterprise Institute (MTech).

1.1. Office of Technology Commercialization (OTC)

The main objectives of the OTC are to ensure the transition of IP from the university to industry and business as well as management and development of an IP portfolio. In particular, the functions of the OTC are to assess

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4 Adapted from AUTM (Association of University Technology Managers) presentations and materials.
the market potential of inventions, provide lawful protection, control license agreements and their execution, control the proceeds from commercialization, and, if necessary, assist in starting a new company on the basis of the university’s IP. The OTC has three main areas in which it provides its services: Information Science (23% of inventions and 37% of licenses in 2012), Life Science (23% of inventions and 50% of licenses in 2012), and Physical Science (54% of inventions and 13% of licenses in 2012).5

The main results of the OTC are presented in table 1.

The OTC (as well as similar offices at other universities) generates revenue by licensing intellectual property. The royalty income and patent reimbursement are the main income. A large corporation as well as a start-up company can act as a licensee.

Until 2012, about 86% of licenses were concluded with a small business, whereas in 2012 that figure was 69% (according to the Bayh-Dole Act, universities are encouraged to license inventions to small businesses). In recent years about 50% (in 2012, 46%) of inventions were funded with public money (a percentage that approximately corresponds to the general tendency around the country).6

The OTC has the following royalty distribution policy: 10% of the income received goes to the inventor(s); 30% is paid in university administrative fees. After expenses are covered, 50% of net revenue goes to the inventor(s) and 50% to the university (of which 85% goes to the inventor’s department and 15% goes toward promoting patents).7

In addition to the quantitative indicators mentioned above, the success of the office is defined by the development of research and entrepreneurship at the university, the involvement of talented young scientists, the reputation of the university and its research, and the importance of the university’s innovation for the economy and society.

The important component of successful activity of the office is the highly qualified and skilled team that allows it to carry out a technological audit of inventions and to make reasonable decisions on technology commercialization.

1.2. Maryland Technology Enterprise Institute

Mtech’s mission is as follows:8

- Educate the next generation of technology entrepreneurs;
- Create successful technology ventures;
- Connect Maryland companies with university resources to help them succeed.

Mtech’s total economic impact since 1985 has been about $32.3 billion; about 8,000 direct jobs have been created through Mtech programs; and twenty-nine entrepreneurship and innovation courses, as well as a number of successful venture creation programs that

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5 OTC, University of Maryland, College Park (http://www.otc.umd.edu/about/statistics).
6 OTC, University of Maryland, College Park (http://www.otc.umd.edu/about/statistics).
8 Mtech, University of Maryland, College Park (http://www.mtech.umd.edu/).
help entrepreneurs create successful new ventures, have been offered by Mtech.\textsuperscript{9}

MIPS (Maryland Industrial Partnerships Program) is one of Mtech’s programs. MIPS fosters academic-industrial partnerships for innovation. Funds from MIPS and Maryland companies go toward accelerating research and knowledge into products. MIPS is a win-win-win: companies leverage their R&D funding and gain access to faculty expertise; faculty and students gain funding to engage in commercially relevant research; and the state benefits via accelerated and increased revenue.\textsuperscript{10}

Since 1987 commercial products benefiting from MIPS have generated more than $28.1 billion in revenue, added thousands of jobs to the region, and contributed to successful products such as Martek Biosciences’ nutritional oils, Hughes Communications’ HughesNet\textsuperscript{TM}, MedImmune’s Synagis\textsuperscript{®}, and Black & Decker’s Bullet\textsuperscript{®} Speed Tip Masonry Drill Bit.\textsuperscript{11}

1.3. Other Technology Commercialization Partners

Technology commercialization at the University of Maryland does not happen only through the OTC and Mtech. The Center for Advanced Life Cycle Engineering, or CALCE, is a good business model of technology commercialization. CALCE is funded by over 150 organizations (members) worldwide. All results from the projects are shared among all the members. Members are provided a free license to all CALCE IP for their internal use only (if they wish to commercialize something, they must negotiate with the University of Maryland for rights). Generally, CALCE does not produce patents or even licensable technology (produce models and data)—earning revenue via licensing is not central to CALCE’s business model.\textsuperscript{12}

The main tasks of technology commercialization at US universities can be identified as the following:\textsuperscript{13}

- Accelerate the transfer of new technologies from universities to the marketplace.
- Provide services (training, counseling, and mentoring) for university researchers and potential business partners.
- Assess the fair market value of IP owned by the university, and determine and negotiate fair terms of transactions and agreements.
- Use best business practices while taking into account the interests of the general public.
- Resolve conflicts among groups of researchers, industrial partners, and the university.

Although some American universities have made great progress in technology commercialization and scientific entrepreneurship, there remain a number of problems. One of the main ones is that inventors do not always disclose inventions to their university’s office of technology commercialization in time, which could possibly jeopardize the patent process.

However, as our interviews have shown, inventors deem that the rules and regulations imposed by the OTC limit their freedom in scientific research. Another problem is the fact that universities tend to be excessively decentralized. Too much decentralization can cause entrepreneurial projects to lose their integrity and synergy, and may result in a loss of control over intellectual property. At the same time, universities should not rush to centralize their operations too much, as excessive centralization of management can constrain initiatives and dampen the entrepreneurial spirit of students and professors.

But despite those problems, technology commercialization at US universities has been successful overall. For example, commercialization at the University of Maryland alone generates around $1 million a year (table 1) for the Office of Technology Commercialization, not to include returns to the various companies. The United States affords an excellent example for countries such as Russia to follow.

\textsuperscript{9} Mtech, University of Maryland, College Park (http://www.mtech.umd.edu/docs/mtech\_spread\_2014.pdf).
\textsuperscript{10} Presentation on the Maryland Industrial Partnerships Program, prepared by Joseph Naft, director.
\textsuperscript{11} Mtech, University of Maryland, College Park (http://www.mtech.umd.edu/docs/mtech\_spread\_2014.pdf).
\textsuperscript{12} Presentation about CALCE prepared by Dr. Peter Sandborn, director of Mtech and professor in the Department of Mechanical Engineering, May 2014.
\textsuperscript{13} Adapted from AUTM and OTC presentations and materials.
2. Technology Commercialization in Russia

Let us now turn to technology commercialization in Russia. Russia is good at research, and her science and research fields remain world class (American Councils for International Education 2014). Russian scientists and inventors are known throughout the world. The Russian government has actively financed R&D in recent years: expenses for R&D were 1.48% of GDP in 2013 (see figure 2), compared with 1.16% of GDP in 2010 (UNESCO Institute for Statistics 2012). They are less than in the United States (2.66% of GDP in 2013), but for Russia they are considerable nonetheless, and the percentage is expected to reach 3% by 2020, according to the strategy of innovative development of Russia.

But Russia patents a large amount of IP without commercial potential and commercializes only 2.2% of inventions. Most Russian R&D is carried out in public institutes that have weak commercial ties. Thus, Russia’s biggest deficiencies are technology commercialization and practical application of inventions.

There are four main models of technology development in Russia: (1) government contracts and research grants; (2) business contracts; (3) university-based start-ups (Federal Law 217 (2009), “Law on Small Enterprises near Universities”); and (4) licensing.

Russian universities are focused on models 1 and 2 of technology development and have historically not been concerned about the practical use of scientific results. But models 3 and 4 are where technology commercialization is really at, and they represent new trends for Russian universities.

Models 3 and 4 demand inventions (IP) with the potential for commercialization, support organizations (structure) and resources, and the promotion of team (especially model 3) and entrepreneurial skills. These aspects are missing at Russian universities. Universities are not ready to pursue these models of commercialization. Therefore it is precisely models 3 and 4 that need to be developed.

Technology commercialization in Russia means any form of commercial usage of IP, including a cession of the rights, licensing, and internal use of IP by universities and commercialization by specialized companies.

In Russia, the adoption of Federal Law 217 in 2009, which made possible technology commercialization at universities, has brought Russian universities closer to the model of the entrepreneurial universities one finds in the United States. Its importance cannot be overstated. The law allows universities to create small medium enterprises (SME). It was passed to support the implementation of IP in the production of innovations, which in turn was derived from the state budget.

Today, Russian universities have a quite comprehensive, although far from perfect, institutional framework for the involvement of IP in economic circulation and the realization of two main models (as in the United States) of technology commercialization.

The implementation of Federal Law 217 is considered to be a difficult process but the range of unresolved issues is constantly decreasing (in particular, in connection with Federal Law 273 adopted in 2012, “About Education in the Russian Federation”). It will take several more years to create a sustainable system. That can be seen from the experience of colleagues in America, where a similar law was adopted but much earlier (1980).

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3. Russia and the United States: A Comparative Look

Let us now compare the United States and Russia. Table 2 compares the purposes of R&D, technology commercialization, and patenting in the two countries.

US scientists care about the commercial use of scientific results; Russian scientists are interested in science for its own sake, without caring too much if the results of their research are useful or practical. We believe that it is necessary to look for a balance between the practical benefits of science and “pure” science.

We then compared diverse aspects of technology commercialization at US and Russian universities and developed general recommendations for Russian conditions (table 3).

In recent years a number of serious reforms that changed the rules of technology commercialization were carried out in Russia. However, all this was implemented in an environment created with outdated approaches. Government institutions do not understand the challenges universities face and the possible consequences to universities of legislative changes.

Historically, market relations in Russia did not affect the process of technology commercialization at the country’s universities; applied research was conducted generally at scientific research institutes; universities did not play major roles in innovative and regional development. Therefore, the development of innovation and entrepreneurship, as well as finding an optimum balance between different types of activities (education, innovation, technology commercialization, entrepreneurship, etc.), is far more difficult at Russian universities than at American universities.

State legislative and structural measures in Russia are generally directed at the creation of innovative physical infrastructure and the tools of innovation (resources, incubators, science and technology parks, funds), but filling that infrastructure and finding good projects to take advantage of those tools remain a problem. Creating such structures and tools alone will not create the intended effect. Also needed are an innovative competitive environment and an entrepreneurial culture promoting the birth and advance of ideas and new technologies—two things very poorly developed in Russia. And without them the innovative ecosystem, in particular at universities, will not function. Physical infrastructure and the tools of innovation together with an entrepreneurial culture, friendly communications, networking, and mentoring—those make the environment effective for technology commercialization.

Table 2. The Purposes of R&D, Technology Commercialization, and Patenting at US and Russian Universities

<table>
<thead>
<tr>
<th>Action</th>
<th>United States</th>
<th>Russia</th>
</tr>
</thead>
<tbody>
<tr>
<td>The purpose of R&amp;D</td>
<td>Commercialization; implementation of knowledge and technology, benefiting the economy and society; qualitative, instead of quantitative, measurement of success of scientific results</td>
<td>Patents and articles written only because of contract obligations; the criteria for successful research is the number of patents (articles) regardless of their quality and opportunities for practical application</td>
</tr>
<tr>
<td>The purpose of technology commercialization</td>
<td>Focus not only on revenue, but rather on the availability of new technologies to the market; commercialization is a subsidized activity and considered to be an investment for the benefit of society; the OTC is rarely financially independent</td>
<td>Unclear understanding; generally commercialization regarded as a revenue generator</td>
</tr>
<tr>
<td>The purpose of patenting</td>
<td>Protection of an invention/new technology with the goal to commercialize and to implement the inventions in practice; conscious patenting; strong protection and high commercial potential of IP</td>
<td>Patents are obligations (mostly used for theses, government contracts) and used to fill the statistical reports of the university; formality of patenting; weak protection and low commercial potential of IP</td>
</tr>
</tbody>
</table>
State innovation policy in Russia is more directed at the implementation of scientific projects at universities and the stimulation of inventors and research teams to find possibilities for technology commercialization independently. However, the scientist-businessman is a rarity in Russia. Scientists are not particularly skilled at knowing market conditions, cannot determine the market value of their own inventions, and almost always cannot turn technology into a saleable product.

For its part, industry is not familiar with the technologies developed at universities. Even when an industrial company is interested in a university’s technology, the university simply is not ready to work with the company. Generally this is because the university does not under-

### Table 3. Diverse Aspects of Technology Commercialization at US and Russian Universities and Recommendations for Russia

<table>
<thead>
<tr>
<th>Aspect</th>
<th>United States</th>
<th>Russia</th>
<th>Recommendations for Russia</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University policies on IP in the context</strong></td>
<td>Does not concentrate on getting patents; success can be achieved through commercializing the knowledge in other forms (protection under copyright law, knowledge and skills, technical documentation, know-how, etc.)</td>
<td>Often universities focus on generating technologies and patents, ignoring technology transfer in other forms</td>
<td>The best American practices confirm that Russia should not focus on IP protection and should apply an extended approach to technology transfer</td>
</tr>
<tr>
<td><strong>Government programs to support R&amp;D</strong></td>
<td>Implementing programs that fund collaborative R&amp;D between businesses and universities; the ultimate goal is to put scientific knowledge and technology into practice</td>
<td>Usually support programs that fund R&amp;D at a university; commercialization and application of developed technologies are not necessary</td>
<td>The support programs should direct funds to research that closely cooperates with businesses; the results of R&amp;D should be put into practice</td>
</tr>
<tr>
<td><strong>University interaction with businesses</strong></td>
<td>Openness of universities to the business community; decentralized management and quick decision-making at universities; game rules are clear and shared</td>
<td>There is no well-planned policy for engaging with businesses; lack of understanding between interest groups; complexity of administrative procedures and lack of flexibility</td>
<td>Necessary actions should be taken to build sustainable partnerships with businesses; Russia should decentralize management at universities</td>
</tr>
<tr>
<td><strong>Staff responsible for IP and innovations</strong></td>
<td>Experts with the knowledge in business and science, licensing agreements, and start-ups can provide administrative assistance to staff and students as well as create a value proposition statement for potential partners</td>
<td>Weak management of IP and innovations; absence of expertise in running a business and conducting business transactions; responsible staff are unable to transform the raw invention into available IP for the marketplace</td>
<td>Develop institutes to train managers of IP and innovations as well as attract people experienced in business operations</td>
</tr>
<tr>
<td><strong>Distribution of revenues from commercialization</strong></td>
<td>University has an internal policy of the sharing of revenues (royalty distribution); in case of success, the proceeds from commercialization are allocated between the inventor, university, and further research</td>
<td>No general rules of revenue distribution; the legislature does not have to share revenues with the inventor; it reduces incentives for innovators</td>
<td>Revenue sharing scheme should be established; it should account for realistic assessment of costs including obtaining IP (R&amp;D) and turning that IP into a successful product</td>
</tr>
<tr>
<td><strong>Education of new generation of entrepreneurs</strong></td>
<td>Developed; most businesses and engineering professors have experience with the private sector and supplemental business operations; entrepreneurial spirit and innovative ideas of students are always encouraged and welcomed</td>
<td>Not developed; professors who teach innovative entrepreneurship lack experience in business; entrepreneurial spirit and innovative ideas of staff and especially students are not encouraged</td>
<td>It is necessary to develop educational courses with professors who are knowledgeable and experienced in the business world as well as develop programs that support and welcome the innovative ideas of staff and students</td>
</tr>
</tbody>
</table>
stand the rules of the game, does not have qualified experts who can manage the dialogue between science and business, and does not have strong project teams capable of “packaging” the innovative project for industry needs.

The Russian government conducts a top-down innovation policy: decision-making and the distribution of resources are centralized, and there is a lack of organizational flexibility. The fear of misuse of public funds blocks initiatives and the flexible adaptation of support mechanisms. Innovations should not depend on the state; they should be born independently through a bottom-up culture of innovation.

In spite of the fact that a number of important normative legal acts regulating innovative activity at universities, as well as a number of changes in legislation, have been adopted, university administrators, faculty members, inventors, experts, and students do not understand basic concepts of IP protection and usage. At the leading American universities, promoting IP management and educating key players about it began in the middle of the twentieth century, long before adoption of the Bayh-Dole Act. In Russia, they are only now beginning.

As noted, the scientific and technical potential of Russia is huge. The largest companies in the world are very interested in benefiting from and using innovative products and technologies developed in Russia. But the realization of Russian potential is not a simple matter. One complication holding Russia back is that of training technology entrepreneurs, project teams, and innovative managers at her universities. There is no good business education in Russia. In most cases, faculty members in business schools have never been in industry and have no experience with the kinds of projects businesses usually undertake. This gap between science and business has affected the quality of teaching and education.

Although difficult, it is possible to raise capital (invite investment) in Russia. Investors around the world would rather choose strong teams instead of good (even disruptive) technologies because without a good project team, no technology can be used to any great benefit. The problem in Russia is a lack of strong project teams that are able to justify an investor’s capital. Training of such teams and the development of business skills have to happen at the universities, which are unfortunately still a long way away from being able to do those things. And only experts with experience in entrepreneurship can provide high-quality training.

It is necessary to train not only students in economic and business schools, but also students in technical schools, because they are future technology entrepreneurs with their ideas and projects. If there is an idea, the student or the university graduate has to know what to do with it. And such initiatives have to receive new mechanisms of support within universities, including access to capital.

Universities need a stable source of public funding for research. The Russian government actively finances and supports the development and advancement of new knowledge and technologies (through the Russian Humanitarian Science Foundation, the Russian Foundation for Basic Research, Federal Target Programs, the Foundation for Assistance to Small Innovative Enterprises, Skolkovo, Rusnano, RVC, etc.). The state acts as a so-called “business angel” during the first stages of innovative projects, helping universities to carry out R&D and to enter the market for private capital.

Universities actively participate in such programs; however, when public financing comes to an end, technologies are not yet ready for the market, the project team is not ready (or has no desire) to market IP or start a business; there is no administrative and consulting support available. Participation in such programs becomes an end in itself; further development of technologies and the organization of successful new ventures happen only in isolated cases. And here is where the university can play an important role: it can encourage teams to package innovative products with the help of departments and centers of technology commercialization, or universities can arrange for outside parties (intermediaries) to market those products.

In the modern world of innovations, the concept of “Open Innovation” (Chesbrough 2003) dominates. The idea and principles of Open Innovation are that in today’s market and business world, in today’s open community and with transparent processes, nobody can be successful and prosper on his own. New knowledge and abilities, experience, contacts, networking, and
reputation are necessary. The important part is assigned to innovative managers and new players—intermediaries in the innovation market. They must perform most of the work and provide most of the services when it comes to technology commercialization. They are objective owing to their independence and are translators in the dialogue between science and business, leveling distinctions between the two and clearing up misunderstandings.

In Russia such intermediaries hardly ever participate in technology commercialization, and if they do, they are not trusted. Thus, Russian universities hardly ever work with intermediaries, and the failure to do so significantly reduces their success in technology commercialization.

Protection of IP in Russia is a separate issue. The conceptual principles of IP protection were established in Russia with the adoption of the Civil Code of the Russian Federation (part four). The legal foundation has thus been established; however, the efficiency of the system is far from perfect. IP protection plays an important role in attracting venture and direct investments and in developing innovations. Figure 3 shows two indexes: that for country attractiveness for investments (how attractive a country is to investors) and that for IP rights protection. Russia significantly lags behind many other countries, and that negatively affects its investment attractiveness. The United States enjoys some of the strongest IP protection and the highest index of country attractiveness for investments.

Only if IP is well protected is it an asset. Strong protection of IP is a necessary condition of practical application and use of new technologies in meeting economic targets.

Patents in Russia have no such protection and they are not valid as they are in the United States. Unlike in Russia, the process of obtaining a patent in the United States remains extremely difficult, labor-intensive, and expensive. Criteria and requirements for obtaining patents are very strict.

In Russia applying for a patent is quite easy; it is possible to patent practically everything and thus a patent has no value and does not make sense. What Russia needs to do is to develop a system of intellectual rights protection, including creating an effective judicial system for IP protection and ensuring that applications for a patent are taken seriously and evaluated thoughtfully.

So, scientific and technical entrepreneurship is a new phenomenon for Russian universities. It demands new standards of administrative, research, and business activity, in particular:

- entrepreneurial behavior, which should be common;
- physical innovative infrastructures and innovation tools;
- policies that promote innovation and that cultivate an entrepreneurial culture;
- flexible management systems;
- a system of human resources management at universities and a business network of graduates;
- expertise and skills at marketing products and predicting what new technologies will be needed;
- two-way communication between universities and companies.
University-industry cooperation also is a major problem, and it is actively discussed by Russian and foreign experts. The vital, important links between industry and universities in Russia are really weak.

Universities will not be able to succeed in technology commercialization without active collaborations with industry. The basic principles of the university-industry partnership have to be defined (for instance, obligatory involvement of students and graduate students in research, lack of restrictions on the use of scientific results in further research, etc.). Universities and businesses must be free to determine specific conditions and ways in which they can cooperate.

At each Russian university the recognition of a number of barriers—legal, procedural, structural, cultural, social—which prevent a university from becoming an incubator of innovations is necessary. The understanding of these barriers will allow universities to overcome them and to succeed as a supplier of highly qualified specialists and producers of saleable IP.

4. Policy Recommendations

Generalizing from what we have noted above, we can propose the following policy recommendations for Russian universities:

- Develop an integrated ecosystem, one that brings together science, entrepreneurship education, innovation, and collaboration.
- Generate IP with commercial potential (real saleable products, not products that exist on paper only); analyze, screen, and “package” innovation projects; focus on market research and create a value proposition statement. Technology becomes a commercially viable product when it solves a specific problem in the real world; a concept is well developed and a technology is ready for industrial use when it is difficult to reproduce and has patent protection.
- Develop an entrepreneurial culture among employees and students; popularize innovations, and improve IP management and entrepreneurship. Staff and students at universities should be encouraged to generate and develop new ideas. The current culture of indifference has to be replaced by business activity and initiative, courage, and a desire to succeed in developing new products and bringing them to market.

- Create entrepreneurship education opportunities (programs, speaker series, open hours) to educate innovators with strong entrepreneurial skills; promote student innovation and entrepreneurship; create and train project teams and IP managers.
- Involve those with business skills in innovations in IP management and entrepreneurship education.
- Connect with companies to collaboratively use resources and pursue opportunities; facilitate university-industry collaboration; aspire to win-win scenarios (the university and industry benefit); work directly with local businesses and communities; focus on the real requirements of business.
- Weaken centralization, to give freedom to divisions and the ideas of the young generation.
- Establish American-Russian long-term business relationships of interest, benefiting both countries (e.g., EURECA).

For IP management as a main part of technology commercialization at universities we can propose the following:

- Publicize research results that have commercial potential and can be used to benefit the economy and society.
- Discourage the premature publication of scientific results because in this case it will not yield a commercially viable product.
- Clarify the particular points of law that relate to IP creation and use.
- Carry out a full assessment of IP (identify obstacles to protection and commercialization, commercial opportunities, etc.).
- Provide timely and effective protection of IP in the appropriate form (patents, know-how, etc.) and IP management.
- Develop a suitable strategy of commercialization by joint efforts (experts, inventors, and university administrators), establishing terms of concrete actions.
- Provide equitable distribution of economic benefits from IP commercialization, to encourage inventors and to provide cash rewards to all stakeholders.
We can propose the following (in our opinion, the most important) policy recommendations for the Russian government:

- Conduct a bottom-up innovation policy.
- Investment in programs that promote a cultural shift toward entrepreneurship and innovation.
- Invest in human capital for innovation, entrepreneurship, and science commercialization.
- Stimulate demand for innovations rather than just emphasize the production of innovative products, tools, and mechanisms.
- Adopt a number of measures and acts for strengthening IP protection.

Both universities and the government need to place a priority on research results that can have real-world economic effects rather than focusing on merely investing in research.

5. Conclusions

We began this paper by proposing that Russia can benefit a great deal from the United States when it comes to technology commercialization. Needless to say, the way in which US universities have promoted technology commercialization cannot be copied detail for detail, because the situation in Russia is not exactly like the situation in the United States. We can observe the best practices of US universities, but they cannot be exactly replicated. It is necessary therefore to create a Russian model of technology commercialization that, while drawing on the spirit and general features of technology commercialization in the United States, is adapted for the specific conditions in Russia.

In Russia, research activity is conducted largely without a specific goal for commercial use. However, the following has to become the rule of any scientist and inventor: secure strong legal protection and license an idea (to begin a business) so that others do not begin to use it and do not start earning money from it. Unfortunately, in Russia, there are a lot of cases in which intellectual property is appropriated and put to commercial use. It is necessary to understand that the most valuable asset in technology commercialization is well-protected IP.

Technology commercialization is generally not about science; it is about the market, clients, partners, marketing, finance, etc. It is extremely important to keep in mind the needs of end users of innovative products. And all stakeholders in the technology commercialization process have to realize that commercialization is not a game of “what do we have” but one of “what does someone need.”

References


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