Vladimir N. Leitsin
Maria A. Dmitriyeva

ON THE PROSPECTS OF COOPERATION BETWEEN RUSSIAN AND LITHUANIAN INNOVATIVE SECTORS

From the perspective of the modern system of domestic relations facilitating the development of research and industrial potential of the country and aimed at creating the conditions for the development of science intensive industries, which extract a high surplus value, the authors consider the research and education and innovation sectors of the Republic of Lithuania – the closest neighbour of the Russian Federation in the North-West region. The analysis of competences of Lithuanian research and education sectors helped identify promising research and technology development areas in terms of innovation cooperation between the Russian Federation and the Republic of Lithuania.

Key words: national innovation system, universities, industrial and technological parks.

The development of interaction of the institutional structure of modernization of the Russian Federation with the innovation system of the Republic of Lithuania is very promising due to its traditionally well-developed higher education sector with a strong academic tradition in the field of scientific and technological research, a relatively high proportion of the population with higher education and knowledge of Russian and English, motivation of the young generation to get higher education. International experience shows that the properly working network of institutions to support innovation infrastructure is as important as financial incentives.

Development of innovative areas in Lithuania faces a universal problem of converting innovations into the end product so as to provide for strengthening links between science and business sectors to facilitate economic growth and increase in knowledge. According to the resolution of the Government of the Republic of Lithuania dated February 17, 2010 №163, the current situation in the country's innovation sector is as follows [1].

1. Innovation can assist to overcome the economic crisis and promote economic recovery. New products, technologies, processes, business models and organizational structures will improve the competitiveness of enterprises in the domestic and external markets.

2. The structure of the Lithuanian economy is outdated. The share of added value provided by agriculture is higher than in most other EU countries. The share of services in the economy is just over 60% of gross domestic product (GDP), while the EU average is over 70% of GDP.

3. Exports of Lithuanian goods and services has increased in recent years (in 2006 was 48.8 billion litas in 2007—53.3 billion litas, while in 2008 — LTL 66.9 billion). The share of exports in sectors with advanced and moderately advanced technologies remains below average for the EU.

According to the Statistical Office of the European Commission (Eurostat), in 2006 the share of exports produced within these sectors was 33.1 %, while the EU average was 48.1 %. The share of high technology services accounts for only 13.8 % of the export services (the EU average — 48.7 %).

4. Lithuania lags behind most EU Member States on labor productivity. According to Eurostat, the added value in Lithuanian economy, created in one working hour increases every year, but in 2008 it amounted to only 61.5 % of the EU average. Low levels of added value are partly determined by the low development of the sector of advanced and moderately advanced technologies.

According to the European Innovation Scoreboard for 2008, the total Lithuanian Summary Innovation Index (SII) is 0.29, whereas the average SII for the EU-27 has a value of 0.47. In terms of SII indicator, Lithuania is ahead of only Romania, Latvia and Bulgaria. Such lagging behind might result from insufficient financial support to R&D sector (in 2007 it received 0.82 % of Lithuanian GDP while in the EU — 1.85 %).

Recent developments in innovation policy indicated a desire of the Government of Lithuania to improve its coordination and implementation. Existed Lithuanian Governmental Commission on Science and Technology and the Commission of Education and Science which existed prior to Lithuanian accession to the European Union were integrated into one. The Commission on Science, Technology and Innovation was created in spring of 2005. Lithuania's accession to the EU in May 2004 made it possible to double funds available for innovation.

A number of measures aimed at strengthening the infrastructure of innovation support and institutional development, improvement of cooperation between R & D and business sectors in innovation development, enhancing the quality of human resources for R & D and innovation, and strengthening public and private research institutions. Preparation of Lithuania to participate in the Seventh Framework program led to a discussion of priorities for science at a high level, and this fact emphasizes the importance of R & D improving for the national economy [2].

In order to encourage private investment in science and innovation, the Seimas adopted the Law on Amendments to the Income Tax Act in the Republic of Lithuania of April 10, 2008, which allows businesses to reduce their taxes through spending on research. The new law stipulated that enterprises that invest in technological renovation became able to reduce their taxable income to 50 %. Since 2008, when the Research Council of Lithuania was reformed and legitimized as a provider of research programs fund, the principle of competitive research financing became applicable.

Research and education sector in Lithuania

The higher education system of Lithuania is represented by the universities of classical type, as well as polytechnics and profile universities. According to the Statistical Office of the Government of the Republic of Lithuania, in 2007 18 500 employees, 6,300 of whom had scientific degree, were engaged in research activities. As for the number of such employees Lithuania is not far behind the EU average (according to the Eurostat, in

2007 there were 11.5 research positions for 1, 000 new jobs in Lithuania and 14.6 in the EU). In 2007, the majority of Lithuanian researchers were engaged in higher education and public institutions, and only 13.7 % — in business. In the EU, at the same time, their share was 42.3 % on average.

Vilnius University is a member of the European Association of Universities (EUA) and the Conference of Rectors of the Baltic universities. Since 1998, this university has been a member of the Utrecht Network, which brings together 33 Western and Central European universities.

These are the main areas of research in the University of Vilnius [3]:

— *biomedicine and biotechnology*: projects are aimed at developing new medicines, improving diagnostics methodology, genetic research, improving the quality of life;

— *material studies and technologies in physics and chemistry:* projects designed to create ultra-thin conductive ceramic nets, electrical ceramics of nanopowders, the development of laser technology, the creation of new ceramic and layered coatings, membranes, development of new optical methods and devices for nondestructive control, nanotechnologies (in 2001—2004 a lot of such work was funded by the NATO);

— *engineering and information technology*: the majority of projects connected with security, creating databases, inter-disciplinary networks, e-government, intellectual signal processing, e-learning via the Internet.

Many projects focus on the science and society cooperation, social governance, healthcare issues, integration of Lithuania into the EU, various legal aspects of the innovation implementation.

Recent years have seen a decrease in the number of papers relating to the natural resources and agriculture; the major projects in this area refer to global climate change and the Baltic Sea research.

Currently, the ***Vilnius State Technical University*** is a home for 11 research institutes, 4 research centers, and 23 scientific research laboratories. By 2009 VSTU had been a national leader in the innovation process [4]: University staff got 11 patents on a method for measuring heavy metal concentrations in tree year rings; increase in hardiness and sustainability of porous ceramics; automatic hydraulic and pneumatic system of fire fighting; filter-grassy ditch; a method and apparatus for determining the degree of tightening of threaded connections; device for soil rehabilitation; biofilter, the method of calibration devices to control the accuracy of the alignment positions of the barometer; mechanism of a flat belt, the bioreactor.

The main research areas in VSTU are the following [4]:

— research, development and use of construction materials and technologies;

— development and application of information technologies, statistical analysis and methods for simulation of physical processes;

— development of cooperation between the socio-economic, cultural and technological processes;

— experimental and theoretical studies of eco-systems and the development of technologies for environmental protection;

— research, development and artistic creativity in architecture, urban planning and cultural heritage;

— development strategy of the transport system and research in the field of transport technology;

— research, development and application of technologies of geodesy and cartography and the methods of measurement of physical quantities;

— design, improvement and optimization of electrical and electronic equipment and systems;

— research, development and improvement of mechanical, mechatronic and biomechatronic materials, systems and technological processes;

— research and development of energy efficiency strategies and their application models, processes and systems;

— studies in spatial planning and its sustainability evaluation.

According to the framework of the development of transport system and logistics, Vilnius State Technical University created the Lithuanian Centre of Excellence in the field of intermodal transfer and logistics. Priority areas of its research are transport policy, the development of intermodal transport networks and innovative intermodal technologies, modeling intermodal transportation, the development of urban mobility and urban freight transport.

Of the six universities and academies, located in Kaunas**,** ***Kaunas University of Technology*** (KTU) been a leader of academic life in Lithuania. KTU — the largest technological university in the Baltic countries (Lithuania, Latvia and Estonia). It is a home for successful development of electronics, information technology, mechatronics, economics and social sciences [5]. Joint laboratory of the International Research Centre and the Institute of Physical Electronics and the laboratory of micro-and macro-dynamic systems are functioning there. The laboratory has all necessary equipment for laser holography, atomic power microscope, test boards for polymeric materials, for dynamic systems and for studies of active suspensions. These are the main research areas of KTU:

— study of micromechanical systems;

— modeling and dynamics of mechanical systems;

— study of vibration cutting;

— mechanical testing of materials;

— study of orthogonal cut for testing dynamic properties of materials;

— theoretical and experimental studies of vibro-insulating structures;

— determination of the optical characteristics of diffraction optical elements.

Particular attention is paid to the study of micro-motors and microrelays. The University carries out research work to develop adapting systems which are flexible and responsive to changes in environmental parameters. Together with the laboratory of the International Research Centre and the Institute of Physical Electronics they study the optical characteristics of optical diffraction polymer. An optical method of laser control of frequency the polymeric microstructure is elaborated.

Klaipeda University is an autonomous public scientific and educational institution in the Republic of Lithuania [6]. The leading research areas here are the following:

— marine environmental research and marine transport;

— hydrology and oceanography;
— port of technology and equipment;
— history and language of Lithuania and the Baltic sea region;
— environmental engineering, landscape architecture;
— underwater archeology, recreation and tourism;
— social geography.

The Baltic Institute for Coastal Research and Planning of Klaipeda University leads vigorous research activity.

The main areas of its research activity is "interdisciplinary research in sustainable coastal zone management", which includes analysis and forecast of changes in the marine environment; elaborating scientific background for sustainable management of coastal resources, systemic analysis and environmental modeling, functional analysis of the coastal zone; use of resources of the Baltic sea, risk assessment of oil spills and hazardous substances in the Baltic sea.

Šiauliai University is a classical educational institution [7]. The university has several research centers in: biomedical engineering, dialectology, educational research, energy and environmentally friendly technologies, social studies, special education, simulation of physical processes, public health and gender studies.

Scientific activities of the *Center of Biological Research* are focused on histology, physiology, and molecular and applied animal genetics.

The main objectives of the *Research Center of Energy and Environmentally Friendly technologies* presuppose participation in national and international projects in energy efficiency, alternative energy sources and environmental protection, raising environmental awareness in society, introduction of new information on environmental studies into the curricula on all possible levels.

Research interests of Biomedical Engineering Center lie in elaborating, testing and enhancing the systems of computer communication for people with disabilities, human ophthalmic system, image processing.

Areas of Special Scientific Research and Education Center focus on study of disability, theoretical and applied research in the social integration; education and study of social activity.

Kaunas University of Vytautas Magnus has solid experience in international research. Since2008 28 research groups have been convened with the aim of integrating research activities in various fields. Academic and research clusters have been formed:

— In the field of biomedicine and physics (application of innovative technologies in the study of climate change, danger of environmental pollution for public health, etc.);
— In humanities (applied research in international communication and translation, etc.);
— In the social sciences (study of multicultural and language change in the context of globalization, the European space: politics, communication, discourse, etc.) [8].

The University has the following research clusters:

— *Biomedicine and physics*, where basic research areas are: biophysics for bionanotechnology and biomedicine, the impact of anthropogenic

environmental change on ecosystems; harmonious hybrid power, innovative technologies for the research of health risks posed by climate change and environmental pollution, the development of analysis methods and their application to molecular analysis of biological objects, synthetic products and environment, analysis of systems of modeling, control and optimization, biomedical systems, methods of security, reliability and risk;

— *Humanities* — research into relations between the church, government and society on Lithuania; the multilingual development of competence; the theory of war, history of the Lithuanian Army and heritage of war; identity of Lithuanian art history and cultural heritage; applied research of intercultural communication and translation; cross-cultural exchange in Central and Eastern Europe: global problems and local experience; study of human relations in the context of bioethics.

— *Social sciences*, which conduct research in the areas of: psychological functioning, individual and psychological abilities, improving them in education and healthcare institutions; multiculturalism and change the language in the context of globalization, the impact of globalization on laws.

Lithuanian Academy of Sciences (LAS) is a budgetary institution, which brings together Lithuanian and foreign researchers, whose academic activities are related to Lithuania. LAN stands as an independent expert and consultant in the field of research and higher education, culture, social development, economy, environmental protection, healthcare, technology, etc. It also initiates a comprehensive interdisciplinary research [9]. The structure of the Lithuanian Academy of Sciences includes five research sub-units:

— *Department of Humanities and Social Sciences*, which conducts research in the Lithuanian language, literature, history of Lithuania, philosophy and sociology, focuses on problems of national economy and social structure, art, laws, and the prospects for evolution;

— *Department of Mathematics, Physics and Chemistry*, which conducts research in the problem of the theory of relativity, mathematical logic, semiconductor and laser physics, theoretical physics and astronomy, electrochemistry and chemical technology;

— *Department of Biology, Medical Sciences and Earth Sciences*, which does research in experimental and molecular biology, biochemistry, genetics, immunology, biotechnology and ecology, as well as some areas of medicine, such as cardiology, surgery, allergology, pharmacology, pediatrics. The Department coordinates the activities of the experts in the Earth Sciences (geology, geography, oceanography, geodesy and cartography, geo-mathematics);

— *Department of Agricultural and Forestry*, whose activities are aimed at topical issues in agriculture and forestry (agriculture, forestry, animal husbandry, veterinary, engineering ecology, food safety, agrarian economy and rural sociology). The department cooperates with experts in other fields of study;

— *Department of Engineering* conducts research in electronics, information technology, energy, mechanics, materials technology,

construction and transport. Departmental staff takes an active part in solving national economy issues and developing high-tech strategies and projects.

Creating **techno-parks and industrial parks** attracts foreign investors and the financial assistance of EU funds to Lithuania to solve social and economic problems [10]. Techno-parks tend to university towns. In Vilnius a techno- park "Northern Town" has been functioning for several years. In 2007, the country's three largest university — Vilnius, Kaunas and Klaipeda — announced the creation of parks, calling them respectively the Silicon Valley, Kaunas Technology Park and the Marine tehnopolis. Parks, receiving some benefits from the city, are developing mainly due to EU grants.

In 2003 the Panevezys Mechatronics center was established, a modern laboratory where students can carry out some practical work and specialists in the field of mechanics can raise their qualification (hydraulics, pneumatics, etc.). Today, the center develops such areas as nanotechnology, technics of microsystems and material research.

Klaipeda Science and Technology Park (KNTP) carries out intensive project activities that promote entrepreneurial character, actively works in the fields of technology transfer and transport development. Klaipeda Science and Technology Park implemented several projects: "The provision of support services to SMEs of high and medium technologies in Klaipeda", "Regional development of innovation sector in the information and communication technologies (IKT)», «Baltic innovative bridge — strengthening technological cooperation in Gdynia and Klaipeda","Innovative Solutions for Business" and others [11].

Kaunas park of high-tech and information technologies was established by the Ministry of Economy, Kaunas technological University, University of Vytautas the Great and the Lithuanian Energy Institute. Kaunas Technology Park hosts 10 companies specializing in IT, automation, and alternative energy.

Visoryaysky park of information technologies (VPIT) resulted from cooperation between research and educational institutions, national government and municipalities and the IT-companies. At present it employs more than 700 IT-professionals [12]. Development program of Visoryaysko-go industrial park includes the Center of research and technologies using solar energy [13].

Examples of successful implementation of program of innovative development in Lithuania can be found in effectively operating ***innovative businesses*** in the following areas.

• *Biotechnology*. JSC «Profarma» manufactures biological products and new therapeutic proteins used to treat infectious diseases. The company has developed innovative technology for the modification of therapeutic proteins and extending their half-disintegration time in the plasma, the production of drugs for gynecological infections [14].

JSC «SICOR Biotech» is a producer of biotechnological drugs. The company is the only one in Central and Eastern Europe, which is engaged in developing and manufacturing innovative recombinant biopharmaceuticals substances. Company contributes to the development of biotechnology, genetic engineering and other research fields in Lithuanian universities [15].

Laser and optical technologies. «Ekspla» is a developer, manufacturer and supplier of pulsed solid-state lasers, laser systems, and sources of power, cooling, and various supplementary devices. At present «Ekspla» supplies more than half of picosecond lasers to the world markets [15].

«Šviesos konversija» is a leading global developer and manufacturer of continuous-wave source, tunable superfast light sources based on a series of TOPAS-optical parametric frequency amplifiers and mixers.

«Geola Digital» is one of the world's leading companies in the field of holographic and laser images of high quality. The company manufactures equipment for digital and analog holography, and distributes photographic supplies for holography and spectral records worldwide [15].

«Eksma optics» is a manufacturer and global supplier of precision optical components, crystals, and the mechanisms used in the lasers, laser and photonics laboratories [16].

«Standa. P. O. BOX» was established in 1987 as a research and production company. It develops and produces cell optical tables, vibration protecttion systems, optics holders, positioners for optics, positioners of linear and rotational movement, motorized positioners and controllers for PCs, and precise micrometer screws; optical crystals; solid-bdied lasers [17].

Mechatronics. «Medelkom» develops and manufactures ultrasound diagnostic scanners for various fields of medicine (more than 10 models), portable ultra sound scanners for veterinary ultrasound transducers (over 50 types), equipment for video-colposcopy. While producing ultrasonic transducers, some unique technological processes were elaborated: precision cutting of pezoceramics, high precision photochemistry and galvanics, organic chemistry, precision assembly, inspection and adjustment of electrical parameters; assessment [18].

JSC «Viltechmeda» is engaged in the production of infusion syringes meant for intravenous injections of drugs [15].

JSC «Elinta» coordinates the activities of groups of companies, carries out scientific research, organizes personnel training and also performs other activities necessary for a company holding functioning. «Elinta» group of companies specializes in industrial automation, automatic and measuring devices trade; production of computer surveillance systems; car electronics repair [19].

• *Electronics*. JSC «Elga» is the largest manufacturer of electric distribution devices in the Baltic Sea countries. Trying to guarantee high quality of manufactured goods and their compliance with the international standards, the company is constantly introducing new technologies in design and production. JSC «Elga» produces the electric distribution devises of low voltage (0.4 kV) — for any from the input distribution devices to the smallest switchboards. Module distribution system SĮ-04 allows you to quickly change the configuration of the production: input distribution cells, switchboards, capacitor banks, motor control centers, bus bridges, transit cable boxes, etc. [20].

JSC «Elektroninės technologijos» is engaged in designing and manufacturing electronic equipment for special purposes, software design for the single-crystal microcontrollers [21].

JSC «Elgama-Elektronika» is a company with more than 15-year experience in designing and manufacturing electronic meters and the most advanced in this area in the Baltic Sea region. In addition, the company develops, manufactures devices and systems for measurement, control, energy management and data collection [15].

JSC «Lietkabelis» is one of the leading manufacturers of various cables and wires among the Baltic countries. The company produces various copper and aluminum electric wires and cables proguides and cables, connectors, cables and wires for electric equipment, automotive cables, cables for data communications and telecommunications, cable for various applications [15].

«Elmika» is engaged in research and elaboration of electronic measuring instruments, components and systems for devices operating at ultra-high frequencies, millimeter and submillimeter (THz) wave frequencies, including signal generators, scalar and vector electric network analyzers, power meters [22].

JSC «Geozondas» is a developer and manufacturer of digital oscillographs, microwave measuring systems, navigation systems (GPRS) and other electronic measuring devices for various applications. «Geozondas» is actively involved into research, development and manufacture of ultra-wideband measuring instruments and systems based on the generation and measurement of electrical pulses of picosecond and subnanosecond length, as well as applications for solving the problems both in civil and military field [23].

JSC «Elsis PRO» deals with developing, implementing, maintaining and improving the commissioned software and information systems. The company operates in the sectors of high technologies, communications, electronics, energy, defense and security, military infrastructure, transport, digital TV. It is the major provider of defense electronics for the Ministry of Defense and Armed Forces of Lithuania. Software developed in Lithuania, is used in telecommunication companies, banks, ministries of finance, defense, internal affairs, foreign affairs, economy, many commercial and government enterprises [15].

SC «Precizika Metrology» produces world-known meters. The company pays great attention to innovation projects, research, optimization of Industrial processes, as well as personnel re-training. It works actively with universities and research institutes.

The main activities of *JSC «Lumen»* are research and developing, manufacturing and sale of electronic devices for the dentistry. The company is known for a tool which employed new electronic technology and enables to measure the length of the tooth channel with precision up to 0.1 mm.

• *Chemicals and chemical products.* JSC«Achema» is a leading producer of nitrogen fertilizers and chemical products in Lithuania and the Baltic countries. The company produces of nitrogenous and mixed fertilizers, liquid fertilizers, ammonia, nitric acid, methanol, formaldehyde, urea formaldehyde resins, polyvinyl acetate dispersions, industrial gases (N2, O2, CO2), water-based paints.

• JSC «Amilina» applies new innovative technologies to wheat processing (the so-called "wet" processing of grain). Wheat grains are milled and fractionated into starch and gluten, later sold to paper and food

producers. Byproducts of "wet" method of processing are mixed with wheat bran, dried, and produced into animal food and granular biofuels [15].

• Company BIOK is the first and largest Lithuanian cosmetics producer. The company specializes in the production of facial and body creams, shampoos, shower gels and deodorants. The company was awarded the prize for the most innovative product launched in 2007.

JSC «Mestilla» is a producer of the methyl ether, which has one of Europe's most modern plants for rapeseed processing into environmentally clean biodiesel fuel (in Klaipeda Free Economic Zone).

The perspectives of research and scientific cooperation between Russia and Lithuania

The competences of the research and academic sector of Lithuania can be demonstrated by reviewed publications on main scientific achievements, which are announced on the official websites of the above-mentioned organizations. Analysis of the main research areas of universities and institutes, as well as announced scientific publications of leading Lithuanian scientists [24—51] showed that the following areas of technological development of Lithuania can be promising in terms of cooperation in innovative field:

• Sectors of biotechnology, laser technology, electric energy production, optical equipment manufacturing;

• Sector of transport and logistics services;

• Sector of the research of the Baltic Sea and its coastal zones;

• Lithuanian processing industry (food processing, wood processing and furniture manufacturing, textiles, petrochemical and chemical production, production of fertilizers and chemical fibers).

An important aspect is a positive Lithuanian experience in engaging the private businesses into the sector of innovations. It supports high-tech industries such as laser technologies, biotechnologies, information and communication systems.

Within the frameworks of an innovative development strategy of Lithuania [1] it was accepted to pay more attention to the following new promising areas of economy: environmentally friendly technology, healthcare (pharmacies, medical and health services, health and recreation equipment, environmentally safe agricultural and food products, etc.). These promising areas prove similarity of strategic interest of development economic innovative sectors of the economy in Russia and Lithuania.

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About authors

Prof. Vladimir N. Leitsin, Head of the Innovation Park, Immanuel Kant Baltic Federal University.

E-mail: leitsin@mail. ru

Prof. Maria A. Dmitriyeva, Head of the Department of Modelling, “Region” research and education centre, Social Science and Humanities Park, Immanuel Kant Baltic Federal University.

E-mail: dmitrieva_m@inbox. ru