

Problems and prospects of university innovative infrastructure in the triple helix model “university - business – government”.

Subtheme: Start-ups, spin-offs, science parks, business incubators, technology transfer offices, joint research projects, in-firm (company) universities, business acceleration centers, corporate incubation, university proof-of-concept centers, etc.

Vera Pudkova, Head Commercialization Unit, Tomsk State University of Control Systems and Radioelectronics, vv@tusur.ru.

Alexander Uvarov, Vice-rector for Innovations, Tomsk State University of Control Systems and Radioelectronics, au@tusur.ru, leader of innovative cluster of TUSUR.

Keywords: university innovative infrastructure, technology transfer offices

Introduction

The classic cycle of innovation project and the role of infrastructure, that supports an innovative project at every stage, are considered in this research. The classic cycle of innovation project means: basic research – advanced research - a laboratory model - industrial design - small series - large series - sales. For example, taken into account the infrastructure to innovation support of Tomsk State University of Control Systems and Radioelectronics, Tomsk city, Russia.

TUSUR has almost all of elements that support innovative projects: Scientific Departments, Commercialization Unit, Student Business Incubator, Technology Business Incubator will be completed in 2012. There are surrounding of 125 spin-out companies and an innovative-friendly regional environment, the main element of which is the Special Economic Zone.

The study focus are the problems faced by the infrastructure, university staff and entrepreneurs during creation of innovative businesses. Recommendations to solve these problems are presented in this article.

State of the art

The innovative infrastructure of Tomsk State University of Control Systems and Radioelectronics (TUSUR), Russia, is shown on Figure 1. This must be the “classical” infrastructure of innovation support. It is obvious that:

The office of commercialization of inventions (OCI) selects the ideas that have the best prospects from the commercial point of view and results of fundamental research, and assists in attracting funding for their commercialization. Employees help scientists to work out the commercial potential of scientific and research results, a strategy for protecting intellectual property, and attracting finances for international exploitation of the results of intellectual activity. The OCI recommends inventions with commercial prospects for the creation of juridical persons in accordance with Federal Law 217, assists with preparing documents for creating enterprises, and attracting financing. Its assistance includes participation in international projects, networks, databases, and entering international markets. In TUSUR this is achieved via the ENN network and the Gate2RunBIN project.

Copyright of the paper belongs to the author(s). Submission of a paper grants permission to the Triple Helix 9 Scientific Committee to include it in the conference material and to place it on relevant websites. The Scientific Committee may invite accepted papers accepted to be considered for publication in Special Issues of selected journals after the conference.

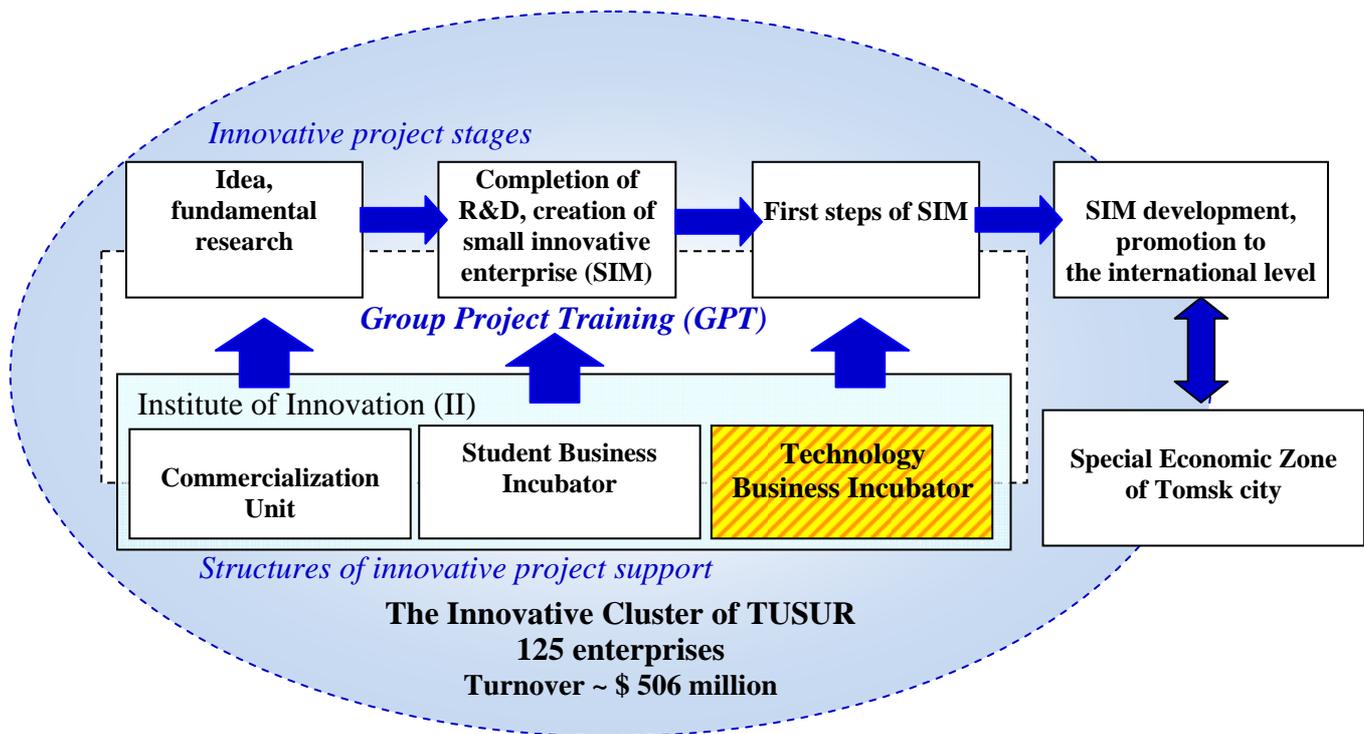


Figure 1. The innovative infrastructure of Tomsk State University of Control Systems and Radioelectronics (TUSUR), Russia.

Furthermore the business incubator supports innovation projects not only with providing work space, but also with offering services at a discount: strategic development questions, protecting intellectual property, marketing, legal and accounting support. TUSUR's business incubator is divided into two: student and technological (which is under construction and will begin work at the end of 2012).

The student business incubator "Friendship" (SBI) was Russia's first (opened in 2004) and has its own building of 3000m² and 300 work places for conducting research and development and in the sphere of radio technology and IT. Places are awarded on a competitive basis. Residents are provided with full support in the aforementioned areas.

TUSUR's SBI has international level equipment and distinguishes itself in its interaction with strategic investors in student projects: TUSUR's alumni association and ERIC enterprises.

The technological business incubator (TBI) will be located in a TUSUR lab building currently under construction. The total area will be 3312 m². It will house no fewer than 30 innovative projects (200 places).

TBI will be equipped to work in the priority areas of nanoelectronics, radio technology, ITC systems, intellectual power electronics, and innovation studies.

It is foreseen that after 2-3 years in TBI innovative enterprises will be ready to move to the Special Economic Zone of Tomsk.

It is also obvious that, being housed in the university, some departments will assist scientists in patent applications and marketing. For example, support is provided at different steps by TUSUR's Patent Information Department (PID) and Marketing and Advertising Department (MAD). PID's work involves the protection of intellectual property. MAD works out appropriate marketing strategies. Thus the university creates all the necessary conditions for the realization of innovation projects and the creation of innovative companies.

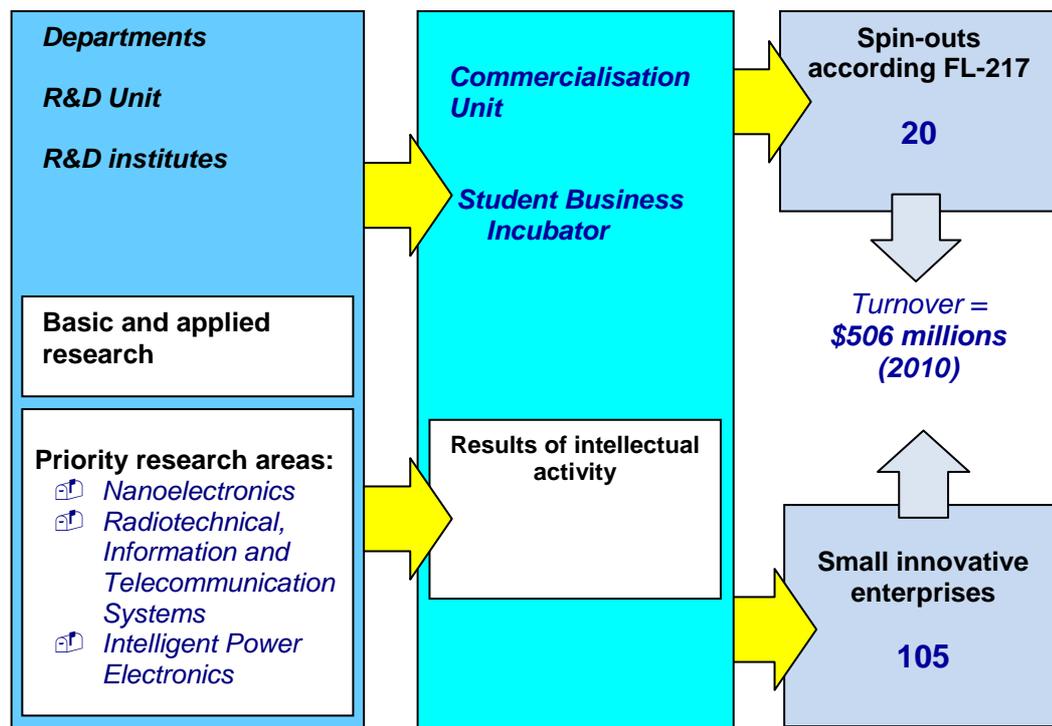
It is worth noting two peculiarities of TUSUR in the system of Russian higher education.

The first is the key role played the Institute for Innovation in supporting innovation projects. The Institute provides for the integration of research, educational and entrepreneurial activity.

The second is TUSUR's Educational, Research and Innovation Complex (ERIC). ERIC encompasses 125 enterprises created within the university as research divisions or developments of new projects. Pic. 2 shows the two main routes for creating innovative enterprises at TUSUR:

- By including one of the results of innovative activity into the registered capital of a company in accordance with Federal Law 217;
- By graduates of the university in close cooperation with employees and students, using the infrastructure of support for innovative activity.

There are around 500 knowledge-based enterprises working in Tomsk, 125 of which are headed by graduates of TUSUR, accounting for approximately 80% of the knowledge-based production of Tomsk Region. Therefore we can see that the efforts of TUSUR graduates have created a new sector of the economy – a knowledge-based economy.



Pic. 2. Scheme of creating TUSUR innovative enterprises

ERIC enterprises are part of the innovative infrastructure and support student projects with real market potential, orienting them toward an international level. The TUSUR Alumni Investment Fund is a strategic investor in student projects.

TUSUR Innovative Cluster has developed regulations for development of the innovative project from idea to output of goods/services into market. In accordance with regulations the University supports the innovative infrastructure by means of other than governmental budget sources, and projects are supported and funded by members of TUSUR Alumni Association (TAA). Starting with the project of group project training (GPT) and up to the push the enterprise products into the market all expenses are covered by members of the TAA. In the process of company creation, usually 51% owned by investor from TAA, 24,5% - student groups, which is the main driving force of the project, 24,5% - owner of intellectual property (for example, scientific supervisor).

On the basis of research results a successful mechanism of interaction between university and businesses was developed in TUSUR Innovative Cluster to implement innovative projects and staff training for these projects, which provides a solution for two problems:

- 1) Implementation of effective scientific and technological developments on the orders of business in the interests of Russian economy based on knowledge.
- 2) Quality improving of the target training by involvement of students in real research and business projects.

The article includes the analysis of innovative projects support mechanism that promote the effective transfer of generated knowledge and technology in business, as well as the further output of products and services into regional, Russian and international markets.

The effectiveness of the infrastructure was proved in practice. Results of the infrastructure at the end of 2010 are presented below:

- 125 enterprises and private entrepreneurs of TUSUR Innovative Cluster, who organized their structural units in university, are developed successfully.
- 120 innovative projects implemented by TUSUR alumni at existing enterprises of Tomsk.
- The total number of enterprises, organized by university alumni in the Tomsk Region - 176 companies.
- TUSUR is the founder of 20 business entities created under the Federal Law FL-217.
- Services rendered by enterprises of TUSUR Innovative Cluster in 2010 were \$ 506 millions.

Methodology

The research methodology includes an expert survey, analysis of speeches and publications of infrastructure, the university and small businesses staff. Problems are ranked according to importance. Solutions are developed on the basis of a systematic approach.

Findings and interpretation

Next we can examine the extent of participation by the university, business and state in the Russian Federation in determining problems, aims and tasks in the innovation economy and the role of innovation support infrastructure.

Table 1. Problems, aims and tasks of Triple Helix actors

	University	Business	State
Problems	Small number of results of innovative activity implemented in production, length of implementation, little economic effectiveness for the university and authors	Absence of tax incentives to develop innovation. Barriers to high-tech market production entry. Tough competition	Low rate of economic growth. Use of formal institutes to develop innovative business do not enable expected economic growth
Aim	To get the maximum economic effect from implementing results of innovative activity	To get maximum profit by selling products and services having a high profit margin from intellectual components	To build formalized institutes for the conduct of business as practical as possibly and giving maximum economic effect

Tasks	Commercialization of results of innovative activity	<ol style="list-style-type: none"> 1. To find innovative products/services and be the first to enter the market and 'milk the cow'. 2. To modernize production by harnessing innovative technology, thereby reducing costs on production or provision of services 	To boost the economy by moving toward innovative development
-------	---	---	--

For solving of tasks and achievement of set aims, the university, business and state play different roles in the realization of stages of the innovation project's life cycle.

Table 2. Participation of the university, business and state in the innovation project's life cycle.

Stages	University	Business	State
Getting results of innovative activity	University employees conduct research work and record the results of innovative activity of the research process	Sometimes looks and asks "What is science doing right now?" Sometimes finances work and assumes intellectual property rights	As a rule, finances fundamental and applied research
Evaluation of results of innovative activity from the commercial point of view	Employees of the OCI evaluate: are the results commercially attractive? Which product can be commercialized and who will buy it?	Consults with university employees	Requires records of results of innovative activity gained from state financing to be provided to the Ministry of Education and Science
Development of strategies for intellectual property protection	If approved at the previous stage – the form of protection will be determined (patenting or commercial secret)	Consults, conducts negotiations, tries to make a profit	Enables the development, acceptance and observance of laws in the sphere of intellectual property
Development of commercialization strategy	OCI employees develop a commercialization strategy	Does not participate	Does not participate
Realization of intellectual property protection	Patenting process or commercial secrets documents are created	Does not participate	Enables legal protection of intellectual property rights
Evaluation of worth of results of innovative activity	OCI employees organize the evaluation process	Does not participate	Assists in developing methods of evaluation

Inclusion of the results of innovative activity on the university's balance	Carried out by university employees	Does not participate	Controls accounting processes
Negotiations with investors and potential co-owners. Determination of share of registered capital	Conducted by OCI employees	Participates in negotiations	Does not participate
Creation of a company	OCI employees participate in the preparing of documents	Participates in preparing of documents and company registration	Enables the development, acceptance and observance of laws in the sphere of registration
Informing the Ministry of Education and Science	OCI employees do this	Does not participate	Supports the data collection process
Conclusion of a licensing contract with the company	OCI employees prepare the licensing contract	Participates in the preparation of the licensing contract	Supports the registering organ - Rospatent
Investment attraction	Search conducted by OCI employees	Invests in the project	Develops and realizes investment programs. Attempts to create private-state financing of risky projects
Work of the company	University employees represent the university's interests in the company	As a rule, a representative of business manages the company or, at least, consults with the management	Creates, partially supports the work of the company (special economic zones, business incubators, technoparks). Enables the observation of laws and paying of taxes
Distribution of profit	University receives its profit share	Business receives its profit share	Sets tax rates

In Table 2 we see clearly the role of the innovation support infrastructure. The Table demonstratively shows that, having passed through all stages, having various degrees of participation, each actor of the Triple Helix model can achieve his aims.

Analyzing the aforementioned information, it is worth noting the role of Triple Helix actors in the process of creating innovative businesses, which they fulfill from the point of view of the theory of economic development:

- University – developer and owner of the results of innovative activity and also an initiator in creating companies,
- Business – investor and manager of the company
- The State – regulator of interaction, creator of conditions for the development of the company in the innovation economy.

The picture of interaction provided earlier ought to be followed. However, in practice in Russia we see considerable deviations from the theory.

Problems:

In part, universities have no critical approach to the evaluation of the potential of results of innovative activity: some create companies based on results which have no commercial interest, others on the contrary have commercially attractive results, but do not create companies due to lack of business experience and unreadiness to bring on a team of managers.

Business has a wait-and-see position. Business is unwilling to risk large investments in risky projects if these projects are not initiated by themselves, and there is not yet a plethora of mentors and business angels. Business rarely calls for innovation.

The State. It is worth noting that on the one hand the State pays attention to universities and business – the very passing of laws demonstrates this. On the other hand, aside from regulation, the State fulfills controlling and punitive functions. In part, the State ‘informally’ presses on universities: “You asked for permission to create enterprises, but you’re not hurrying to create them by the hundred or thousand...”

Also, based on analysis of the interaction of the university, business and government in the Russian Federation, authors identify key limitations of the interaction between universities and business and suggest ways to overcome these limitations:

1. The universities with the assistance of regional and federal authorities formed infrastructure fragmentarily. This infrastructure includes: commercialization units (CU), technology transfer centers (TTC), student business incubators (SBI), technology business incubators (TBI), technoparks, - and supports innovative activities.

To build the infrastructure, the federal government granted financial means with co-financing by regional governments or businesses, but it does not allocate funds for annual operation of innovative infrastructures. Regional authorities are trying to support and maintain the infrastructure, but in miniscule amounts. Everyone knows that innovation infrastructure can come to self-sufficiency in some cases, in the overwhelming majority it needs to be supported by various governmental financial programs. In developed countries such support is provided by the government: both through direct funding and through various programs and support of innovative projects which order services from infrastructure organizations.

If you create object and not provide its support, the object could destroy in nearest future.

Therefore in case of further government ignoring of issues to support the innovation infrastructure, the National Innovation System (NIS) - will collapse, even before it could be formed in the minimum scale. Exactly the innovative support infrastructure is the basis of NIS.

2. In Russia there are such corporations as “Russian Technologies”, “Nanotechnologies”, there are mega-projects (such as the Sukhoi Superjet-100), large-scale venture capital funds, and it helps to develop large projects. However, university innovative projects need to also grow up to big projects to use the proposed governmental resources. It needs time. During development of innovative projects they also need financial support, but the mechanisms, which facilitate financial support for small and medium projects, are the critical few.

One of such mechanisms is The Fund for Assistance to Small Innovative Enterprises (Chairman of the Supervisory Board – Ivan Bortnik). Staff, students and graduate students actively participate in the programs of the Fund such as "START" and "UMNIK". But the amount of financing for one project does not allow this project to growth to a serious level. It is necessary

to multiplier The Fund for Assistance volume in 100 times to get a significant effect from transforming R & D results to business.

Another mechanism of large innovative projects "growing" can be a venture fund at university, but in compliance with Russian laws it is impossible to establish such fund, because the Ministry of Education and Science will be its main manager instead of university current. Situation: there are investors from university innovative cluster, who are ready to provide funds for venture innovation projects, but do not want to manage these projects. There is a portfolio of innovative projects which on terms of the "classic" venture capital are ready to accept these investments (one project is required from \$ 0,2 millions to \$ 2 millions). But there is no mechanism that can bring these stakeholders to the mutual benefit without causing of claims from the regulatory & control authorities.

3. The Federal Law 217-FL of 02.08.2009 is long-expected and helpful: finally government marked another area of universities activity: innovative business creating.

However, in its implementation universities face the following significant limitations:

1) A company created under the The Federal Law 217-FL is not allowed to engage in other activities except for "the practical application (implementation) of intellectual activity results", where the law is not clearly clarify: Has a company a right to sell a product or services which are created on the basis of intellectual property? In real economics a company will not survive by ONLY "practical application (implementation) of intellectual activity results". In addition to introducing of new technologies and development company should buy, sell and produce also non-innovation products - products that have strong demand in the market. These activities are necessary to survive in tough market conditions, and to enhance competitiveness by means innovative product/service producing.

It is necessary to allow for such companies legally to engage activity which is related to innovation activities, including manufacture, purchase and sale of non-innovative products/services.

2) According to the 217-FL, when university creates, it is eligible for 25% and more (joint-stock company) or more than 33% (limited liability company) of company shares. Thus, under the Law, the waves of limitation and control procedures fall on created company, like on state-financed organizations. Accordingly, it would not allow a startup company to compete on open market and lead to its rapid closing.

It is necessary allow universities to decide percentages of the share capital or a stake of created company.

3) The Russian Government initiatives to support innovative educational programs (2006-2008) and support of national research universities (2009-2018), did not include funding for research, results of which are objects of intellectual property - the basis of created companies share capital (according 217-FL).

University (to conduct scientific research) applies to the market for financial support - to large and medium-sized enterprises, which finance developments, and reserve the right on intellectual property (however, the government is doing the same in the financing of such studies). Thus, it is possible to attract financing usually only for applied research. Funding sources for fundamental research remain heavily restricted. Of course, there are sources, such as: Federal Program "Kadry"(Staff), Ministry of Education and Science, Russian Foundation for Basic Research, Russian Foundation for Humanities - and they play a good role in the humanities and social sciences, but in technical and natural are clearly insufficient.

Having a really poor budgeting for research, university has to work in the same market as the Massachusetts Institute of Technology (USA), having a research budget of \$ 2 billion, the University of Tokyo and Shanghai, with their billion-dollar budgets for research. Therefore, Russia loses much in the global markets of innovative products.

Of course, universities can attract finance for applied research by orders for research from businesses and enterprises (for example, TUSUR receive up to \$ 10 million per year), but in this

case all intellectual property belongs to the customer. However, the orders of the market do not solve the problem of intellectual property generation that can be basis for large business.

Along with the above problems in the modern conditions of the Russian economy there are the following **prospects**:

1. World development of the economy ‘pulls’ along countries and regions and the State cannot ignore this. There are high hopes that the innovation support infrastructure will receive considerable support in those regions where the State feels the inevitability of the innovative path to development and openly announces it. Sources of support, as a rule, are business and the State. Which source to which extent depends on local conditions. The State can provide support indirectly, such as creating conditions for big business which can undertake the financing of infrastructure.
2. Innovation support infrastructure needs to use modern and permanently widened possibilities for communication. Society becomes more open and communication interaction of interested parties can be achieved from practically any corner of the Earth: from the North to the South Pole, from Japan and Kamchatka to the shores of the West United States, in the desert and forest, in a metropolis and on an island, even in Prokopyevsk and Yurga.
3. Infrastructure is capable of leading and developing interaction in the Triple Helix. For it is employees of the infrastructure who are the key figures, who are capable of communicating in three languages: of university, business and government. A highly-qualified professional understands the various needs of the university, business and the State, and communicates with each in their own language. (This can be a subject for further research.)

From the all above-mentioned it follows that the government must make bold ensure proactive funding for basic and applied research in an amount not less than 3% of GDP, and most importantly, rightly direct financial flows - to the universities that funds reach the specific scientific workers.

Conclusions:

It should be noted that each actor of triple helix model “university - business – government” plays one's own role in economic development. Despite the problems, the prospects for interaction between universities, business and government who understand each other, speak the same language and achieve the development goals of the regional economy by achieving their personal goals are very attractive. And the maximum result is expected if the direction of actors development in the triple helix will be parallel and directed in one direction.