

A

Theme 7 Place based innovations

Title: Place-based innovations: how to determine local key institutions to build and accelerate regional clusters in the Triple Helix model in Russia?

Liana Kobzeva, Center of Corporate Development, Institute for Innovations, Tomsk State University of Control Systems and Radioelectronics (TUSUR), Tomsk, Russia

Contact: 05.liana@gmail.com

In 2007 I established the Center of corporate development in the Institute of innovation of Tomsk state university of control systems and radioelectronics.

2011-2012 – member of the organizing committee of Tomsk innovation Forum, Forum’s web-site editor.

2013 – program director of the XV Tomsk innovation forum INNOVUS-2013

Since 2010 – engaged in projects devoted to dissemination of advanced scientific and technological knowledge, promotion of researchers and developers. Curator of TEDxTomsk.

Since 2012 – engaged in project on creating the center of innovations, science and education in Tomsk.

Evgeny Gribov, Center of Corporate Development, Institute for Innovations, Tomsk State University of Control Systems and Radioelectronics (TUSUR), Tomsk, Russia

Contact: ckr@sbi.tusur.ru

Keywords: innovations, local key institutions, clusters

INTRODUCTION

As one of the leading innovation regions of Russia, Tomsk region implements a project of center for education, research and development of international standard “INO Tomsk 2020”, which is carried out on the basis of the Triple Helix. The Administration of Tomsk region, universities, scientific institutions and business enterprises determined all together the top priority directions of region’s science and technology development according to which the innovation ecosystem and innovation clusters should be established.

In 2012 Tomsk region Administration raised the question of science and technology state in the chosen top priority directions, the roles of each participant in the Triple Helix and institutions that should be established in order to support the development of these directions and to organize information exchange on the right track in the sphere of R&D. That is why Tomsk region Administration was wondering: what kinds of research are conducted in Tomsk Universities and Institutes of Tomsk Scientific center of the RAS Siberian branch? What kinds of them are necessary to be supported so that new SME would be generated and a gross regional product would grow? And what kinds of new institutions need to be established, what would be their goals and functions?

Tomsk region Administration consulted the authors in order to find the answers for the questions mentioned above in two out of seven top priorities in science and technology development of Tomsk region. They are “energy efficiency and energy conservation, cost-effective use of resources and environmental protection”.

CURRENT STATE

The USA and European researchers in their articles on innovation policy, entrepreneurial universities, development of regional innovation clusters pay a greater attention to innovation ecosystem, inventory of science state and determination of top priorities in science and technology development.

In Russia a great role is assigned to the state of science and technology development, determination of top priorities in science and technology development within the federal and regional scientific foresights and it is represented in the Foresight magazine of National Research University Higher School of Economics. It is worth mentioning that the research was conducted in 2011 by the RF Ministry of Public Health on determination of competences in the sphere of Russian medical studies, leading scientists and necessary institutions for transition to network model of R&D management. Since December 2012 Russia implements the project called “The map of Russian science”.

RESEARCH FOCUS

The group of authors conducted the research in order to find the answers to the following questions:

What research teams are conducting the R&D in the sphere of energy efficiency, energy saving, environmental protection and cost-effective use of resources? What kind of support do they need from the regional authorities so that they could increase the efficiency of scientific research and their results of commercialization? At what development level is the interaction of research teams and local innovation business? What local key institutions should be established in order to build and accelerate regional clusters of energy efficiency and resource saving technologies in Tomsk?

METHODOLOGY

The research was conducted in several stages:

The first stage (retrospective monitoring) includes the data collection posted for the last two years on regional, federal and international web-sites devoted to R&D conducted by Tomsk research teams in the sphere of energy efficiency, energy saving, environmental protection and cost-effective use of resources. The result contains the list of research teams, the research topics, articles and reports of Russian and international conferences.

The second stage embraces semi-structured interviews with 77 heads and participants of research teams of Tomsk Universities and institutions of the RAS Siberian branch as well as list of R&Ds.

The third stage includes discussion of promises and potential of R&D commercialization together with international and Russian experts.

FINDINGS AND INTERPRETATION

The chosen methodology allowed to get the following results:

- It was possible to determine the type of research teams that conducted R&D in the sphere of energy efficiency, energy saving, environmental protection and cost-effective use of resources:

- Research teams that conduct research and publish the results in scientific articles and Russian scientific publications. These research teams have experience in implementing of patents in the Russian language, but have no international experience, they have minimal experience in marketing ;The point of view of such a team can be expressed by the quote of a respondent: “Our team has been working since 1960s. Gradually early career scientists come join our team. We publish our research outcomes in the papers, articles and patents. We don't strive for implementing the results. It's not the matter of scientists”
- Research teams that generated a product or a service based on their research, but have no time and competence to commercialize and market it. The majority of research teams has no experience and competence in R&D commercialization process and do not trust this to outsiders represented by business or regional authorities.

“Our research team deals with different issues of energy audit that is energy systems, electric systems, power supply systems. While rendering energy audit services we have worked out several programs to estimate the efficiency of pumps including frequency controlled ones. I would not say that we are going to develop a software product on the basis of this software. We are satisfied with the software we developed it only for our own work. If there is some more work we will use and improve it. It is a by-product of the energy audit work. We conduct research to assure quality of our services rendered. As a rule, 25 % of income from the services rendered is spent on R&D”.

- Competence centers are research teams that have both members who are responsible for research and those who are responsible for product generation and it's positioning on the market. According to the results of research there are four competence centers in the sphere of technology of water purification up to the drinking standards, industrial electronics, atmospheric research and safety assessment of nanomaterials and nanoproducts.

The first Competence center is “Biotest-Nano” Center, National Research Tomsk State University. Currently the main research direction is nanomaterials safety assessment. Biotest-Nano” Center is the only center in

Russia, accredited according to international standards to assess nanomaterials safety. The center is positioned on the market of nanoindustry safety assessment.

The second *Competence center* is a research team that deals with development of ecologically clean, resource efficient, nonchemical water treatment to use the water as a drinking water. The research team works at the Institute of High Technology Physics, National Research Tomsk Polytechnic University. The research group is skillful in the full range of works necessary to conduct a reliable research: fundamental studies, design, technological equipment production, footlocker production to place the equipment, commissioning, service staff training, and maintenance.

The third *Competence center* is a Research and Education center “Inosphere Physics and Electromagnetic Ecology”, National Research Tomsk State University. The research team deals with development of network radar for ionospheric sounding. The competencies of the Research and Education are focused on the research stage. 15 state contracts make up the workload of the center. The research areas of the center are “Electromagnetic ecology” (electromagnetic waves exposure on humans): solar and Earth physics, solar and Earth connections, solar activity influence on Earth magnetic sphere assessment e.t.c. The research outcomes make the research team competitive on the international market of specific equipment installed at the stations aimed at research and data collection on Earth atmosphere conditions. The market capacity is about 200 installations. Russia has not been represented on this market so far.

The fourth *Competence center* is «Industrial Electronics Company» LLC. The research team's skills combine research competencies of Industrial Electronics Research Institute, TUSUR together with market competence. The research team deals with the issue on how to reduce the share of energy consumption while producing a unit when, e.g, drilling. The biggest costumers of the *Competence center* are Federal Network Company of Unified Power System, MRSK holding and distribution companies of low voltage power line.

It is noteworthy to mention characteristics of the situation in research developments commercializing which concern all three types of the research teams working in resource efficiency enhancement, energy- and resource saving as well as environmental protection:

- the majority of respondents whose research and developments were about to be commercialised are being sold in other regions rather than Tomsk region;
- there is a low demand for research and developments among large businesses both in Tomsk region and all over Russia;
- the main source of financing for research and developments in the regional universitites and research centers is federal target programs. These programs take aim to support the minimal set of

applied research competencies in the Universities mostly and they don't provide the access to the market (commercial products, customers search);

- research groups that have end product ready to be launched on a large production scale face up with the following:

- cycles of state financing (1 year): the group may wait for at least 1 -1,5 year to get the product purchased for the first time (the customers are mostly large state companies);
- cycles of new technology transition for the industries;
- cycles of technological modernization for definite production lines.

- The functions and tasks of many research teams at the work place (universities, research centers e.t.c.) are contradictory to the reduction of pilot item to practice. There are no specialists at the Research Centers and Universities able to tackle this problem.

- The R&Ds of research teams are at various completion stages starting from pilot studies to a market product. Generally, research teams have some challenges with transition process from laboratory sample to the product due to lack of funding. As these are research teams initiating work within the federal target programs then they have no business funding for product generation. The specific character of the situation is reflected in the quotes of respondents who stress the complicated nature of transitions from the pilot item to the market product:

«We are at the stage when we need to develop industrial installation. This is our main task, the display sample at least so that we could show the real installation but not the handmade product to the investor»

«We are not industrial enterprise we are not going to promote and distribute the technology. We are ready to be the partners. We are too far from the production process itself. So we need to deal with that in a more detailed and professional basis. We just solve some problems that should not be solved by scientists»

«We have a laboratory model that is a sample that we displayed as a demo installation. It can be switched on in any room and we can get nano carbon from methane balloon. To start marketing we need to make an industrial sample that is 30 kW capacity installation, 100 kW for plasma. It is capable to process hundreds of cubic meters of gas an hour but demo installation process about 20 liters a minute. We can make an industrial sample but we need funding. In theory, if Tomsk region government united the work of scientists and provide financial resources we could make a 60 kW installation that processed hundreds of cubic meters of gas an hour. The most important is that we can get 100 thousand dollars for a ton of carbon. It is a market price. Simple soot is also carbon. It costs 40 thousand rubles for a ton. SHF-plasma carbon costs 100 euro. We can get several tons from 100 cubic meters of such gas. Now we just burn this amount of gas. This is a

paradox of the modern time. We are currently trying to find an investor, organization that can co-invest these works together with the University. Generally we face up the situation when a company is ready to buy an installation but the University doesn't fund us to make it and to conduct additional research»

«We conduct research in design of specific wooden complex constructions with insulant. The constructions differ dramatically from the analogues ones. The research team has more than 10 patents. We don't have a production line. The research is funded from State programs and is to be completed in 3 years. I believe the next stage of work will be commercialisation»

The respondents also note that there are some peculiarities of the research financing by federal government: «In general the function of state contracts and federal target programs is performed only in one direction that is to purchase material infrastructure that doesn't give an opportunity to support the whole range of work which is necessary to have successful R&D».

- The following spheres were chosen as sector-specific priorities of the research teams R&Ds that could be the basis for creation of clusters for energy saving and cost-effective use of resources:

- Renewable energy sources and energy storage devices
- Heat power engineering, heat and electric networks
- Rational use of natural resources
- Water purification up to drinking standards
- Elimination (and reduction) of ecological damage
- Biodegradable materials and waste treatment
- Hydrocarbons treatment and reduction of their negative impact on the environment
- Biotechnologies for ecosystem support and restoration
- Comprehensive monitoring, prediction of environmental state and the Earth surface

The developments of research teams are segmented around the following fields:

- The key spheres for Tomsk region Administration support for improvement of research efficiency and results commercialization:

- communication with the management of corporation and small scale innovative businesses to form the order for the development as well as formulate the joint research agenda.

The respondents say about the lack of:

- strong players able to formulate the order for research and developments in the industry:

«Production connections for University-Industry can exist when an enterprise has money to invest

into R&D. I believe now there are no so many spheres where there is enough money except oil and gas industry»

- information about real needs of the industrial enterprises: «First and foremost, it is interesting and important to know what organizations and enterprises of power industry are interested in energy accumulators»

-information on the modern technological process of a company: «Generally, there is its own technological process, its own specific tasks in any company. If we implement something new, we need to do that carefully. It is necessary to explain to the management board, first and foremost, how they can benefit from that: what advantages they get and that they will not experience deterioration of the situation»

- Improvement of information awareness on corporate technology strategies and their incorporation into implementation;

«We would like that the local authorities, large corporations payed more attention to information on R&D problems that appear while implementing their strategies and formulated the rules how the research teams could join the authorities to adress the challenges»

- Problem-oriented support at each level of R&D;

Research teams have differnt points of view on the peculiarities of R&D regional support:

«All cycles of work must be funded starting from the idea and finishing with industrial sample. Tomsk region Administartion should help scientists to establish contacts with large companies to conduct pilot trials and making of industrial installation»

«Today the fundamental research is supported at the federal level. To get money for applied research and make a product is more difficult. I believe this must be the focus of Tomsk region Administartion support».

«I would like to put forward one idea: authorities should support innovation markets establishment. If there are rules that anyone can play, that is Universities, businesees and government, the R&D investment share will increase».

«I would like to see the support R&Ds from the city to stimulate R&D and to purchase new equipment to meet the needs of the city households».

- Market orientation in the early stages of scientific research;

«We started to understand something about the market as a research team when we set up our own company and sell our products for the first time. Then we conducted applied research that was in demand on the market. Many markets depend on the state that is why it is necessary to keep track on the priorities of the state. It is necessary to create a system to find out the needs of definite companies in the definite

industries to set the tasks for R&D and to make orders through federal and regional programs to the Universities. It makes possible for the research management to be aware of the situation on the market».

- Clarifying the problems of “centers” of demand for new technologies: housing and utilities infrastructure and big oil and gas companies; One of the respondents say: “There is no transparent mechanism to present research and educational range of research and technological problems and tasks of large companies to the public. The companies have the range of problems listed, e.g. 20 questions that need to be solved. The University gets this list. Usually the University rector is a person who sees it. For instance, the rector takes part in an exhibition where there are meetings with the management of the companies. Then the list comes to R&D department of the University and is handed down to the departments. For the departments to start their work they need to get additional information that is a technical task for each point on the list. But it is almost impossible to get from the company. As a result, the development process is finished at the very beginning”.
- *The respondents claim that there is also a difficulty in an interaction with other large industrial customers: « We had an order to produce 15 installations from Russian Federal Agency on Hydrometeorology and Environmental Monitoring». We have a letter from the agency that they are to purchase 15 installations. We have negotiated twice for 2 years but it is impossible to complete the order in time due to lack of finances».*
- Regional level announcement of key dates for implementation of new technologies to start new research and developments by all participants of the Triple Helix Model: regional government, businesses and Universities. The urgent need to undertake the measures is reflected in the following quotas.
 - *«The development of regional policy to announce technological transitions can create the demand for new developments and stimulate R&D. For instance, all the households in Tomsk shall have energy efficient water purification installations since 2018. 90 % of installations shall be made in Tomsk. Only «A» class energy efficient residential buildings shall be built since 2016.*
 - *«Development of municipal policy to announce technological transition stages: to form perspective (2 years ahead) announcements of the city on new technology transitions in key spheres with further formulation of technical tasks can activate R&D sector. The policy of transitions will serve as a road map for the Universities, research centers and small scale innovative enterprises to conduct strategic R&D activities»*

– All research teams work on the basis of theories and knowledge of 1950-1960s and do not use state of the art scientific theories, that results in a decrease in scientific and technological breakthroughs. One of the prominent scientist in Tomsk region assessed the state of the modern science: “ If to assess the research directions as from the point of view on modern state of science I can say it is obvious that there is no breakthrough expected in the current R&D. It is the reflection of 1950-60s science schools evolution. All the ideas are represented in the publications of 1950-60s”.

- The academic community is challenged with low level of outsourcing process. It happens because in order to construct laboratory facility research teams need specific items the production of which is an expensive and uneconomical process for small innovation enterprises at the University. Thus, all items and devices are ordered outside the region and innovation ecosystem of Tomsk region loses financial inflows.

The movement of the research team from exploratory research to research and then to development is a process that implies the increase in tasks to be outsourced. This means that the closer they are to the end-product the greater cooperation with small scale innovative enterprises in Tomsk should be.

Innovative and Innovation active companies can't fulfill the tasks outsourced by research teams (to construct facilities, to make an item e.t.c.) as they take aim to deal with mass production only. They don't benefit from manufacturing of a single item due to labour and financial expenses. Under these circumstances the research teams order equipment from other Russian and foreign suppliers. The effective tool can be in this case so called “innovation voucher”, that is given to the research teams to pay the manufacturing services needed at different stages of R&D activities.

Thus, research support from Tomsk Region government could be represented not in the form of direct financing of a project but in «R&D voucher» form that is given to the research team to get the necessary equipment, a tool or an item in a single quantity.

- One of the key local institutions in Tomsk region innovation system research teams chose universities and scientific organizations. Research teams believe it is necessary to create new institutions that could boost the efficiency of scientific research, their results of commercialization and generation of regional innovation cluster, such as:

- demonstration center of energy saving and effective use of resources technologies;

The functions performed by the Center are as follows: to establish communication between all the participants of Triple Helix model, to trigger the projects investments and casting of research teams to develop technology needed, to establish the regular show floor to demonstrate the R&D results, to attract companies and research teams to demonstrate their developments

- Establishment of Specialised Technology Transfer Centers at the Universities. «General» Technology Transfer Centers that are currently operating at the Universities are not effective at a new stage as they seek for the end- product developments in all areas of research. The respondents named the features of new model for Technology Transfer Centers to operate and necessary steps that need to be taken to change the old model into the new one.
 - to start work with the developments under study instead of work with ready to be manufactured items to correct the current developments and reduce them to practice that is in real demand by the definite enterprises with definite conditions of production (establishment of connection between businesses and Universities/Research centres);
 - to start work with a definite research field instead of work with all of them (to recruit specialists in definite science fields to enhance the quality and efficiency of developments commercialization);
 - To start financing of Technology Transfer Centers according to the business model instead of regional and University budget financing. The business model is as follows: financing is provided by a customer, research teams and companies' contributions (selling of patents and licenses), that occur due to successful commercialisation of developments.
- association that unites scientists, small innovation enterprises, and representatives of big companies to establish negotiation floor and stimulate the commercialization of research outcomes in “energy efficiency and energy conservation” and “cost-effective use of resources and environmental protection”. One of the necessary functions of such associations is to formulate the joint research agenda for the enterprises and Universities.

CONCLUSIONS

The first stage of generation of regional innovation cluster is determined by all the participants of the Triple Helix of development priorities for science and technology and inventory of science state in these directions. The work on research and inventory provides an opportunity to determine what local key institutions to build and what regional clusters should be created together with the existing ones and to come up with their functions.

New local key institutions to build and accelerate regional clusters should be established while taking into consideration the situation assessment by all the participants of Triple Helix Model:

- Universities;
- businesses;
- government.

New local key institutions to build and accelerate regional clusters should be established for the definite research direction because each direction has different conditions:

- research and commercialisation of their results depend on specific character of the scientific knowledge;
- interaction of Universities, businesses and government;
- good relationships among all the participants of Triple Helix Model.

For Tomsk region the new local key institutions are the Center of R&D results display, specialized Technology Transfer Centers and the association. The Administration of Tomsk region establish the Center in order to maintain the interconnection between universities, business and the Administration of the region. The Association is to create the meeting point between the participants of the Triple Helix to boost the commercialization of R&D results, to create new SMEs and high-technology jobs.

IMPLICATIONS FOR BUSINESS MANAGEMENT OR POLICY

According to the Research results, the recommendations for innovation policy might be as follows:

- Development of methodology for regional inventory of science state in order to determine new local key institutions and their functions for generation and development of regional innovation clusters in the Triple Helix model.

References

1. Triple Helix: University, Industry Government Innovation in Action (Routledge, 2008).
2. Report of project group "Creating clusters for energy saving and cost-effective use of resources in Tomsk region", December 2012.
3. Henry Etzkowitz, Marina Ranga, "A Triple Helix System for Knowledge-based Regional Development: From "Spheres" to "Spaces".