Development of Science at the Faculty of Transport Engineering in Vilnius Gediminas Technical University

Vilius Bartulis\textsuperscript{a,}\textsuperscript{*}, Nijolė Batarliene\textsuperscript{b}, Darius Bazaras\textsuperscript{b}, Marijonas Bogdevičius\textsuperscript{b}

\textsuperscript{a}Vilnius Gediminas Technical University, J. Basanavičiaus g. 28, LT-03224 Vilnius, Lithuania
\textsuperscript{b}Vilnius Gediminas Technical University, Plytinės g. 27, LT-10105 Vilnius, Lithuania

Abstract

The aim of this paper is to review the research activity at the Faculty of Transport Engineering in Vilnius Gediminas Technical University in various aspects: science priorities, doctoral studies, publications, collaboration with other countries. The results of this review are the recommendations for improving the existing science base at the faculty.

© 2016 The Authors. Published by Elsevier Ltd.
Peer-review under responsibility of the organizing committee of Transbaltica 2015.

Keywords: science; research activity; doctoral students; publications.

1. Introduction

The mission of higher education and research is to help ensure the country’s public, cultural and economic prosperity, provide support and impetus for a full life of every citizen of the Republic of Lithuania, and satisfy the natural thirst for knowledge. The Lithuanian policy on higher education and research guarantees the quality of higher education and research, the equal access to higher education for all citizens and favourable conditions for the best of them to conduct their research, and to seek academic and creative perfection; the said policy ensures that the system of higher education and research satisfies the demands of society and the economy, supports its openness and integration in the international sphere of higher education and research.

* Corresponding author

E-mail address: vilius.bartulis@vgtu.lt
2. Evaluation of science at the Faculty of Transport Engineering

After the re-establishment of Lithuania’s independence, the strengthening of the country’s economy has led to an emergence of Lithuanian transport sector as a relevant factor in the development of economic foundations of the state. Rise of a new transport system provided an impulse for preparation of highly qualified air and rail transport specialists. Therefore, new study programmes have been established along with the basis for its proper implementation. The Department of Transport Machinery of the then Vilnius Technical University introduced Aviation Mechanics, Rail Transport Machinery and Economics study programmes; teachers of these areas were accepted. All this led to an establishment of Aviation Institute; Rail Transport Department in 1994, and consequently, Faculty of Transport Engineering along with four specialized Departments. This is the way in which the material basis of scientific research in the area of land transport and growing team of researchers emerged and developed. Geographical location, the crossing of II and IX corridors contributed to entitle Lithuania as a transit country. The demand for transport specialists increased; little formerly known term ‘logistics’ emerged so as new research areas and topics.

Researchers of the Faculty substantially contributed to transformation of large local regional system into an independent, complex and modern transport system capable of integrating successfully not only into Eastern, but also Western transport systems. The concepts of international transportation policy and integration into international markets as well as development plan for multimodal transport in Lithuania were formulated. Recommendations for improvement of Lithuanian road network and transport infrastructure were provided; the concept of public passenger transport mode interaction was formulated. In 2000, Prof. Habil. Dr. Adolfas Baublys and Prof. Habil. Dr. Ramūnas Palšaitis received Lithuanian Science Prize established by Lithuanian Academy of Sciences. This prize was awarded to the VGTU scientists for the scientific work cycle “Formation Strategy of Lithuanian Transport System: Theoretical and Methodological Aspects” (1988–1999).

In 2006, Prof. Habil. Dr. Bronislovas Spruogis received the WIPO famous inventor's certificate and a gold medal for contribution to Lithuanian technological culture and the development of the intellectual property system.

3. Research areas and priorities

Research areas at VGTU Faculty of Transport Engineering remain unchanged over the course of time:

- Improvement of road vehicle maintenance for saving resources and diminishing harmful impact on the environment; reliability of road vehicles; road traffic safety; automobile dynamics and technical expertise.
- Improvement of railroad rolling stock maintenance, efficient use of resources; traffic safety and environment protection.
- Research on processes of the hoisting machines, transport technological equipment and systems, pipeline transportation, modelling of transport traffic flows, road pavement manufacturing technologies and improvement of quality control methods.
- Transport policy, logistics, improvement of passenger and freight transportation technologies.

In 2013, the aforementioned areas of research were revised in accordance with an ongoing research in the area of Sustainable Transport carried out at all subdivisions at University:

- Energy saving and environment-friendly transport means;
- Transport systems and traffic modelling, optimization, safety and management;
- Transport and logistics technology, interaction of transport modes;
- The new movement technologies, intelligent transport systems.

Scientists of the Faculty of Transport Engineering specialize in all mentioned topics. This is evidenced by publications, topics of PhD dissertations and projects:

- Research methods and application of vehicle traffic flow dynamic processes by identifying traffic conditions and pollution of the environment;
- Research on rolling-stock dynamic processes by identifying traffic conditions and accident causation;
- Theoretical and experimental research, development and improvement of alternative fuel experimental methodology, experimental data sampling and analysis, evaluation of the proposed alternative fuel efficiency, preparation of recommendations for business entities;
• Development and application of innovative research methods on improvement and energy consumption reduction of railway rolling stock operating parameters;
• “Numerical program and research of the geothermal loops thermo hydrodynamic processes”. Project of the Research Council of Lithuania, No. MIP-12516. (Department of Transport Technological Equipment and Klaipėda University).

4. Research projects

The most relevant research projects with other institutions in Lithuania and abroad are the following:

1. In Transport Engineering field:
• Intelligent, Dynamic Tyre Monitoring System to Use Synergy Effects for Sustainable Mobility (DTYRE). Joint project with Ilmenau University (Germany). 2011–2012.
• Bridging East West for Aerospace Research (BeAware). Project was funded under F7P and aiming to bridge partners with a focus on collaborations among SMEs, large companies, and research organizations in Western and Eastern Europe.

2. In Logistics and Transport Management field:
• BSR TransGovernance – the support of government structures at various levels in the implementation of 11th priority area (Transport) of the EU strategy in the Baltic Sea Region. Region Blekinge, Sweden.

National Integrated programme “Development of Civil Engineering Sector and Transport” is designed for renewal of scientific equipment for fundamental and scientific research and extension of the knowledge in the field of Transport Engineering Research. National Integrated programme “Development of Civil Engineering Sector and Transport” comprises the following projects:

• “Research methods and application of vehicle traffic flow dynamic processes by identifying traffic conditions and pollution of the environment”. (Infrastructure development project “Renewal and development of Transport and Civil Engineering Higher Education Studies and R&D Infrastructure” (TRANCIV-R&D)), Department of Transport Technological Equipment.
• “Research on rolling-stock dynamic processes by identifying traffic conditions and accident causation”. (Infrastructure development project “Renewal and development of Transport and Civil Engineering Higher Education Studies and R&D Infrastructure” (TRANCIV-R&D)), Department of Transport Technological Equipment.
• “Development and application of innovative research methods on improvement and energy consumption reduction of railway rolling stock operating parameters”. (Infrastructure development project „Renewal and development of Transport and Civil Engineering Higher Education Studies and R&D Infrastructure” (TRANCIV-R&D)), Department of Railway Transport.
• “Optimization of internal combustion engines while using alternative fuel blends”. (Infrastructure development project „Renewal and development of Transport and Civil Engineering Higher Education Studies and R&D Infrastructure” (TRANCIV-R&D)), Department of Automobile Transport.

In 2013, Scientists of the Faculty of Transport Engineering, Ministry of Transport and Communications of the Republic of Lithuania, Kaunas University of Technology and Klaipėda University submitted proposal for preparation of National Transport Research Programme “Establishment and Development of Competitive and Safe Transport and Logistics System”, which was evaluated among 8 (out of 30) proposals by the Research Council of Lithuania. In 2008, the Ministry of Education and Science organized a call to prepare feasibility studies, involving preparation of highly-skilled professionals, implementation of research and experimental development activities,
strengthening of science and business relationship and in this way forming the basis for the development of R&D susceptible business subsectors. “Transport” was one of the 4 feasibility studies submitted to the Ministry of Education and Science.

It is therefore important, that the Science of Transport Engineering would integrate into European Transport Research Centres, practice. International Logistics – one of the continuous activity areas, which can be characterized by strong internal relations and wide geography. The majority of the consumers within developed countries consider the improvement of International Logistics as a very important process.

The transport and logistics sector represents 12% of Europe’s GDP and forms a vital component of the economy. The European Technology Platform on Logistics, ALICE, was officially launched in Brussels on 11 June 2013. The Platform is set-up to develop a comprehensive strategy for research, innovation and market deployment of logistics and supply chain management innovation in Europe. The platform will support the EU Program for research: Horizon 2020, where Lithuanian scientists are taking part. The objective is to work towards a 30% improvement of logistics performance by 2030, i.e. to accelerate the deployment of more efficient, competitive and sustainable supply chains.

Ongoing Projects at the Department of Logistics and Transport Management:

• BSR TransGovernance – the support of government structures at various levels in the implementation of 11th priority area (Transport) of the EU strategy in the Baltic Sea Region.

The Faculty of Transport Engineering is currently participating in the activities of Smart Specialization in Lithuania programme (Transport and Logistics Sector).

The Scientific Research and Innovation programme HORIZON 2020 provides funding to address the following challenges:

• Health, Demographic Change and Wellbeing;
• Food Security, Sustainable Agriculture and Forestry, Marine, Maritime and Inland Water Research and the Bioeconomy;
• Secure, Clean and Efficient Energy;
• Smart, Green and Integrated Transport.

The overall goal of Scientific Research and Innovation programme HORIZON 2020 is sustainable development. Scientists of our Faculty are determined to work in this project.

The strategic transport solutions require specialists with exceptional knowledge of transport means, theoretical and constructive principles of handling and storage, interaction of road and environment, technical maintenance, traffic safety and transportation organization, information technology, management, logistics; specialists, who are capable of analysing, developing and improving transport means and technological equipment.

5. Doctoral studies

The teaching staff at the Faculty of Transport Engineering carry out studies in the field of Transport Engineering; specialize in preparation of young scientists at second and third level studies. Bright youngsters can bring new ideas. VGTU implements joint doctoral studies in the field of Transport Engineering in partnership with Klaipėda University and Aleksandras Stulginskis University. The dynamics of defended Doctoral Theses (2005–2014) are shown in Figure 1.

The Doctoral Committee is supplemented with experts from other countries (Ukraine, Latvia, Hungary, Poland, Switzerland, etc.). Young doctors win prestigious postdoctoral fellowships. Dr. Aurimas Vilkelis has been awarded with postdoctoral fellowship in Zurich University of Technology. Dr. Aurimas Vilkelis continues to develop his scientific activities and adapts the results of the research to Swiss Transport System. In order to expand the research geography and strengthen the process of joint doctoral studies in the field of Transport Engineering, PhD students conduct scientific research at the laboratories of foreign universities. Very intense scientific and social relations are established with Polish Universities and Research Centres (Warsaw University of Technology, Military University of Technology (MUT), Industrial Institute for Motoring (PIMOT), Motor Transport Institute), Budapest University
of Technology and Economics (Hungary), National Aviation University (Ukraine), Riga Technical University (Latvia), Ilmenau University of Technology (Germany), Zurich University of Technology (Switzerland) and other foreign universities. In the research field of Transport Engineering the collaboration between the universities of the Republic of Kazakhstan, Slovakia, the Czech Republic, Byelorussia and the Republic of Lithuania is being established. International cooperation should improve the quality of scientific research and collaboration in addressing relevant problems of transport.

6. Publications of research production


In 2008, the Ministry of Education and Science approved a formal assessment methodology for research production. New levels and types of research production were introduced in the Humanities and Social Sciences; the importance of articles to be published in scientific journals with high citation indices increased; the importance of articles to be published in ISI Web of Science within Physical and Technological Sciences has reduced. Our scientific journal “Transport” have been added to the aforementioned database and in 2009 articles received citation indices. As the publication categories have changed, it is therefore difficult to compare output of printed research production at different periods, thus here we present results of the last few years. Figure 2 indicates re-calculated dynamics of scientific publications in accordance with recognition categories.

![Graph](image-url)
Despite of the fact that scientific conferences are quoted very little in the assessment of researcher's qualifications, in recent years the printed conference proceedings are dominant. Our researchers began to participate more actively in foreign and Lithuanian scientific conferences. Figure 3 shows the absolute alteration number of the most valued publications – collection of peer-reviewed articles in ISI Proceedings database (2007–2014).

This indicator depends not only on researchers. As practice shows, the article published in the same journal may not receive the citation index in the following year as the journal may be removed from the citation list for multiple factors. The substantial uplift in 2009 appeared due to the newly added journal in the citation list which previously have lost its citation. Nevertheless, the growing tendency of publications under this category is clearly visible.

7. Other scientific activities

Organization and participation in international scientific conferences is a very important area of scientific work organization at the Faculty of Transport Engineering. Each second year the Faculty of Transport Engineering organizes international scientific conference “TransBaltica”. The scope of the conference has expanded greatly receiving 170 participating members from 11 countries in 2013. Conference reports are issued as a separate publication (Proceedings of the International Scientific Conference). Scientists of the Faculty participate and present their research at major scientific events, conferences, congresses at Global and European levels: 11-th European Automotive Congress (EAEC 2007), 8-th World Congress on Computational Mechanics (WCCM8), 12-th World Congress in Mechanism and Machine Science (IFToMM 2007), 5-th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008), 12-th World Automotive Congress (FISITA, 2012), International Conference on Coupled Problems in Science and Engineering Coupled Problems (2013), etc.

Another important aspect of scientific activities at the Faculty of Transport Engineering is the organization of the conference for Junior Researchers ‘Science – Future of Lithuania. Transport’ which is held annually in spring. This conference attracts a great number of junior researchers at second and third cycle studies engaging in corporate scientific discussions and presenting research results for innovative technical solutions. The conference receives participating members from other universities in Lithuania and overseas.

In 2014 the scientific forces of the faculty intensified – the former university’s research subdivisions (the Transport Institute and The Competence Centre of Intermodal Transport and Logistics) were assigned to the Faculty upon the structural re-organization. The mentioned subdivisions have a considerable experience in implementing major international projects; have contributed greatly to the improvement of Lithuanian transport system.

CCITL performs the secretariat functions of The East–West Transport Corridor Association (EWTCA) (president – Dr. Algirdas Šakalys). The East–West Transport Corridor Association connects transport centers in the south of Sweden, Denmark, Germany, Lithuania with Byelorussian, Ukrainian, Russian and Asian transport systems. The objective is to develop a global competitive transport and logistics chain in Lithuania. The Association expands and facilitates the cooperation between transport and logistics companies, intermodal transport operators, consignors and consignees, national authorities and research structures; promotes political and economic dialogue between
countries belonging to the corridor and EWTC partners and other regions of the world. The main objective of EWTC – is to foster cooperation between diverse transportation hubs and develop a global competitive transport and logistics chain. It is aspired, that “East–West” transport corridor would develop less polluting transport and stand out as a “green corridor”. It is very important economic project.

We have good social partners, who turn to our researchers and send their employees to study at different levels, including doctoral studies. For instance, over the past three years, JSC “Lithuanian Railways“ received three doctors in the field of Transport Engineering prepared by our Faculty. This company assists in laboratory development; joint projects are being carried out.

Transportation and traffic safety can be substantially improved by innovative information systems applied in passenger and freight flows management, transportation control. At the same time it is thus necessary to improve transport infrastructure – quality of roads, railways, terminals. Negative transportation impact on the natural environment and human population must be managed in order to reduce it in the long-term perspective.

Rising volumes of transportation and increasing speed of operation negatively affect energy resources. This raises important challenges: to reduce fuel costs, minimize energy consumption, develop new types of fuels, improve internal combustion engines and engines consuming other energy resources, develop new modes of transport. All these problems are being successfully solved by scientists of the Faculty of Transport Engineering at Vilnius Gediminas Technical University.

“Science – is an inseparable part of successful and competitive country” – has once emphasized the president of the Lithuanian Academy of Sciences Prof. Dr Valdemaras Razumas. Indeed – if there were no science, there would neither be advanced technology, nor competitive country.

8. The recommendations for improving the existing science base

The Faculty of Transport Engineering plays a significant role in the formation of National Research Programme on Transport and Logistics and its conducted research results are important for scientific, pedagogical and practical aspects. The significance of the Faculty’s work is approved by awards and international recognition. Research areas cover an entire Transport and Logistics sector and combine technical, technological and management aspects. The spectrum of research projects is wide. Project results are multifaceted – new technologies, solutions, product prototypes and knowledge are obtained. It is worth noting, that each project, regardless of the programme, provides prerequisites for carrying-out the research, obtain data, process it and eventually, on the basis of this material, results in preparation of scientific publications. One of the most promising activities is development of doctoral studies with a mission to recruit a greater number of graduates and provide opportunities to continue and develop their career. Another challenge is an increase in scientific production while considering the results of the conducted research and demands of business sector.

References
