TSI TRANSPORTA
UN SAKARU
INSTITŪTS

Scientific Activity Report

2019

This report provides information on the aims and objectives of the research activities, scientific publications of the employees of Institute - articles in journals and collections of articles from the conferences, monographs and patents as well as it identifies priority areas of research, describes the local and international conferences held at the Institute and scientific journals published by the Institute.

	REPORT (ANNUAL)
TSI TRANSPORTA UN SAKARU INSTITŪTS RESEARCH AND DEVELOPMENT DEPARTMENT	FORM RD89G Revision 0

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1. GENERAL INFORMATION

1.1. Mission, Vision

The mission of the Transport and Telecommunications Institute is to become a European level university of applied science offering education and scientific research in ICT and transport areas. TSI enhances its position through the delivery of excellent teaching, through the engagement in the research of international quality and the knowledge services of the highest standard, enabling us to make a significant contribution to the social, cultural, educational and economic development.

Our vision for the Research Strategy is:

Research excellence and innovation are integral to the vision of the Transport and Telecommunication Institute. Our goal is to address fundamental and strategically important questions, and to deliver economic, social and cultural impact at regional, national and international levels. We engage in internationally leading research activities and collaborations.

The University Research Strategy is presented as a series of objectives under six main themes:
Theme 1: Research excellence and profile
1. To support and enhance existing areas of excellent research.
2. To identify and develop emerging areas of research excellence, including those that cross traditional subject or discipline boundaries.
3. To achieve an optimal performance in the national system of accreditation of scientific organizations, thereby maintaining a visible, quality assured research standing in the academic community and beyond.
4. To support the effective dissemination of original and significant research outputs through high quality outlets.
5. To understand, influence and respond to external research priorities at both national and international levels.

Theme 2: Collaboration
1. To promote and support collaboration in order to extend the quality and breadth of our research.
2. To provide support for collaborations that address strategically important priorities, including interdisciplinary research.
3. To develop sustainable collaborations nationally and internationally, working with leading HEIs, research institutions and other organisations, including industry and other commercial partners.

Theme 3: Sustainable research environment
1. To increase the proportion of academic staff engaged in high-quality research through recruitment and ongoing staff development.

2. To direct targeted investment towards key infrastructure and an agile research support system which fosters and sustains high quality basic and applied research and responds promptly to emerging opportunities.

3. To enhance the resilience of our research base by diversifying our engagement with external funding streams.

4. To recruit, develop and retain high-quality postgraduate research degree students and to provide them with a stimulating and supportive research environment and development opportunities.

Theme 4: Supporting researchers and research leaders

1. To attract, retain and reward high quality academic and research staff who are able to make a significant contribution to our research profile.

2. To encourage all staff and research degree students to reach their full research potential and to support their career development.

3. To facilitate best practice in research leadership and management, including equal opportunities and diversity.

4. To make good use of our collaborations to develop opportunities for career and skill development.

Theme 5: Research informs educational strategy

1. To ensure that the curriculum is informed and enriched by research.

2. To engage research-active academic staff at all levels in teaching.

3. To foster the development of research skills in students and to engage them in research, where appropriate, through taught programmes.

Theme 6: Social, economic and cultural impact

1. To engage with partner organisations and communities to inform our research and deliver social, cultural and economic benefits.

2. To exploit the potential of the University's research both to generate resource for the Institution and in order to offer solutions to real- world problems.

3. To promote the impact and value of our research, to generate public understanding and awareness of the University and its contribution to society.

Figure 1 Framework for development of the research program of TSI

1.2. Research Infrastructure

The TSI research infrastructure managerial and policy-making institutions are the Board, Rector, Vice-Rector for science and development. The advisory and supportive functions are delegated to the three Councils: Professorship, Promotion, Doctoral Studies and Research. The primary external advisory body for the research in the Institute is the International Scientific Advisory Board: Prof. Nicos Komninos (Greece), Prof. Michael Schenk (Germany) and Prof. Andres Monzon De Caceres (Spain). Their role is to review research activities, provide insights for the key developments and events, provide advice on the challenges, propose funding opportunities and act as ambassadors for the Institute.

Policy implementation functions are given to the Research and Development Department - a structural unit of the Transport and Telecommunication Institute, which main tasks are to promote the efficient use of research potential, monitor the needs of the market, create the environment for continuous partnerships with the industry, expand international scientific and technological cooperation, commercialization, managing and assisting with national, European and international projects, organize conferences and other academic and non-academic events, publish scientific journals, keep records and report on research and innovation activities of the Institute. The TSI Research & Development Department is a focal point entity responsible for the research infrastructure of the Institute.

All 17 laboratories of the TSI work in close collaboration with the management and research and development department and Faculties. The Figure 2 below presents a schematic structure of the research & development infrastructure of the Institute:
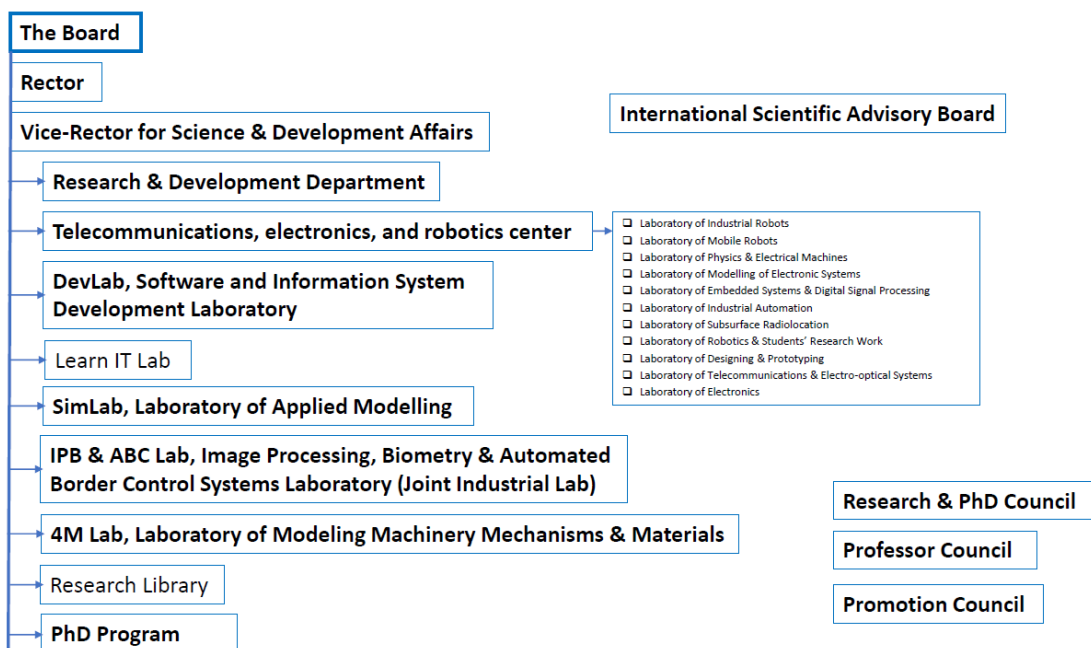

Figure 2 Research Infrastructure

The three new laboratories had been opened in the framework of the Centre in 2018 - Laboratory of Industrial Robots; Laboratory of Mobile Robots and Software and information system development laboratory, DevLab. The Industrial and Mobile Robots Labs were opened within the framework of the project No. 8.1.1.0/17/I/009 "Modernisation of Transport and Telecommunications institute STEM study programmes"; DevLab is TSI investment project for the development of applied research in the field of information technology and computer science; development and support of research at the Computer Science and Telecommunication Faculty as well as the implementation of TSI projects and applied research.

Laboratory of Industrial Robots
The laboratory is equipped with 4 industrial robots: the KUKA KR16 robot, the ABB IRB6600 robot, and two KUKA KR125 robots. The laboratory has a functioning segment of an automated production conveyor line, which includes sensors, actuators and control systems based on programmable logic controllers. The laboratory is intended to study the principles of design, operation and use of industrial robots in order to acquire the ability to program industrial robots to perform typical technological operations of robotic production.

Laboratory of Mobile Robots
Within the STEM project additional robotic arm setup consisting of "Universal Robots U3" (with gripper tool and camera) was added to the equipment of TSI in 2018 to provide learning opportunities for students to practise applied programming for industrial processes. Within the same project laboratory additionally was equipped with robots of the following brands: NAO 6 humanoid robots (6 pcs.), Khepera IV compact mobile robots (8 pcs.), Koala 2.5 mobile robots (3 pcs.). The personal computers of the laboratory have the software necessary for programming these robots. The laboratory is intended to study the principles of programming mobile robots, to implement and study existing and developed robot control algorithms: environment mapping algorithms, route planning and navigation algorithms, object detection and recognition algorithms, remote algorithms, artificial intelligence algorithms, etc.). Laboratory robots and software allow to learn the principles of creating mobile robots, to understand the features of the use of mobile robot information devices and to develop practical skills in the implementation of mobile robot control algorithms.

All laboratories are equipped with the latest software and hardware. They are widely used in academic and research activities of the Institute. Each laboratory is a collection of contemporary technical, software and methodological equipment and materials, which allows conducting classes with students at the edge of innovative research. Apart from the above-mentioned laboratories of Industrial Robots and Mobile Robots, the following laboratories are parts of the TERC.

Laboratory of Physics and Electrical Machines. The laboratory is equipped with training equipment of the company PHYWE, which helps exploring the effect of the fundamental laws of physics. At the same time, the electrical machine equipment from the manufacturer K&H MFG, helps to understand the principles and work of modern electric motors.

Laboratory of Modelling of Electronic Systems. The laboratory is equipped with a wide range of applied software allowing simulation of the work of electric circuits and the designing of printed circuit boards. The list of available programs consists but not limited to: Electronic Design Automation package OrCAD; Functional Modelling (Simulation) System Proteus VSM; Modelling (Simulation) System of Industrial Standard NI Multisim; Graphical Programming System NI LabVIEW; Designing System for Microcontrollers AVR Studio; Designing System for PLIC (programmable logic integrated circuits) Xilinx ISE WebPACK.

Laboratory of Embedded Systems and Digital Signal Processing. The laboratory is equipped with special debug kits with modern microcontrollers such as AVR, Freescale, STMicroelectronics, as well as programmable logic circuits XILINX. The equipment of laboratory allows designing and exploring digital signal processing systems and intelligent control systems.

Laboratory of Industrial Automation. The laboratory is equipped with Siemens control software systems and models of the production lines. The laboratory is designed for the research of the principles of industrial networks and engineering of the systems of automation based on industrial logic controllers. Industrial manipulator Kawasaki RS03N allows learning the principles of programming of industrial robots and exploring the features of integration of the robotic devices into the automated production lines.

Laboratory of Subsurface Radiolocation. The laboratory is equipped with the ground penetrating radar of the company GSSI and a set of options for the research of the roadbed. There is software RADAN 7, for processing the data of ground penetrating radar, installed in the laboratory. All the equipment of the laboratory allows exploring the methods of non-destructive quality control of road surfaces and carrying out of work to assess the quality of the laying road surfaces and detection of hidden engineering communications.

Laboratory of Robotics and Students' Research Work. The laboratory is equipped with a variety of modern measuring equipment made by the company HAMEG and a set of debug modules for microcontrollers, PLIC and signal processors. Software and hardware platform NI ELVIS II allow carrying out the research of the operation of electronic devices through physical, semi-natural and mathematical simulation. The laboratory contains a set of functional units of the robots from LEGO, Lynxmotion, Pololu and Parallax, which allows to create autonomous mobile robots and learn the principles of the construction of control systems of robotic facilities in the laboratory.

Laboratory of Designing and Prototyping. The laboratory is equipped with software and hardware of production the prototypes of the electronic devices, including CNC machine tool LPKF Protomat S63 to produce double-sided printed circuit boards. Soldering Equipment of the laboratory allows to carry out montage using PTH (Pin Through Hole) and SMT (Surface Mount Technology) technologies.

Laboratory of Telecommunications and Electro-Optical Systems. The laboratory is intended for students to explore the principles of the construction of telecommunications equipment: Global

System for Mobile communications (GSM); Global Positioning System (GPS); Radio-Frequency Identification System (RFID); Optoelectronic Systems; Digital Telephone Networks; Radio Transmitting and Receiving Devices; Antenna-Feeder Devices.

Laboratory of Electronics. This laboratory is equipped with type setting fields for creating electrical circuits. All the research work is with the use of specialized laboratory measuring equipment.

Aside the Robotics Centre, six other laboratories function as part of the Transport and Telecommunication Institute. These six laboratories listed below encourage students engage in high-quality innovative research in the fields of IT, Digital Economy and Telematics:

Laboratory of Applied Software Systems of the Transport and Telecommunication Institute carries on research and offers consulting in the following fields: traffic, logistics and business processes. The research and analysis are fulfilled using nowadays simulation software. The software of the laboratory allows to do the high-quality, representative and many-sided analysis of the research systems. Such projects as the projects connected with the new bus station in Riga, three level flyover of South bridge model, Liepaja city traffic macroscopic model can be mentioned as a vivid example (see more on website las.tsi.lv).

Multimedia Laboratory. The laboratory is equipped with video-recording and editing equipment complex, which allows creating educational, informative and commercial videos. The filming process of video lectures for the purposes of distance studying, sound recording for video materials and their preparation for placing into e-studying environment takes place at the filming studio. Moreover, the conference presentations and lectures of the lecturers and guest lecturers are being broadcasted live on the internet.

Cisco Networking Academy. Cisco Networking Academy (CNA) Program developed by the specialists of Cisco Systems Company is the most fundamental and methodically worked over among other similar programs in the area of network technologies. Annually over 500 000 students use it in their learning in more than 8000 academies in 164 countries of the world. Only 29 countries do not have networking academies. The purpose of the program is the fundamental training of specialists of planning theory and practice, construction and technical maintenance of local and global networks with the use of generally recognized standards and solutions.

Learn_IT Project Laboratory. The main goal of this Laboratory would be to test a set of tools that will help to increase the effectiveness of learning by supporting the high level of concentration in a manner adapted to the individualized rhythm of learning. The solutions offered under the framework of LEARN IT project may be a good alternative for traditional ways of stimulation of concentration and focus during the process of learning. The Learning Lab with software for mobile devices was developed so that it can be used to prepare personalized recommendations for each person who will be tested in this Laboratory.

4M Laboratory, which provides access to the students and staff of TSI to the latest literature and scientific journals. The library has electronic catalogue of all information entities and it is possible to search the necessary information via internet.

IPB & ABC Laboratory - Image Processing, Biometry & Automated Border Control Systems. Since 2017 TSI in cooperation with one of the industries & business leader – company X-InfoTech organized a new modern research laboratory. Analysis and processing of images (the same as - pattern recognition, machine vision, Image Processing, Pattern Recognition, etc.) is a modern trend - scientific direction supporting a huge number of applications related to monitoring objects and territories, medicine, artificial intelligence, security systems.

DevLab - Software and information system development laboratory. DevLab is challenge-based laboratory of Computer Science and Telecommunication Faculty, targeted on organizing creative teams of developers who able to deliver smart software solutions to industry, based on cutting-edge technologies. Laboratory unites researchers, students and industry to create innovative solutions, develops new industry-demanded skills in the area, empowers start-up thinking and makes any students ideas possible. We are giving unique possibility for students to be involved in real software development projects and develop own practical skills, staying in campus and receiving support from leading teaching and research staff of TSI. In our projects we are feeding software, web apps, mobile applications and robots with artificial intelligence, forecasting methods, natural language processing, chatbots, behavioral models, advanced data analysis, augmented realty, image and video processing.

1.3. Research Journals

Transport and Telecommunication Scientific Journal.

Journal "Transport and Telecommunication" is a peer-reviewed open-access scientific journal, owned by Transport and Telecommunication Institute. This Journal is a source of information and research results in the full scope of transport science: modelling and planning the transport systems, technical means of transport; transport infrastructure, traffic control, intellectual transport system, telematic and also concerns the interdisciplinary questions: transport and the environment, safety in transport, quality and effectiveness of transport, interoperability and intermodality. The journal aims at addressing professionals in transport and telecommunication in different types of positions in the area of industry, research and academic institutions. The Journal is published quarterly in the electronic and printed version.

The papers published in Journal "Transport and Telecommunication" are included in the following scientific databases:

SCOPUS (since 2008, Vol. 9, No 1), Elsevier Database; De Gruyter Open; The Summon; Transportation Research Board; ProQuest; ProQuest Engineering Journals; ProQuest Illustrata: Technology; ProQuest SciTech Journals; ProQuest Technology Journals; CNKI Scholar (China

National Knowledge Infrastucture); EBSCO Discovery Service; Google Scholar; Primo Central (ExLibris); SCImago (SJR), and many more.

The Figures below demonstrated the development process of the journal. The data are obtained from the Scimago Journal & Country Ranks (http://www.scimagojr.com/):
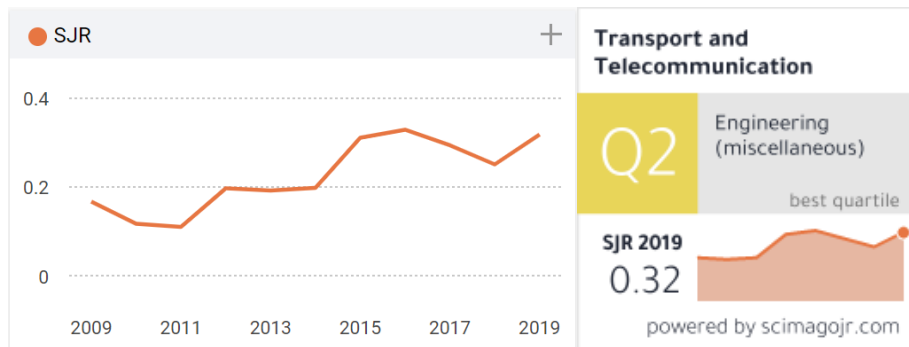
Figure 3 Transport and Telecommunication Journal performance (Scimago)
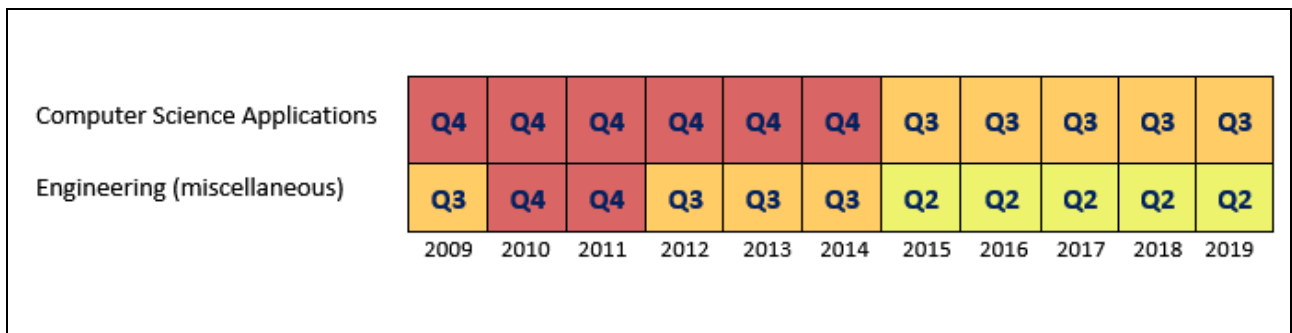
Figure 4 Transport and Telecommunication Journal performance (Scimago) (2)

The significant improving in journal position based on the KPI values included in following Table: (Table 1).

Journal position based on the KPI

KPI	2019[1]
	Table 1
H-index of the Transport and Telecommunication Journal	**11**
SJR indicator	0.32
Cites per document (3 years)	1.263
International Collaboration	33.33%
Change the quality of the journal in following categories[2]: • Computer Science application • Engineering (Miscellaneous)	Q3 Q2

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[1] Based on data from SCImago Journal & Country Rank http://www.scimagojr.com/ (data available for the year 2019)

[2] Based on data from SCImago Journal & Country Rank http://www.scimagojr.com/ (data available for the year 2019)

Aside from "Transport and Telecommunication" journal, the TSI publishes a scientific peer-reviewed journal "**Computer Modelling and New Technologies**", which is also a quarterly scientific & research journal, ISSN 1407-5806, ISSN 1407-5814.

1.4. Research Staff

The research staff of TSI is registered in VIAA (State Education Development Agency Republic of Latvia) research staff database.

Figures 5 and 6 show the dynamics regarding research staff in TSI staring from 2013:
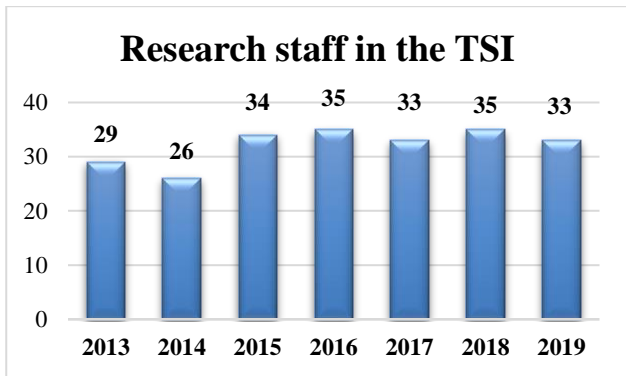
Figure 5 Research staff in the TSI
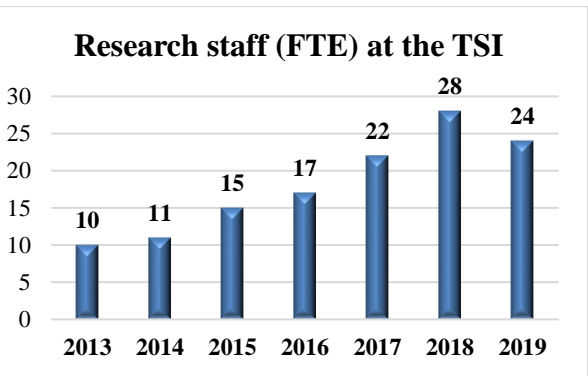
Figure 6 Research staff (FTE) at the TSI

Figure 7 shows the distribution of staff by type at the TSI:
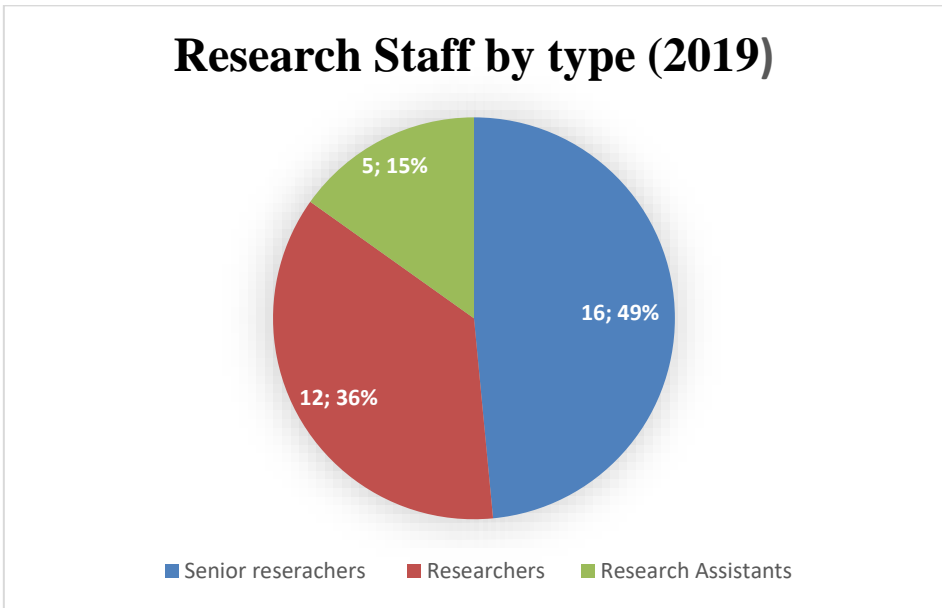
Figure 7 Research staff by type

2. RESEARCH OUTPUT

2.1. Number of scientific publications and other outputs

Scientific publication / outputs, 2019

Table 2

1. Original articles in anonymously refereed scientific journals cited in Web of Science & SCOPUS	34
2. Articles in other refereed scientific edited journals and conference proceedings	1
3. Monographs published[3]	2
4. Other scientific publications - proceedings[4]	22
5. Textbooks and other research-related publications	0
6. Patents/ including international	0
7. Computer programs and algorithms[5]	0
8. Registered cultivars	0
9. Conference abstracts	38
10. Visiting lectures	9
11. Articles, radio and television programs and journals popularizing science	2
12. Other[6]	0

Figure below shows publication statistics for the last five years:

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[3] Includes doctoral theses and monographs.
[4] Includes edited proceedings, collections and special issues of scientific journals, and unrefereed scientific articles, excluding conference abstracts, chapters in books.
[5] Approximates the number of programs and algorithms that have been in use outside the unit.
[6] May include design products, prototypes, artefacts, exhibitions, performances etc.

Figure 8 Publication performance and dynamics

2.2. Lists of most important publications by academic personnel and researchers with doctoral degree

1. G. Adamos, E. Nathanail, **I. Yatskiv**, E. Budiloviča and M. Tsami. "Measuring Travellers' and Stakeholders' Satisfaction on Perceived Sustainability of a Transport Interchange", *Transport and Telecommunication*, Vol. 20 (4). 2019, pp. 379-388.

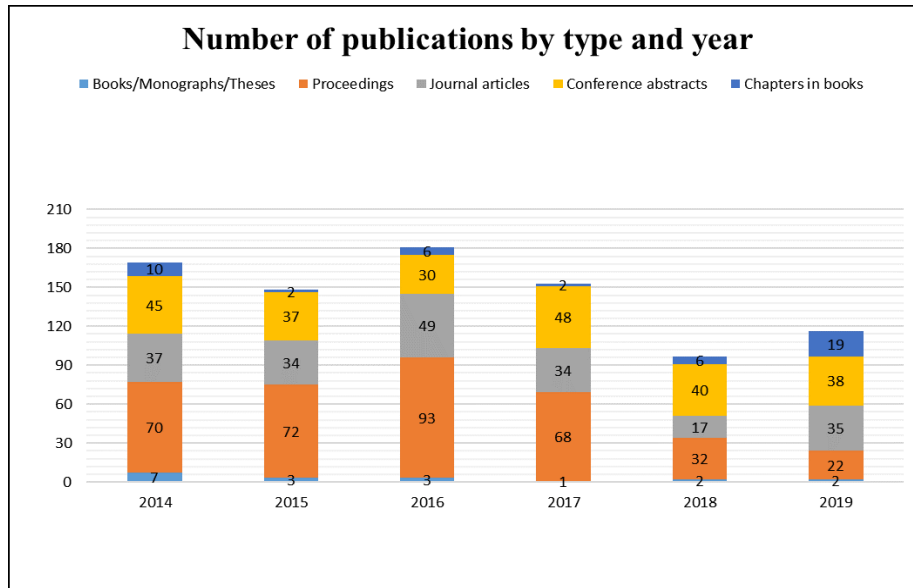2. Avdekins and **M. Savrasov**. "Making warehouse logistics smart by effective placement strategy based on genetic algorithms", *Transport and Telecommunication*, Vol. 20, Nov, 2019, pp. 318–324.

3. **Kabashkin** and N. Tikanashvili. "Ontology-Based Approach for Human Competency Gap Analysis in Air Traffic Management", *Transport and Telecommunication*, Vol. 20. 2019, pp. 279-285.

4. **Kabashkin**. "Reliability of Cluster-Based Nodes in Wireless Sensor Networks of Cyber Physical Systems", *Procedia Computer Science*, Vol. 151. 2019, pp. 313-320.

5. **Kuzmina-Merlino** and S. Saksonova. "Cryptocurrency as an Investment Instrument in a Modern Financial Market", *St Petersburg University Journal of Economic Studies, SUJES*, Vol. 35 (2). 2019, pp. 269-282.

6. J. AntonioSánchez et al. "Cloud service as the driver for university's software engineering programs digital transformation", *Procedia Computer Science*, Vol. 149. 2019, pp. 215-222.

7. **D. Pavlyuk**. "Feature selection and extraction in spatiotemporal traffic forecasting: a systematic literature review", *European Transport Research Review*, Vol. 11, Dec, 2019, pp. 6.

8. **Yatskiv** and A. Hismutova. "Impact Clutter Reduction in Parallel Coordinates Using Aesthetic Criteria.", *Frontiers in Artificial Intelligence and Applications*, Vol. 312. 2019, pp. 81-100.

9. K. Malnaca and **I. Yatskiv**. "Impact of Critical Variables on Economic Viability of Converted Diesel City Bus into Electric Bus", *Nathanail E., Karakikes I. (eds) Data Analytics: Paving the Way to Sustainable Urban Mobility. CSUM 2018. Advances in Intelligent Systems and Computing*, Vol. 379. 2019, pp. 847-855.

10. E. Budilovich, V. Magginas, G. Adamos and **I. Yatskiv**. "Investigating the Accessibility Level in Riga's International Coach Terminal: A Comparative Analysis with European Interchanges", *Nathanail E., Karakikes I. (eds) Data Analytics: Paving the Way to Sustainable Urban Mobility. CSUM 2018. Advances in Intelligent Systems and Computing*, Vol. 879. 2019, pp. 839-846.

11. **Yatskiv** and V. Gromule. "Comparing the Customer Use and Satisfaction in Two Latvian Transport Interchanges.", *Nathanail E., Karakikes I. (eds) Data Analytics: Paving the Way to Sustainable Urban Mobility. CSUM 2018. Advances in Intelligent Systems and Computing*, Vol. 879. 2019, pp. 831-839

12. **I. Kabashkin**. "Dependability of Multichannel Communication System with Maintenance Operations for Air Traffic Management" In book: "Advances in Intelligent Systems and Computing". Springer. 2019. pp. 256-263.

13. **M. Savrasov**. "Evaluation of Shopping Mall Implementation Impact on Safety Aspect of the Transport Network Based on Simulation: Case-Study of Riga" In book: "Vision Zero for Sustainable Road Safety in Baltic Sea Region". A. Varhelyi, V. Zurauis and O. Prentkovskis eds. Springer International Publishing. 2019. pp. 195-205.

14. L. Zaitseva and **B. Misnevs**. "Competency-Based Approach Teaching Software Engineering" In book: "Smart Education and e-Learning 2019". Uskov, V. L., Howlett, Robert, Jain and L. C. eds. Springer. 2019. pp. 231-241.

15. **I. Kozlovska** and **I. Kuzmina-Merlino**. "Linkage Between Management of Long-Lived Non-financial Assets and Performance of Latvian Companies Listed on the Baltic Stock Exchange" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 684-693.

16. **K. Užule**, **I. Kuzmina-Merlino** and **I. Ishmuhametov**. "Who are Latvian Women Entrepreneurs of Small Businesses? A Preliminary Study" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 661-669.

17. I. Jackson, A. Avdeikins and **J. Tolujew**. "Unsupervised Learning-Based Stock Keeping Units Segmentation" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 603-612.

18. **I. Yatskiv**, E. Budilovich, I. Blodniece, E. Nathanail and G. Adamos. "A Cross-case Analysis of Riga Interchanges' Information Services and Technologies" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 582-592.

19. V. Magginas, E. Nathanail, G. Adamos, M. Tsami and **I. Yatskiv**. "Environmental Friendly Transport Interchanges: Active Travel Accessibility and Policy" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 572-581.

20. **A. Krivchenkov** and A. Skrunds. "Measurements of the Parameters of a Broadband Satellite Data Channel in the SEVSAT Ship System" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 440-449.

21. **A. Krivchenkov**, **A. Grakovski** and I. Balmages. "Required Depth of Electricity Price Forecasting in the Problem of Optimum Planning of Manufacturing Process Based on Energy Storage System (ESS)" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 331-342.

22. R. Saltanovs and **A. Krainyukov**. "Employment of SIC MOSFETS and GaN-Transistors for Wireless Power Transmission Systems" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 293-301.

23. **A. Krivchenkov** and R. Saltanovs. "Increasing the Efficiency of the Wireless Charging System for Mobile Devices that Support Qi Standard" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 249-258.

24. R. Saltanovs, A. Rubenis and **A. Krainyukov**. "Influence of Constructive Materials of Road Cover on Magnetic Field Dispersion of Wireless Power Transmission Systems" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 214-223.

25. **I. Yatskiv** and **N. Spiridovska**. "Data Preparation Framework Development for Markov-Modulated Linear Regression Analysis" In book: "Reliability and Statistics in Transportation and

Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 178-190.

26. K. Malnaca, M. Gorobetz, **I. Yatskiv** and A. Korneyev. "Decision-Making Process for Choosing Technology of Diesel Bus Conversion into Electric Bus" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 91-102

27. **I. Kuzmina-Merlino** and S. Saksonova. "The Principles of Creating a Balanced Investment Portfolio for Cryptocurrencies" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 714-724.

28. **O. Pozdnyakova** and **A. Pozdnyakov**. "Conflict Management in the Educational Process at the University" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer, Cham. 2019. pp. 798-807.

29. **I. Kabashkin**. "Availability of Applications in Container-Based Cloud PaaS Architecture" In book: "Reliability and Statistics in Transportation and Communication". Springer. 2019. pp. 241-248.

30. **D. Pavlyuk**, M. Karatsoli and E. Nathanail. "Exploring the Potential of Social Media Content for Detecting Transport-Related Activities" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018". Kabashkin, Igor, Yatskiv, Irina, Prentkovskis and Olegas eds. Cham : Springer International Publishing. 2019. pp. 138-149.

31. **A. Krivchenkov**, **B. Misnevs** and **D. Pavlyuk**. "Intelligent Methods in Digital Forensics: State of the Art" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018.". Publisher: Springer, Cham. 2019. pp. 274-284.

32. **Y. Stukalina** and O. Zervina. "Developing a Marketing Strategy for a Higher Education Institution in the Agenda of Customer–Driven Education" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018. Lecture Notes in Networks and Systems"". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. 2019. pp. 759-757.

33. **Y. Stukalina** and M. Pol. "On Higher Education Realities: Supporting Education and Research" In book: "Reliability and Statistics in Transportation and Communication. RelStat 2018. Lecture Notes in Networks and Systems". I. Kabashkin, I. Yatskiv and O. Prentkovskis eds. Springer. 2019. pp. 749-758.

34. I. Karakikes, W. Hofmann, L. Mitropoulos and **M. Savrasov**. "Integrating Logistics and Transportation Simulation Tools for Long-Term Planning" In book: "Data Analytics: Paving the Way to Sustainable Urban Mobility". E. G. Nathanail and I. D. Karakikes eds. Springer Nature Switzerland. 2019. pp. 807-814.

2.3. Other scientific publications

1. N. Dolle and **I. Kuzmina-Merlino**. "The Ways of Measuring Corporate Communication Performance in Major Enterprises. Proceedings of the 9th International Conference on Leadership, Technology, Innovation and Business Management. December 12-13, Istanbul, Turkey.". A. Kutlu ed. 2019. pp. 174-181.

2. M. Merlino and **I. Kuzmina-Merlino**. "Managers' Competencies and Managers' Education in Digital Era. Proceedings of the 9th International Conference on Leadership, Technology, Innovation and Business Management. December 12-13, Istanbul, Turkey. Editor Asuman Kutlu.". 2019. pp. 438-447.

3. **D. Pavlyuk**. "Spatiotemporal Traffic Forecasting as a Video Prediction Problem". *2019 6th International Conference on Models and Technologies for Intelligent Transportation Systems (MT-ITS}*. 2019. pp. 1-7.

4. **D. Pavlyuk**. "Random Forest-controlled Sparsity of High-Dimensional Vector Autoregressive Models". *ITISE 2019. International Conference on Time Series and Forecasting. Proceedings of Papers*. Valenzuela et al eds. 2019. pp. 343-354.

5. **Y. Stukalina**. "Strategic Brand Positioning in a Modern Academia". *The European Proceedings of Social & Behavioural Sciences EpSBS*. M. Özşahin ed. 2019. pp. 20-29.

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7. **Y. Stukalina**. "Marketing in higher education: promoting educational services and programmes". *Proceedings of the International Scientific Conference "Contemporary issues in business, management and economics engineering'2019"*. 2019. pp. 616-624.

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a. Textbooks and other research-related publications

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3. **J. Baranova**. "Особенности изучения предмета" Компьютерные сети" студентами дистанционного обучения". *Abstracts of the International Conference RESEARCH and TECHNOLOGY – STEP into the FUTURE. December 06 2019.Riga, Latvia*. 2019. pp. 11-12.

4. **O. Pozdnyakova** and **A. Pozdnyakov**. "Involvement of Adult Female Students in Distance Learning As an Option to Overcome the Learning Barriers". *Abstracts of the 19th International Multi-Conference "RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION" (RelStat'19),16–19 October 2019. Riga, Latvia*. I. Kabashkin and I. Yatskiv eds. 2019. pp. 122.

5. **I. Ishmuhametov**, **L. Kuzmenko** and **A. Palma**. "Conditions for Foreign Students'adaptation and its Features in the Higher Education Institution in Latvia". *Abstracts of the 19th International Multi-Conference "RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION" (RelStat'19),16–19 October 2019. Riga, Latvia*. I. Kabashkin and I. Yatskiv eds. 2019. pp. 117.

6. **Y. Stukalina**. "Evaluating University Research Performance: What Criteria to Use?". *Abstracts of the 19th International Multi-Conference "RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION" (RelStat'19),16–19 October 2019. Riga, Latvia*. I. Kabashkin and I. Yatskiv eds. 2019. pp. 116.

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10. N. Dolle and **I. Kuzmina-Merlino**. "Benchmarking of Corporate Communication Measurement Strategies in Major Enterprises Based on the Value-Benefit Analysis". *Abstracts of the 19th International Multi-Conference "RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION" (RelStat'19),16–19 October 2019. Riga, Latvia*. I. Kabashkin and I. Yatskiv eds. 2019. pp. 110.

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24. **D. Pavlyuk**. "Make it Flat: Multidimensional Scaling of City-Wide Traffic Data". *Abstracts of the 19th International Multi-Conference "RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION" (RelStat'19),16–19 October 2019. Riga, Latvia*. I. Kabashkin and I. Yatskiv eds. 2019. pp. 15-16.

25. D. Larin and **J. Tolujew**. "Defining the Proper Model for Aviation Spare Parts Forecast". *Abstracts of the 19th International Multi-Conference "RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION" (RelStat'19),16–19 October 2019. Riga, Latvia*. I. Kabashkin and I. Yatskiv eds. 2019. pp. 14.

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30. **J. Baltgailis**, V. Meņšikovs and V "Banku stabilitāti veicinošās institucionālās vides faktori, to atlase un analīze pasaules valstīs". *Abstracts of the 14th International Academic Conference "Social Science for regional Development 2019"- Daugavpils*. 2019. pp. 8.

31. **J. Baltgailis** and A. Vesjolijs. "Comparative analysis of the influence of mass media on the institutional structure of business in Latvia, Sweden and France". *Abstracts of the 14th International Academic Conference "Social Science for regional Development 2019"- Daugavpils*. 2019. pp. 47-48.

2.4 Research Performance, based on Scopus Data

Overall research performance

<div align="right">**Table 3**</div>

219 ▲ Scholarly Output ❄	86 ▲ Authors	0.74 Field-Weighted Citation Impact
457 Citation Count ❄	2.1 Citations per Publication ❄	7 *h*5-index

Note: This analysis provides an overall metrics summary of the institution. The snowflake means the metrics have been calculated using the Snowball Metrics methodology.

Publications by Subject Area
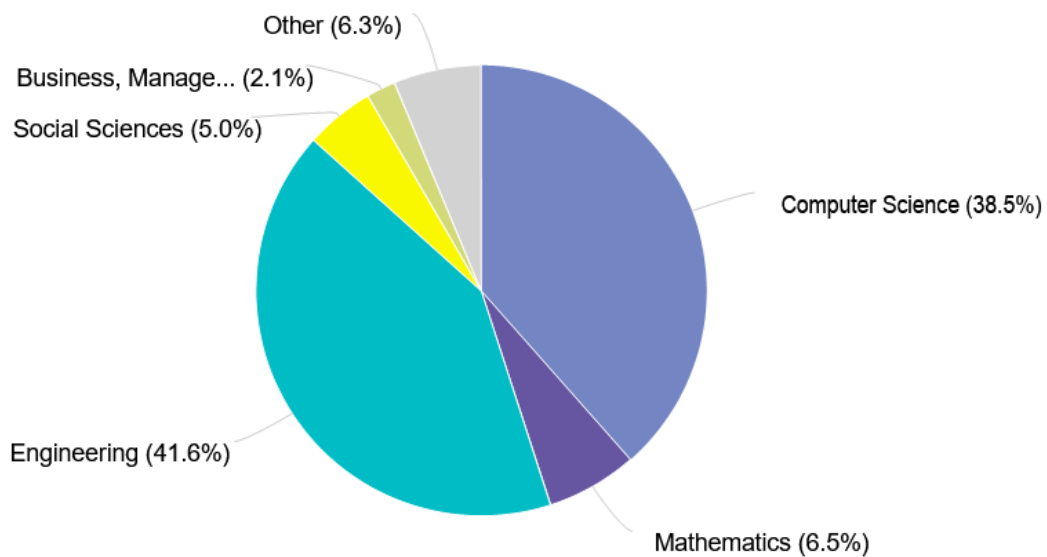
Figure 9 Publications by Subject Area

Field-Weighted Citation Impact

0.74

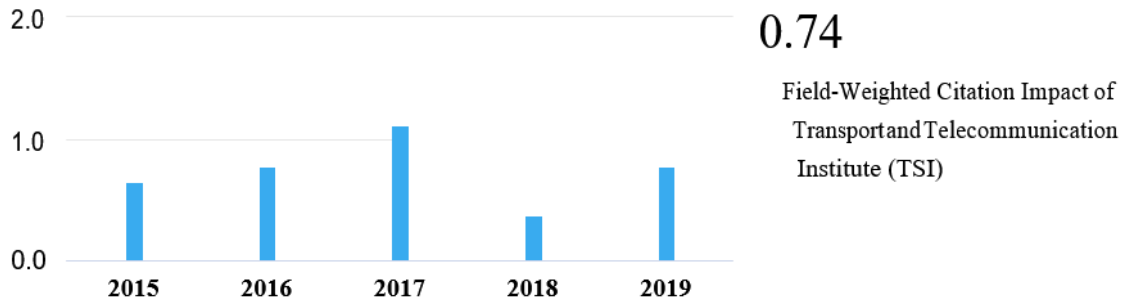Field-Weighted Citation Impact of Transport and Telecommunication Institute (TSI)

Figure 10 Field-Weighted Citation Impact

Note: Field-Weighted Citation Impact (FWCI) indicates how the number of citations received by the institution publications compares with the average number of citations received by all other similar publications in Scopus. A FWCI of 1.00 indicates that the institution's publications have been cited exactly as would be expected based on the global average for similar publications. A FWCI of more than 1.00 above average citations; for example, 2.11 means 111% more than the world average.

Collaboration

Scholarly Output at Transport and Telecommunication Institute (TSI), by amount of international, national, and institutional collaboration
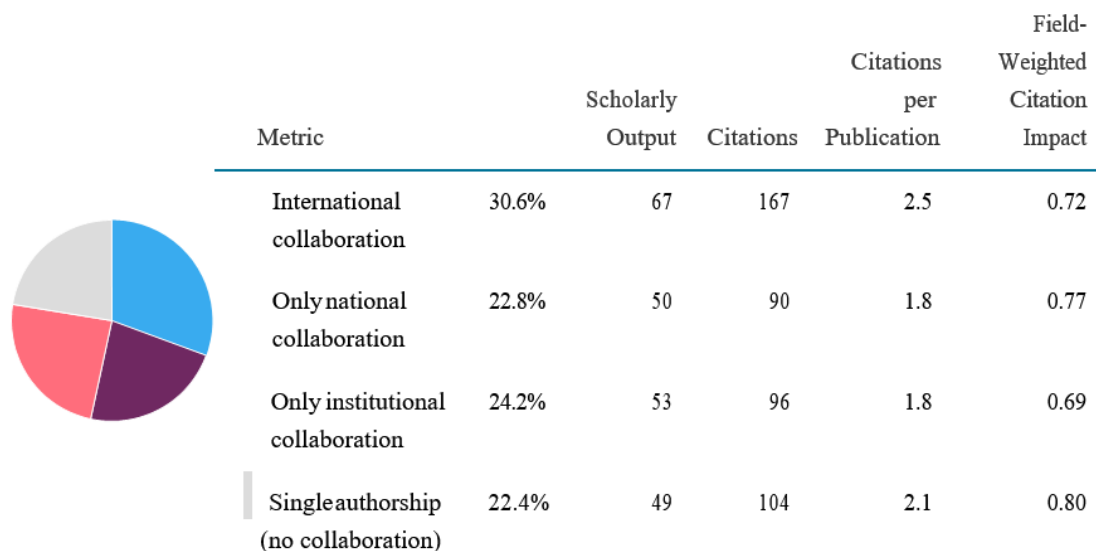

Metric		Scholarly Output	Citations	Citations per Publication	Field-Weighted Citation Impact
International collaboration	30.6%	67	167	2.5	0.72
Only national collaboration	22.8%	50	90	1.8	0.77
Only institutional collaboration	24.2%	53	96	1.8	0.69
Single authorship (no collaboration)	22.4%	49	104	2.1	0.80

Figure 11 Scholarly Output

Note: Indicates the extent to which the institution's publications have international, national, or institutional co-authorship, and single authorship. A publication is assigned a single collaboration type.

Top collaborating Institutions

	Institution	Co-authored publications	Citations received for co-authored ↓publications	Co-authors	Field-Weighted Citation Impact
1	University of Thessaly	20 ▲	27	8 ▲	0.64
2	University of Latvia	15 ▲	27	12 ▲	0.72
3	Fraunhofer Institute for Factory Operation and Automation	11 ▲	14	11 ▲	0.49
4	Riga Technical University	7 ▲	8	10 ▲	0.76
5	Vilnius Gediminas Technical University	6 ▼	7	5 ▼	0.29
6	Keio University	5 ▲	1	3 ▲	0.27
7	Otto von Guericke University Magdeburg	3 ▲	13	4 ▲	0.86
8	RAS-Institute of Control Sciences	3	10	1	1.00
9	Central Research Institute of Electric Power Industry	2 ▲	0	1 ▲	0.00
10	University of Murcia	2 ▲	7	8 ▲	2.14

Figure 12 Top collaborating Institutions

Note: Shows the top institutions that have co-authored scholarly outputs with the institution.

Share of publications at Transport and Telecommunication Institute (TSI) that are among the most cited publications worldwide
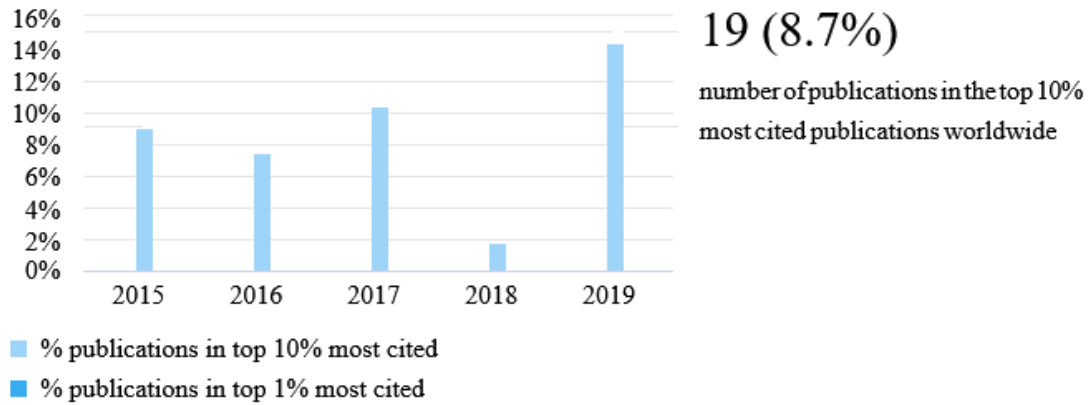
Figure 13 most cited publications worldwide

Note: Outputs in Top Citation Percentiles indicates the extent to which an institution's publications are present in the top 10% most-cited percentiles within Scopus. This number is then field weighted to normalize for differences in subject area citation patterns.

Top Authors

Name	Scholarly Output	Most recent publication	Citations	h-index
1. Yatskiv (Jackiva), Irina	31	2019	59	5
2. Kabashkin, Igor	31	2019	73	7
3. Savrasovs, Mihails	17	2019	31	4
4. Nechval, Konstantin N.	14	2019	31	9
5. Andronov, Alexander M.	13	2019	12	5
6. Tolujew, Juri	12	2019	27	9
7. Pavlyuk, Dmitry	10	2019	37	6
8. Krivchenkov, Aleksandr	9	2019	13	3
9. Kuzmina-Merlino, Irina	9	2019	24	3
10. Grakovski, Alexander	8	2019	15	3

Figure 14 Top Authors

Note: The authors with the highest scholarly output from the institution, along with some metrics about them.

3. MASTER, PHD STUDENTS AND POSTDOC ACTIVITIES

3.1. Number of students

Master and Doctoral degree students

Table 4

Position	2019
Completed their master's degree	35
Enrolled in doctoral studies	5
Active doctoral students	11

3.2. Scope of PhD program activities

PhD Degree Programme "Telematics and Logistics" (51526) is a long-standing successful state-accredited third level higher education programme.

In 2019, 5 new candidates were accepted to the doctoral program of TSI: Fedorov R. (supervised by Pavlyuk D.), Larin D. (supervised by Tolujevs J.), Tyncherov T. (supervised by Kabaškins I.), Pivovar M. (supervised by Misnevs B., Pticina I.), Rozhkova L. (supervised by Kabaškins I.).

In 2019 there were three ongoing post-doc projects (approved in 2017) with the budget total of 133805.88 euro for each of the projects, 5% of the financing coming from the Institute in form of salaries for consultants and infrastructure expenses.

This Postdoc projects are:
1) "Nontraditional regression models in transport modeling" (started 01.10.2017.)
The goal of the project is to develop nontraditional regression models, namely the Markov-modulated regression for analysis and forecasting of traffic flows and adjacent transport tasks in transport modelling and find algorithms for their parameter estimation for big data.
In 2019, Dr. Nadežda Spiridovska participated in following conferences:
- 5th International Conference on Advances in Statistics (ICAS'19) (Athens, Greece)
- 10th International Workshop on Simulation and Statistics (SimStat19) (Salzburg, Austria)
- 19th International Multi-Conference Reliability and Statistics in Transportation and Communication (Relstat19) (Riga, Latvia).

2) "Spatiotemporal urban traffic modelling using big data" (started 01.10.2017.)
The goal the project is enhancing of the methodological base of urban traffic flow analysis with responsive multivariate spatiotemporal models and algorithms of their parameter estimation for big data.
In 2019, Dr. Dmitrijs Pavļuks participated in following conferences:
- 6th International Conference on Models and Technologies for Intelligent Transportation Systems (Kraków, Poland)
- 6th International conference on Time Series and Forecasting (ITISE 2019) (Granada, Spain)
- 22nd Euro Working Group on Transportation - EWGT 2019 (Barcelona, Spain)

- 3rd International Land Use Symposium on "Land use changes: Trends and projections" (Paris, France)
- 19th International Multi-Conference Reliability and Statistics in Transportation and Communication (Relstat19) (Riga, Latvia).

3) „Integrated Model for Energy Generation, Distribution and Management" (started 01.12.2017.)
The main goal of research is to develop country energy mixture model for clean environment and economy development in Latvia and implement a prototype of a novel routed smart grid for energy distribution and management.

In 2019, Dr. Tatjana Endrjukaite has made visiting research trip:
From 4 April 2019 to 16 June 2019 Hawaiian Natural Energy Institute, University of Hawaii, USA she has participated in the Smart Grid International Fieldwork. Joint research activity with high level consultants in HNEI.

She has participated in following conferences:
- 6th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation (BuildSys 2019) (New York, United States)
- 21st International Conference on Information Integration and Web-based Applications & Services (iiWAS2019) (Munich, Germany)
- 19th International Multi-Conference Reliability and Statistics in Transportation and Communication (Relstat19) (Riga, Latvia).

Iyad Alomar defended the thesis "AN INVESTIGATION OF ALTERNATIVE METHODS FOR CONTROLLING THE MOVEMENT OF GROUND VEHICLES IN AIRPORTS at the public session of the Promotion Council of the Transport and Telecommunication Institute on February 19, 2019. Supervisor of doctoral thesis - Dr.habil.sc.ing. prof. Jurijs Tolujevs and Dr.sc.ing. prof. Aleksandrs Medvedevs.

Evelīna Budiloviča defended the thesis "DECISION SUPPORT FRAMEWORK FOR THE SUSTAINABLE URBAN TRANSPORT INTERCHANGES: CASE STUDY OF RIGA CITY" at the public session of the Promotion Council of the Transport and Telecommunication Institute on December 12, 2019. Supervisor of doctoral thesis - Dr.sc.ing. prof. Irina Yatskiv.

3. CONFERENCES AND OTHER SCIENTIFIC EVENTS

TSI continues to hold regularly national and international conferences. The most significant among them is the TSI's Annual International Conference "Reliability and Statistics in Transportation and Communication". In 2019 RelStat-19 Conference was held on 16-19 October 2019. The number of participants in 2019 has increased by 59,22%. A total of 166 authors from 20 countries (Latvia, Russia, Poland, Ukraine, Czech Republic, Austria, India, Germany, France, Estonia, Lithuania, Kazakhstan, Greece, United Kingdom, Japan, USA, Belarus, Georgia, Uzbekistan, Netherland) presented their research.

The Conference Proceedings of 2019 were published in Springer as well as Indexed in Web of Sciences.

Scope of Conferences

Table 5

CONFERENCES					
Conference	**Date**	**Total participants**	**Given Presentations**	**Total Authors**	**Countries**
Annual International Conference "Research and Technology – Step into the Future" (Spring)	26/04/2019	44	24	23	N/A (National)
Annual International Conference "Research and Technology – Step into the Future" (Autumn)	06/12/2019	33	15	18	N/A (National)
International Multidisciplinary Conference "Reliability and Statistics in Transportation and Communication (RelStat-2019)"	16/10/2019-19/10/2019	179	81	166	Latvia Russia Poland Ukraine Czech Republic Austria India Germany France Estonia Lithuania Kazakhstan Greece United Kingdom Japan USA Belarus Georgia Uzbekistan Netherland

Scope of Workshops and Seminars

<div align="right">

Table 6
</div>

WORKSHOPS AND SEMINARS	
Workshop/Seminar	**Period**
International Aviation School was held in Transport and Telecommunication Institute (TSI) for students of the Aviation Management study program.	23/09/2019-27/09/2019
Within the framework of the RelStat'19 conference an ACT Training & Education Workshop & Managing Committee Meeting – MC5 of the WISE-ACT COST action was held at the Transport and Telecommunication Institute (TSI). WISE-ACT is the COST Action CA16222 focusing on the Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport.	17/10/2019-18/10/2019
Open seminar "The Practical Implementation of Managerial Solutions" was held in Transport and Telecommunication Institute by Vladislavs Klepačevskis.	15/05/2019
Guest lecture "A Need for Holistic Management Approach in Today's Aviation Industry" by "K.K. Aviation Ltd" Managing Director's Konstantinos Kalligiannis.	18/01/2019
International Forum "Next Generation of Aviation Professionals"	24/05/2019
Open Plenary session "Future Vision: Technologies and Education -Next 10 years"	06/09/2019
Seminar "5G un 6G: Modern and Future Telecommunication Technologies" was held in TSI for an academic and research staff of the Department of Electronics and Telecommunications, provided by the prof. Shahid Mumtaz from the University of Aveiro (Portugal)	24/09/2019
Guest lecture "World and Latvian Space Industry overview" was held in Transport and Telecommunication Institute by Kirill Bystrov, Co-founder and CBO of TimeTag.Space, representative of Latvian Space Industry Association (LAIK).	27/09/2019
Transport and Telecommunication Institute (TSI) participated in the Business Technology Fair RigaComm. During the exhibition TSI introduced visitors with Mobile Humanoid Robots NAO, Remote Control Drones, and other exciting technology solutions!	10/10/2019-11/10/2019

Scope of Courses

<div align="right">

Table 7

</div>

COURSES	
Course	**Period**
Course **"Decision making methodologies"** for master and PhD students by Eftihia Nathanail from University of Thessaly (Greece)	18/03/2019-22/03/2019
Courses **"Intelligent Systems and Deep Machine Learning"** for Bachelor students by Dr. Stefan Hermann Kuhn from Monfort University (UK)	7 October 2019 25/11/2019-29/11/2019 16/12/2019-19/12/2019
Course **"Smart IoT services"** for Bachelor students by Dr. Shahid Mumtaz from Telecommunication Institute of Aveiro (Portugal)	26 November 2019
Courses **"Modern Database Technologies"** for Bachelor students by Dr. Omar Yasser from Arab Academy of Science, Technology and Maritime Transport (Egypt)	27/11/2019-29/11/2019 30/10/2019-01/11/2019
Courses **"Data Structures and Algorithms"** for Bachelor students by Dr. Aliaksandr Puptsau from European Humanities University (Lithuania)	30/10/2019-01/11/2019 19/12/2019-20/12/2019
Course **"Big Data: lifecycle"** for master and PhD students by Prof. Neil Rubens from Stanford University (USA) and University of Electro-Communications in Tokyo (Japan)	30/10/2019-01/11/2019
Course **"Big Data Project: from Data to Product"** for master and PhD students by Prof. Neil Rubens from Stanford University (USA) and University of Electro-Communications in Tokyo (Japan)	30/10/2019-01/11/2019
Course **"Unstructured data analysis"** for master and PhD students by Dr. Shahaboddin Shamshirband from Norwegian University of Science and Technology, as well as visiting professor at Ton Duc Thang University (TDTU), Vietnam	04/11/2019-09/11/2019
Course **"Development in NET Environment"** for Bachelor students by Dr Ashish Seth, from School of Computer & Information Engineering in INHA University in Tashkent, Uzbekistan	25 November 2019

Course	**Period**
Course **"Global Supply Chain Management – Management of Sustainable Supply Chains and Multimodal Transportation"** for Bachelor students by Dr. Berdymyrat Ovezmyradov from universities in Turkmenistan and Japan.	13/12/2019-15/12/2019
On April 8, 2019, at the Transport and Telecommunication Institute (TSI), Dr. Jean-Luc di Paola-Galloni, a lecturer, leading expert and professional of Logistics, Transport and Mechanical Engineering of the Leading Engineering Company "Valeo" (France) and Co-Chair of the European Road Research Advisory Board (ERTRAC) held a presentation **"Future of Connected Automotive & Opportunities for R&D Projects in Connected Automotive"**.	08/04/2019
On May 31, 2019 at the Transport and Telecommunication Institute (TSI) was held guest lecture **„Populism as a vision of a world and a social movement. Research problems"** given by full Professor of Political Science and Religious Studies Maria Marczewska-Rytko from Maria Curie-Skłodowska University in Lublin, Poland.	31/05/2019

In compare with 2018, TSI has witnessed an increased participation at the international conferences, workshops and seminars/courses activities in TSI. The KPI above shows the TSI R&D sector progress in communication, cooperation, networking and knowledge sharing/transfer at the international level.

4. NATIONAL AND INTERNATIONAL COLLABORATION

4.1. National Collaboration

The table below indicates the most significant activities in collaborations and cooperation with research and academic organizations, enterprises and companies, both at local and international levels. In compare with 2018 annual period, there were more collaborative activities with enterprises, as well as growth in numbers of joint projects and collaboration with research/academic organizations.

Scope of national and international collaboration

Table 8

ORGANIZATION	COLLABORATION
National Research Organizations	**Type of collaboration / projects**
Institute of electronics and computer science	- Cooperation agreement
National Universities	**Type of collaboration / projects**
Riga Technical University	- Common Project Participation (EduRail); - Participation in Doctoral Review Committee - Joint Robotics Championship organisation
Rēzekne Academy of Technology	- Joint Robotics Championship organisation
University of Latvia	- Joint scientific articles - Participation in "RelStat 19'' Programme Committee
Vidzeme University of Applied Sciences (ViA)	- Participation in "RelStat 19'' Programme Committee - Collaboration Agreement in scientific and academic activities (Design of Doctoral program, researcher mobility, etc.)
Maritime Academy	- Collaboration Agreement in scientific and academic activities (Design of Doctoral program, researcher mobility, etc.)
BA School of Business and Finance	- Participation in "RelStat 19'' Programme Committee
Riga International School of Economics and Business Administration	- Participation in "RelStat 19'' Programme Committee
Latvian Agriculture University	- Collaboration Agreement in scientific and academic activities (Design of Doctoral program, researcher mobility, etc.)

Local Enterprises	Type of collaboration / B2B projects
"Accenture Latvia"	- Joint "Java" vocal training development - TSI "Career day" participation - Open lectures at TSI - Joint scientific seminars - Joint event management (e.g. "Action Days") - Student study visits to Accenture office
"X INFOTECH" Ltd	- Strategic partnership - Joint scientific work competition for TSI Students - Development of joint Laboratory IPB & ABC in TSI - Collaborative internship program - TSI "Career day" participation - Scholarships grants for TSI Students - Open lectures at TSI (IT, ICT topics) and student study visits to X Infotech office
Local Enterprises	- **Type of collaboration / B2B projects**
C.T.Co	- Joint event management (guest lectures)
Deloitte Latvia	- Joint event management (Science-to-Business seminar)
RoboLogic	- Collaborative applied research
French Institute	- Collaborative applied research

4.2. Scope of National Level Collaboration Projects

Table 9

Project	Type
Non-traditional regression models in transport modelling	National / Postdoc Latvia
Spatiotemporal urban traffic modelling using big data	National / Postdoc Latvia
Integrated Model for Energy Generation, Distribution and Management	National / Postdoc Latvia
Modernisation of Transport and Telecommunication institute STEM study programmes	National / Working Program 8.1.1.
Optimum planning of energy-intensive production process and optimization of electricity consumption depending on changes in the market price "ENERGOSERT"	National / Contractor
"MIRROR_NOVEL" In cooperation: "One-Two Software"	Cooperation agreement

Project	Type
Saules bateriju simulēšanas modeļa izstrāde (Development of solar battery simulation models) SIA „PVStream"	Consulting project
Mobility study, traffic assessment and update of the "SUMBA" simulation model, Rīgas Domes Pilsētas attīstības departaments	Consulting project

4.3. International Level Collaboration Projects

Scope of international collaboration in projects

Table 10

ERASMUS+ KA2	
TYPE OF COLLABORATION	FIELD OF SCIENCE
Spread your wings (SYW)	Research / education
Digitally supported and virtual study practices for modern logistic systems. "DIGILOG"	Research / education
INTERREG	
TYPE OF COLLABORATION	FIELD OF SCIENCE
Smart Logistics and Freight Villages Initiative (SmartLog)	Research
COST	
TYPE OF COLLABORATION	FIELD OF SCIENCE
Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport	Research / ICT
Project (15221) European Network for Research Evaluation in the Social Sciences and the Humanities (ENRESSH)	Social Sciences and Humanities
Project 15221 Advancing effective institutional models towards cohesive teaching, learning, research and writing development	Research / education
Project TU1408 Air Transport and Regional Development (ATARD)	Air Transport
Project 18236 Multi-disciplinary innovation for social change (SHIINE)	Social sciences
ESF	
TYPE OF COLLABORATION	FIELD OF SCIENCE
Strengthening Transport and Telecommunication Institute Academic Staff in the Areas of Strategic Specialization (STTIAS)	Research / education

4.4. Most Important Foreign Collaborators

Scope of important foreign collaboration

Table 11

ORGANIZATION	TYPE OF COLLABORATION	COUNTRY
Academic organizations	**Cooperation**	
University of Deusto	- Scientific and academic activities (visits)	Spain
Ecole Nationale Superieure des Mines de Paris, ENSMP	- Scientific and academic activities (visits)	France
Grenoble Alpes University	- Scientific and academic activities (visits)	France
Technical University of Munich Department of Civil, Geo and Environmental Engineering	- Scientific and academic activities (visits)	Germany
Transport Policy at Delft University of Technology	- Scientific and academic activities (visits)	Netherlands
Inha University in Tashkent	- Collaboration in scientific and academic activities in European Social Fund project "Strengthening Transport and Telecommunication Institute Academic Staff in the Areas of Strategic Specialisation	Tashkent
Norwegian University of Science and Technology	- Collaboration in scientific and academic activities in European Social Fund project "Strengthening Transport and Telecommunication Institute Academic Staff in the Areas of Strategic Specialisation	Norway
European Humanities University	- Collaboration in scientific and academic activities in European Social Fund project "Strengthening Transport and Telecommunication Institute Academic Staff in the Areas of Strategic Specialisation	Lithuania

Academic organizations	Cooperation	
Arab Academy of Science, Technology and Maritime Transport	- Collaboration in scientific and academic activities in European Social Fund project "Strengthening Transport and Telecommunication Institute Academic Staff in the Areas of Strategic Specialisation"	Egypt
Telecommunication Institute of Aveiro	- Collaboration in scientific and academic activities in European Social Fund project "Strengthening Transport and Telecommunication Institute Academic Staff in the Areas of Strategic Specialisation"	Portugal
De Montfort University	- Collaboration in scientific and academic activities in European Social Fund project "Strengthening Transport and Telecommunication Institute Academic Staff in the Areas of Strategic Specialisation"	United Kingdom
Tallinn University of Technology (TUT)	- Collaboration Agreement in scientific and academic activities - Joint Project collaboration (EDU-RAIL, SmartLog)	Estonia
University of Zilina	- Researcher and academic mobility	Slovakia
The University of Thessaly, Greece	- Collaboration Agreement in scientific and academic activities (Design of Doctoral program, researchers' mobility in EU Project Horison-2020, etc.) - Joint participation in H2020 Project Alliance - Double supervision for PhD student approbation - Joint Summer School in Riga for PhD and MS students - Finalizing Alliance Conference - Transport and Telecommunication Journal Board membership, reviewing	Greece
Regional Open Social Science University, Yoshkar-Ola	Organizing committee of the International scientific-practical conference	Russia
VSEI of Lublin	Researcher and academic mobility	Poland
Vilnius Gediminas Technical University (VGTU)	Conference/Workshop Mutual Participation	Lithuania

Academic organizations	Cooperation	
University POLITEHNICA of Bucharest	Knowledge Alliance in Air Transport Project	Romania
Margad University of Mongolia	Researcher and academic mobility	Mongolia
Samara State Technical University, Samara	Organizing committee of the International scientific-practical conference	Russia
Kyiv National Economic University named after Vadym Hetman; department of Strategic Management	Organizing committee of the International scientific practical conference	Ukraine
Research Institutes	**Cooperation**	
Fraunhofer-gesellschaft zur foerderung der angewandten forschung e.v.	- Collaboration in scientific and academic activities (Design of Doctoral program, researchers' mobility in EU Project Horizon2020, - Common participation in H2020 Project ("Alliance") - PhD workshop in Magdeburg, participation of students	Germany
Bulgarian Association for Management Development and Entrepreneurship	Research mobility	Bulgaria
Enterprises	**Cooperation**	
Training Center "Aviator"	- Collaborative project	Russia

4.5. Important Scientific Cooperation Events

"COST Action CA16222: Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport" in frame of the RelStat'19 conference

On October 17-18, within the framework of the RelStat'19 conference an ACT Training & Education Workshop & Managing Committee Meeting – MC5 of the WISE-ACT COST action was held at the Transport and Telecommunication Institute (TSI).

WISE-ACT is the COST Action CA16222 focusing on the Wider Impacts and Scenario Evaluation of Autonomous and Connected Transport. 70 participants of WISE-ACT COST action arrived at the meeting.

Courses "Big Data: lifecycle" and "Big Data Project: from Data to Product" for master and PhD students by Neil Rubens visiting professor and leading project manager at Stanford University (USA) on projects as well as founder of own startup sectormap.net in Japan

From October 30 Dr Neil Rubens at the Transport and Telecommunication Institute (TSI) conducted guest lectures in Big Data: lifecycle" and "Big Data Project: from Data to Product".

Course topics:

- Overview of Big Data Lifecycle Models (CRISP-DM, SEMMA, etc.)
- Data-centric Machine Learning (functional relationships between data, information, knowledge, and wisdom.
- Information Processing Approaches (bottom-up, top-down)
- Data Types (textual, media, relational, sensors, geo, etc.)
- Data Acquisition (sourcing, crawling, parsing)
- Data Preparation (error detection and correction, normalization, enrichment, linking)
- Data Evaluation (GiGo principle, sampling, assessment)
- Exploratory Data Analysis (visualization, summarization)
- Data Annotation (labeling, ontologies)
- Data Analysis Types (descriptive, diagnostic, predictive, prescriptive)
- Learning from Data (unsupervised, semi-supervised, supervised)
- Evaluation / Model Assessment (metrics)
- Error Detection and Analysis (accuracy, consistency, validity, robustness)

Course "Decision making methodologies" for master and PhD students by Eftihia Nathanail from University of Thessaly (Greece)

From 18 till 22 March 2019 Professor Eftihia Nathanail from University of Thessaly, (Greece) conducted a course "Decision making methodologies" for master and PHD students in Transport and Telecommunication institute (TSI).

Course topics:
- An Introduction to decision - making background, techniques, concerns
- Monetary-based techniques (cost-effectiveness and cost-benefit analyses)
- Multiattribute Utility Theory (MAUT)
- Multi criteria analysis (Delphi, Analytical Hierarchy Process, normalization)
- Decision making in transportation systems (transportation and logistics projects – EVALOG)
- Outranking methods (Electre, Promethee)
- Multi objective mathematical programming (optimisation using Solver and Sitation)

- Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)
- Monte Carlo Analysis
- Fuzzy Logic Method

4.6. Non-academic collaborations

Non-academic collaboration

Table 12

Name and Organisation	Type of collaboration	Country
Latvian Electrical Engineering and Electronics Industry Association (LETERA)	Membership, joint research	Latvia
International Airport "Riga"	Professional Master's in Aviation Management	Latvia
Latvian Information and Communications Technology Association (LIKTA)	Membership, joint research	Latvia
BITS (Baltic Information Technology Society)	Membership, joint promotion of research in STEM	Latvia
Informatics Europe	Membership, information exchange	Switzerland
European Conference of Transport Research Institutes (ECTRI)	Membership, information exchange, reviewing	EU
RAF-AVIA	Professional Master's in Aviation Management	Latvia
Association Latvijas Auto	Consultation	Latvia
Latvian Association of Remotely Piloted Aircraft Systems	Membership, Co-founder, Consultation, Projects.	Latvia
Latvian Aviation Association	Membership	Latvia
Scientific Training Consultation Center of Transport and Logistics (ZMKTLC)	Consultation	Latvia
Association of Paneuropa Coach Terminals	Member of Expert Board	Germany
Ltd. LEO Research Centre	Membership invited lectures, joint projects	Latvia
Ltd. "WING 4 SKY GROUP"	Professional Master's in Aviation Management	Latvia
ECTRI	Irina Jackiva is a Vice President of the association	Belgium
Ltd. "Airline Support Baltic"	Professional Master's in Aviation Management	Latvia

5. MEMBERSHIP IN BOARDS (JOURNALS, CONFERENCES, ASSOCIATIONS)

TSI research and academic staff continue actively participation in the various scientific committees of conferences, as well as in editorial boards of scientific journals, which is very important for continuously growth of expertise area and advanced knowledge sharing.

Table 13

Name	Journal
Igor Kabashkin	- Computer Modelling and New Technologies (ISSN 1407-5806), Latvia - Transport and Telecommunication (ISSN 1407-6160), Latvia - Journal of Air Transportation (ISSN 1093- 8826), USA, University of Nebraska at Omaha - Transport (ISSN 1392-1533), Lithuania, Lithuanian Academy of Science - Technological and Economic Development (ISSN 1392- 8619), Lithuania, Vilnius Gediminas Technical University - Aviation" (ISSN 1392-1534), Lithuania, Vilnius Gediminas Technical University - Journal "Transactions on Transport Sciences" (ISSN 1802-971X), Czech Republic, Ministry of Transport - Sustainable Spatial Development" (ISSN 1691-6174), Riga Technical University - Journal of Aviation Technology and Engineering" (ISSN 2159-6670), published by Purdue University Press, USA - Baltic Journal of Modern Computing (ISSN 2255-8950 electronic; ISSN 2255-8942 paperback), Estonia-Latvia-Lithuania
Irina Yatskiv	- Transport and Telecommunication (ISSN 1407-6160), Latvia - Mathematics in Engineering, Science and Aerospace (ISSN 2041-3165) - Maintenance and Reliability, Polish Maintenance Society (Warsaw) - Transport (ISSN 1392-1533), Lithuania, Lithuanian Academy of Science - Economics of Development, Kharkov National University of Economics - Sustainable Development of Transport and Logistics, Open Access Journal. ISSN 2520-2979
Alexander Grakovski	- Transport and Telecommunication (ISSN 1407-6160), Latvia
Jurijs Tolujevs	- Transport and Telecommunication (ISSN 1407-6160), Latvia
Alexander Andronov	- Automatic Control and Computer Sciences (ISSN 0146-4116), Latvia
Aleksander Stetjuha	- Economic Alternatives", ISSN 1312-7462 University of National and World Economy, Sofia, Bulgaria http://www.unwe.bg/eajournal/en
Irina Kuzmina-Merlino	- International Management Journals, United Kingdom, London. ISSN: 1742-528X (on-line Journals), IMJ Editorial Advisory Board http://www.managementjournals.com/editorialteam.htm

	- The Clute Institute, Journal of Business Case Studies, ISSN 1555-3353 (print); ISSN 2157-8826 (online) Reviewers' team http://journals.cluteonline.com/index.php/JBCS/about/displayMembership/39 - Emerald Emerging Markets Case Studies Journal, Reviewer http://www.emeraldgrouppublishing.com/reviewers/index.htm - The University of World Economy, Editorial Board of University Yearbook (research papers), ISSN: 1312-5486 (print); ISSN (on-line) 2534-8949 http://yearbook.unwe.bg - Journal "Forum Scientiae Oeconomia" , Warsaw, Poland (ISSN 2300-5947 - printed, ISSN 2353-4435 - online), reviewer http://www.wsb.edu.pl/reviewers,m,f,2039
Aleksandr Medvedev	- Journal of Traffic and Transportation Engineering. David Publishing Company. New York, USA – editorial board member - Interstate aviation committee member of Coordinating Council
Georgs Utehins	- Lublin Higher School of Economics and Innovation (WSEI) – editorial board member
Kristine Užule	- Scientific Journal of the Siberian Federal University (Russia) "Gumanitarnije nauki", ISSN 2587-6066, http://journal.sfu-kras.ru/series/humanities/editorial-board
Boriss Misnevs	- International Journal on Information Technologies and Security Special Issue № SP1/2017 ISSN 1313-8251 Indexed in ESCI of Thomson Reuters, co-editor - Journal of Educational and Instructional Studies in the World – WJEIS – ISNN: 2146 – 7463. - http://www.wjeis.org/?pnum=6&pt=Editorial%20Board - International Women OnLine Journal on Distance Education - WOJDE, ISSN: 2147-0367) - http://www.wojde.org/?pnum=5&pt=Editorial%20Board

5.1. Memberships in Program and Organization Committee of Scientific Conferences

TSI staff memberships in Programme and Organization Committees of scientific conferences

Table 14

Name	Memberships
Igor Kabashkin	- Programme and Organization Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat), Riga, Latvia - Programme Committee of the International Conference "European-Asian Transport Corridors: Trends. Strategies. Practices" - Transport Means 2018 - Programme and Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia - Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia

Name	Memberships
Irina Yatskiv	- Programme and Organization Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat), Riga, Latvia - Programme Committee of the International Conference on Dependability and Complex Systems (DepCoS-RELCOMEX), Wroslaw, Poland - Programme and Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia. - Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia
Alexander Grakovski	- Programme Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat), Riga, Latvia - Programme and Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia. - Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia
Jurijs Tolujevs	- Programme and Organization Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat), Riga, Latvia.
Boriss Misnevs	- Programme and Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia. - Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia - International Congress on Education, Distance Education and Educational Technology- ICDET, Antalya- Turkiye
Irina Kuzmina-Merlino	- The Clute Institute, Journal of Business Case Studies, Reviewers' team. http://journals.cluteonline.com/index.php/JBCS/about/displayMembership/39 - The University of World Economy, Editorial Board of University Yearbook (research papers), ISSN: 1312-5486 (print); ISSN (on-line) 2534-8949 http://yearbook.unwe.bg - Yaroslavl State University named after Demidov, Journal "Social and Human Knowledge", ISSN 2412-6519http://www.uniyar.ac.ru/science/scientific-journals/series-the-humanities/editorial-staff/ - Journal "Forum Scientiae Oeconomia" , Warsaw, Poland (ISSN 2300-5947 - printed, ISSN 2353-4435 - online), reviewer - Emerald's Emerging Markets Case Studies (EMCS). Editorial Advisory Board, Available at: http://www.emeraldgrouppublishing.com/products/case_studies/eab.htm. - Journal of Business Case Studies, The Clute Institute, Reviewers' team. http://journals.cluteonline.com/index.php/JBCS/about/displayMembership/39

	- The University of World Economy, Editorial Board of University Yearbook (research papers), ISSN: 1312-5486 (print); ISSN (on-line) 2534-8949 http://yearbook.unwe.bg - Journal "Social and Human Knowledge", Yaroslavl State University named after Demidov, ISSN 2412-6519 http://www.uniyar.ac.ru/science/scientific-journals/series-the-humanities/editorial-staff/ - International Strategic Management Conference, Prague July 12-14, 2018 Peer-Review Committee.
Aleksandr Medvedev	- Programme Committee of the Conference "Research and technology – step into the future", TSI Research and academic conference. - Inter- higher school scientific and educational conference "Actual problems of education" (TTI) – programme committee member
Georgs Utehins	- Programme and Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia - Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia - Lublin Higher School of Economics and Innovation (WSEI) – editorial board member, "Transportation systems and Information Technology"
Mihails Savrasovs	- Programme and Organization Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat), Riga, Latvia - Scientific Committee of the International Conference on Sustainable Urban Mobility, Volos, Greece
Dmitry Pavlyuk	- Programme and Organization Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat), Riga, Latvia
Ishgaley Ishmuhametov	- Member of the Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia - Member of the Programme and Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia - Member of the Programme Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat), Riga, Latvia - Member of the Programme Committee of the International Scientific and Practical Conference "Psychological Support of Education: the theory and practice". (Joint Conference with the TSI). Yoshkar-Ola: MOSI, Russia. - Member of the Programme Committee of the International Scientific and Practical Conference " Innovative Strategies for the Development of Economics and Management" (Joint Conference with the TSI). Samara State Technical University, Samara, Russia

Anna Palma	- Member of the Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia - Member of the Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia - Heritage & Tourist Destinations: Creative Approaches in Development - The International Scientific Conference Tourism and Innovations, University of Economics, Varna, Bulgaria. Peer reviewer
Jeļena Popova	- International Scientific and Practical Conference Cultural Heritage & Tourist Destinations: Creative Approaches in Development - The International Scientific Conference Tourism and Innovations, University of Economics, Varna, Bulgaria. Peer reviewer
Aleksandrs Stetjuha	- Member of the Programme Committee of the Conference "Actual Problems of Education", Riga, Latvia - Member of the Programme and Organization Committee of the Conference "Research and Technology – step to the future, Riga, Latvia - Member of the International Advisory Board of the Journal "Economic Alternatives", University of National and World Economy, Sofia, ISSN 1312-7462
Julia Stukalina	- Member of the Programme Committee of the Conference "Actual Problems of Education - MIP2018", Riga, Latvia - Member of the Programme Committee of the International Conference "Reliability and Statistics in Transport and Communication", (RelStat2018), Riga, Latvia

5.2. Prizes Awarded to Researchers, Honors and Scientific Positions of Trust

TSI Staff awarded with prizes and honors in 2019

Table 15

Name	Prize, position etc.
Irina Kuzmina-Merlino	Best Paper Award in the 9th International Conference on Leadership, Technology, Innovation, and Business Management (ICLTIBM-2019)

5.3. Memberships in committees and in scientific advisory boards of business companies or other similar tasks of no primarily academic nature

One of the most important outcomes and goals for TSI Research & Development program is support and knowledge sharing for business. R2B connections and communications is supported by participation of TSI Research/Academic Staff in business company's scientific advisory boards.

TSI Staff membership in scientific advisory boards of business companies and associations

Table 16

Name	Tasks
Igor Kabashkin	Scientific supervisor of Latvian Centre of Competence in Transport, Energy and Manufacturing
Irina Yatskiv	External expert in Association of Paneuropian Coach Terminals Member of Board, ECTRI
Alexander Grakovski	Member of Council of expert working group of the electronic communications sector (Latvian Ministry of Transport)
Aleksandr Medvedev	Telemātikas un loģistikas institūts Ltd. – board member Aviation Research Center Ltd. – board member Member of Latvian professorial association of higher schools
Ieva Kozlovska	Member of examination commission of the Latvian Association of Sworn Auditors

6. SUBMITTED PROJECT APPLICATIONS

Submitted Project Applications (2019)

Table 17

No	Application	Type of project/programme
1	Digit4Us: DigItal transport services for all users	Horizon2020
2	InDigT, Inclusive Digital Transport	Horizon2020
3	ePICenter: Enhanced Physical Internet-Compatible Earth-frieNdly freight Transportation answER	Horizon2020
4	LogiDrone	Commercial project (X5 Retail Group)
5	ShopSmartNote	Commercial project (X5 Retail Group)
6	RoboShoper	Commercial project (X5 Retail Group)
7	Application of artificial intelligence approach for cybercrime investigation	Mutual funds Taiwan-Latvia-Lithuania cooperation project
8	Development of solar battery simulation models	Voucher programme (LIAA)
9	Fire extinguishing aviation bomb	Voucher programme (LIAA)
10	Creation of inovative cash register demo device	Voucher programme (LIAA)
11	The Energy Food Transportation Nexus as a Solution in the Urban Environment (ENDURE)	Baltic-Nordic Energy Research Programme, Nordic Energy Research
12	Research and Development on Collaborative Self-Adopting Decision Supporting Platform for SMEs	SIA "Ministri", in frame of the .1.1.1. "Praktiskas ievirzes pētījumi" programme (3. kārtas ietvaros)
13	Intelligent Transport and Transport Management study module (INTELTRANS)	Interreg Central Baltic
14	Development of Model of Smart Economy in Smart Cities	1.1.1.2. pasākums "Pēcdoktorantūras pētniecības atbalsts" (PostDoc)
15	Robotic warehouse control system "LOGIDRONE"	Commercial project
16	"TRAVEL SAFE"	H2020

7. FINANCING OF RESEARCH

2019 TSI R&D Budget

Table 18

Financing	Amount EUR without VAT (21%)
Financing for the research	**913 551**
National budget financing	172 919
Revenues from contract work with another Latvian legal entities	57 022
Foreign financing (financing received from international organizations or international organizations contract basis, payments received from abroad on research activities)	678 663
Other funding for scientific work together: References from conferences, seminars, etc.	4 948