The 17th International Multi-Conference

RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION (RelStat’17)

18–21 October 2017. Riga, Latvia

Organised by
Transport and Telecommunication Institute (Latvia)
in co-operation with
Latvian Academy of Science (Latvia)

ABSTRACTS

Edited by
Igor V. Kabashkin
Irina V. Yatskiv

RIGA - 2017
Abstracts of the 17th International Multi-Conference *RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION* (RelStat’17), 18–21 October 2017, Riga, Latvia.

Transport and Telecommunication Institute
Lomonosova iela 1, LV-1019, Riga, Latvia
http://RelStat.tsi.lv


© Transport and Telecommunication Institute, 2017
PROGRAMME COMMITTEE

- Prof. Igor Kabashkin, Transport & Telecommunication Institute, Latvia – Chairman
- Prof. Irina Yatskiv (Jackiva), Transport & Telecommunication Institute, Latvia – Co-Chairman
- Prof. Irina Kuzmina-Merlino, Transport and Telecommunication Institute, Latvia – Co-Chairman
- Prof. Lutfihak Alpkan, Gebze Institute of Technology, Turkey
- Prof. Liudmyla Batenko, Kyiv National Economic University named after Vadym Hetman, Ukraine
- Prof. Maurizio Bielli, Institute of System Analysis and Informatics, Italy
- Dr. Brent D. Bowen, Purdue University, USA
- Prof. Inta Bruna, University of Latvia, Latvia
- Dr. Vadim Donchenko, Scientific and Research Institute of Motor Transport, Russia
- Prof. Ernst Frankel, Massachusetts Institute of Technology, USA
- Dr. Ilia B. Frenkel, Industrial Engineering and Management Department, Sami Shamoon College of Engineering, Israel
- Prof. Alexander Grakovski, Transport and Telecommunication Institute, Latvia
- Prof. Stefan Hittmar, University of Zilina, Slovakia
- As. Prof. Ishgaly Ishmuhametov, Transport and Telecommunication Institute, Latvia
- Prof. Dr. Nicos Komninos, Aristotle University of Thessaloniki, Greece
- Prof. Vulfs Kozlienskis, Riga International School of Economics and Business Administration, Latvia
- Dr. Gatis Krumins, Vidzemes Augstskola, University of Applied Sciences, Latvia
- Prof. Zohar Laslo, Sami Shamoon College of Engineering, Israel
- As.Prof. Nikolova Christina Lazarova, University of National and World Economy, Bulgaria
- Prof. Agita Livina, Vidzemes Augstskola, University of Applied Sciences, Latvia
- As. Prof. Jacek Mazurkiewicz, Wrocław University of Technology, Poland
- Prof. Massimo Merlino, University of Bergamo, Italy
- Prof. Boriiss Misnevcs, Transport and Telecommunication Institute, Latvia
- Prof. Dr. Andres Monzon de Caceres, Universidad Politécnica de Madrid, Spain
- As. Prof. Eftihia Nathanail, University of Thessaly, Greece
- Prof. Andzrej Niewczas, Lublin University of Technology, Poland
- Prof. Lauri Ojala, Turku School of Economics, Finland
- Prof. Ramunas Pašaitis, Vilnius Gediminas Technical University, Lithuania
- Asist. Prof. Dmitry Pavlyuk, Transport and Telecommunication Institute, Latvia
- Prof. Gunnar Prause, Tallinn Technical University, Estonia
- Prof. Olegas Prentkovskis, Vilnius Gediminas Technical University, Lithuania
- Prof. Svetlana Saksonova, University of Latvia, Latvia
- As. Prof. Mihails Savrasovs, Transport and Telecommunication Institute, Latvia
- Dr. Ilze Sproge, Transport and Telecommunication Institute, Latvia
- As. Prof. Julia Stukalina, Transport and Telecommunication Institute, Latvia
- Prof. Juri Toluyew, Transport and Telecommunication Institute, Latvia
- Prof. Tatjana Volkova, BA School of Business and Finance, Latvia
- Prof. Edmundas Zavadskas, Vilnius Gediminas Technical University, Lithuania

ORGANISING COMMITTEE

- Prof. Irina Yatskiv (Jackiva) – Chairman
- Prof. Igor Kabashkin
- Prof. Irina Kuzmina-Merlino
- Asist. Prof. Dmitry Pavlyuk
- Ms. Viktorija Gruzite – Organization Manager
- Ms. Irina Laletina – Programme Manager
Contents

Plenary Session

Smart Specialisation Strategies: An Online Platform for Strategy Design and Assessment
Anastasia Panori, Nicos Komninos, Christina Kakderi and Katharina Fellnhofer ........................................ 2

A Multistakeholder Multicriteria Decision Support Platform for Assessing Urban Freight Transport Measures
Efthia Nathanail .................................................................................................................................................. 4

Simulating Congestion on Public Transport Networks
Guido Gentile .................................................................................................................................................. 5

Session 1. Transport for Smart City

From Travel Time and Cost Savings to Value of Mobility
Tatiana Kováčiková, Giuseppe Lugano, Ghadir Pourhasem ........................................................................ 8

Contribution to the Improvement the Operation of an Urban Railway Line. Case Study: Constantine Tramway
Kahlouche Abdelaziz, Chaib Rachid ........................................................................................................... 9

Synchronisation of Timetables for Public Bus Lines Using Genetic Algorithms and Computer Simulations
Vitalii Naumov ............................................................................................................................................... 11

Modelling the Location of Charging Infrastructure for Electric Vehicles in Urban Areas
Larisa Grackova, Irina Oleinikova, Gaidis Klavs .......................................................................................... 12

The System of the School Routes’ Development and Their Safety Assessment
Irina Makarova, Ksenia Shubenkova, Vadim Mavrin, Aleksey Boyko .......................................................... 14

The Impact of Selected Road Freight Transport Management Measures for the Society and Environment
Tatjana Vasiljeva, Michael Minx ................................................................................................................. 16

Session 2. Sustainable Aviation and Maritime Transport

Risk Assessment of Emission Abatement Technologies for Clean Shipping
Sina Atari, Gunnar Prause ............................................................................................................................... 18

Strategic Energy Partnership in Shipping
Eunice Omolola Olaniyi, Patrick Gerber, Gunnar Prause ........................................................................... 19

Smart and Sustainable Cross-Sectoral Stakeholder Integration into Macro-Regional LNG Value Chain
Laima Gerlitz, Robert Philipp, Anatoli Beifert .............................................................................................. 20

Bypass Turbojet Operating Performance Simulation Based on Similarity Principles
Vladimir Labendik, Sergey Yunusov, Alexander Kolbasov ......................................................................... 22

Time Series Analysis and Prediction Statistical Models for the Duration of the Ship Handling at an Oil Terminal
Julia Rudničkaite, Tomáš Hruška ................................................................................................................. 24

Evaluation of the Risk Management Issues in the Seaports of Latvia and Lithuania
Darius Bazaras, Ramūnas Pališaitis .............................................................................................................. 26
Session 3. Reliability, Safety and Risk Management

Risk Management of Innovative Projects: New Aspects
Alina Konovalova .......................................................... 30

An Empirical Analysis of Time Headways on Two-Lane Roads with Mixed Traffic
Rupali Roy, Pritam Saha .................................................. 32

Advanced Structural Health Monitoring and Diagnostics of Transport, Industrial and Energy Facilities
Aleksey Mironov, Deniss Mironovs, Igor Kabashkin .................................................. 34

Estimation and Evaluation of Risk in the Railway Infrastructure
Piotr Smoczyński, Adam Kadziński ........................................ 36

Shared Risks at Interface between Railway Undertakings and Infrastructure Managers
Piotr Smoczyński, Adrian Gill .................................................. 38

Assessment of Road Safety Morale: Survey Analysis for Hungary
David Baranyai, Adam Torok .................................................. 40

Risks Associated with the Use of High-Strength Titanium Alloys in Transportation Systems
Mykola Chausov, Pavlo Maruschak, Olegas Prentkovskis, Myroslav Karpets .................................................. 42

Advanced Vibration Diagnostics for Perspectives of Helicopter Technical Maintenance
Aleksey Mironov, Pavel Doronkin, Alexander Priklonsky .................................................. 43

Session 4. Statistics and Modelling in Transport Applications

Markov-Modulated Linear Regression: Tasks and Challenges in Transport Modelling
Nadezda Spiridovska .......................................................... 46

Spatiotemporal Big Data Challenges and Solutions for Traffic Flow Analysis
Dmitry Pavlyuk ................................................................. 47

Wide-Scale Transport Network Microscopic Simulation Using Dynamic Assignment Approach
Mihails Savrasovs, Irina Pticina, Valery Zemlynikin .................................................. 48

Study on Riga Public Transport Service Reliability Based on Traffic Flow Modelling
Irina Yatskiv, Irina Pticina, Kateryna Romanovska .................................................. 49

Controlling the Cycles of the Traffic Lights in the Long Run
Alexander Novikov, Andrei Katunin, Ivan Novikov, Anastasia Shevtsova .................................................. 50

Modelling Kinetics of Dynamic Crack Propagation in a Gas Mains Pipe as Cyclic Random Process
Iaroslav Lytvynenko, Pavlo Maruschak, Olegas Prentkovskis, Andriy Sorochak .................................................. 52

Session 5. Multi Criteria Decision Making in Transportation

Multi Criteria Decision Making in Life Cycle Management of Modular Ships with Test System
Igor Kabashkin, Andrejs Zvaigzne .................................................. 54

The Analytic Hierarchy Process (AHP): Prospects for Application in Supply Chain Management
Valery Lukinskiy, Vladislav Lukinskiy .................................................. 55

Methodology for Assessment of Electronic Payment Systems in Transport Using AHP Method
Ivana Olivkova ................................................................. 56

Intellectualization of the Spare Parts Supplier Selection by the Analysis of Multi-Criterial Solutions
Irina Makarova, Ksenia Shubenkova, Polina Buyvol, Eduard Mukhametdinov .................................................. 57

Session 6. Smart Solutions for Supply Chain Management

Models of Inventory Management in Multi-Level Distribution Systems
Valery Lukinskiy, Vladislav Lukinskiy .................................................. 60
The Prediction Model of Express Letter-Mails Sent by Domestic Postal Services
Matej Pechota, Mária Matušková ................................................................. 61

The Development of Models of Supply Chain Management in Retailing
Tatjana Odintsova, Nataliya Kocherjagina, Olga Ryžová ........................................ 62

Factors Influencing Local Food Sales Through Green Public Procurement in Rezekne Municipality
Anda Zvaigzne, Inīta Krivašonoka, Inta Kojisne ................................................ 64

Determination of Parameters for Forming Right Allocation of Items in Picking Area
Raitis Apsalons, Genady Gromov ....................................................................... 66

The Importance of Mapping Regional Disparities and Regional Development: Case Study of the ICT Sector in the Slovak Republic
Emilia Madudova ................................................................................................. 68

Session 7. Intelligent Transport Systems

The Main Challenges of Winter Road Service to Be Solved Within the Framework of Intelligent Transportation System
Boriss Jelisejevs ................................................................................................. 72

Effective Wireless Communications for V2G Applications and Objects in Motion
Aleksandr Krivchenkov, Alexander Krainyukov, Rodion Saltanovs ......................... 73

Possibility to Ensure an Optimal Readability of Rfid Identifiers Placed on Logistics Units
Jiří Tengler, Peter Kolarovszki, Zuzana Kolarovszká, Marko Periša ......................... 75

Weigh-in-Motion by Fibre-Optic Sensors: Problem of Measurement Errors Compensation for Longitudinal Oscillations of a Truck
Alexander Grakovski, Alexey Pilipovecs ............................................................. 77

Experimental Study on Distributed Road Tracking System for Road Traffic Registration
Alexander Dudko, Irina Yatskiv, Yasushi Kiyoki ..................................................... 78

Introducing Fixed-Wing Aircraft into Cooperative UAV Collision Avoidance System
Dmitrijs Lancaster ............................................................................................... 80

Session 8. Telematics

Quantitative Analysis of the Competitive Environment in the Electronic Communications Sector
Lucia Madleňáková, Mária Matušková, Radovan Madleňák, Paweł Droździel .................. 84

The Analysis of the System That Includes Two Ferromagnetic Spheres in Outer Magnetic Field
Yury A.Krasnitsky ................................................................................................ 86

Model of Wireless Data Network in GPSS Language
Aleksandr Krivchenkov ...................................................................................... 87

Session 9. Innovative Economics

Industry 4.0 - for Sustainable Development of Lean Manufacturing Companies in the Shipbuilding Sector
Anatoli Beifert, Laima Gerlitz, Gunnar Prause .......................................................... 90

Corporate Governance Disclosures: The Case of Latvian Companies Listed on Baltic Stock Exchange
Ieva Kozlovska .................................................................................................... 92

The Influence of Visual Smog on Driver Distraction during Night
Radovan Madleňák, Dominika Hoštáková, Martin Hudák, Anna Rudawska .................. 93

Corporate Income TAX Impact on the Company's Financial Flow
Ilze Sproģe, Aina Joppe ....................................................................................... 95

The Role of Productivity in Increasing Latvian Competitiveness
Ilze Sproģe, Sandra Jekabsone, Irina Skribane .................................................... 97
Customer Satisfaction with Banking Services and its Estimation
Ishgaley Ishmuhametov ........................................................................................................ 99

Socially Responsible Investing and Public Pension Fund Performance in Latvia
Irina Kuzmina-Merlino, Svetlana Saksonova ........................................................................ 101

The Issues of Increasing the Effectiveness of Teaching Comparative Economics
Juris Balogailis .................................................................................................................... 102

Sustainable Issues of Business Growth in Power Industry
Liudmyla Batenko, Dmytro Yakovenko ................................................................................. 103

Strategic Management Issues for Small and Medium Business
Kirill Kunitsky ..................................................................................................................... 104

Ina Gudele ............................................................................................................................. 106

The Concept of Strategic Competitiveness Evolution in Conditions of Innovative Model of Economic Development
Anton Kasprirovych ............................................................................................................. 108

Social Models and Their Instability Due To the Properties of Complex Evolutionary System
Yelena Popova .................................................................................................................... 110

Digital Drivers of the Advertising Market: The Russian Realia
Nina Trubnikova, Natalia Konovalova .................................................................................. 111

Adjustment of Banking Activity According to Basel III Requirements: Experience and Problems of Eastern Europe Countries
Natalia Konovalova, Nina Trubnikova .................................................................................. 112

Session 10. Education and Training in Engineering

Career Management in a Technical University as an Essential Factor Influencing Its Competitiveness
Yulia Stukalina ........................................................................................................................ 114

Development of the Training Complex with the Content in the Format of Ontologies
Ilya Stepanov, Valeriy Khabarov .......................................................................................... 115

Learning Analytics and Software Engineering Competences
Boriss Misnevs, Aliaksandr Puptsau .................................................................................... 116

Ensuring the Academic Workforce Age Balance as a Personnel Management Tool
Oksana Pozdnyakova, Anatoly Pozdnyakov ........................................................................ 118

Integrating Interactive Teaching Methods into ADR Training Courses System in Estonia
Jelizaveta Janno, Ott Koppel .............................................................................................. 120

Mobile Education: Negative Effects of Multitasking
Kristīne Užule ..................................................................................................................... 122

Invited Session 11. Identification, Classification, Implementation and Cryptography Problems of Various Complex Systems

Automatic Gender and Emotion Recognition System as Important Factor for Safety Improvement
Jacek Mazurkiewicz ............................................................................................................. 124

Implementation Efficiency of BLAKE2 Cryptographic Algorithm in Contemporary Popular-Grade FPGA Devices
Jaroslaw Sugier ................................................................................................................... 125

Performance Comparison of Observer Design Pattern Implementations in JavaScript
Artur Zochniak, Tomasz Walkowiak ................................................................................... 126
Multistage Hammerstein–Wiener System Identification with the Help of Binary Excitation
Marcin Biegański, Grzegorz Mzyk .............................................................................. 127

Towards CLARIN-PL LTC Digital Research Platform for: Depositing, Processing, Analyzing and Visualizing Language Data
Marcin Pol, Tomasz Walkowiak, Maciej Piasecki.......................................................... 128

Invited Session 12. Sustainable Transport Interchange

Assessing the Design and Operation of Riga’s International Coach Terminal
Maria Tsami, Evelina Budilovich, Vissarion Magginas, Giannis Adamos, Irina Yatskiv (Jackiva)........ 132

Mechanisms for Investment in the Transport Infrastructure Development in Latvia
Irina Kuzmina-Merlino, Oksana Skorobogatova, Niels Schmidtke, Fabian Behrendt, ....................... 133

Smart Solution for 3PL Operators: State-of-the-Art
Aleksandrs Avdeikins, Mihails Savrasovs ........................................................................ 134

Analysis of Riga International Airport Flight Delays
Iyad Alomar, Juris Tolujevs, Aleksandrs Medvedevs ........................................................ 135

Big Data in Transport - Data Sources and Data Sets Used in Literature
Maria Karatsoli, Eftihia Nathanail .................................................................................. 136

Evaluating Smart Urban Freight Solutions Using Microsimulation
Ioannis Karakikes, Lambros Mitropoulos, Mihails Savrasovs ............................................. 137

Development Prospects of Road Transport in Kazakhstan as Part of the Strategy “Nurly Zhol”
Gani Askarov, Utegali Shedenov, Juris Tolujevs ........................................................... 138

Modelling and Simulation of the Riga International Airport to Reduce Turnaround Times of Crucial Clearance Processes
David Weigert, Alina Rettmann, Iyad Alomar, Juris Tolujev ............................................. 140
Plenary Session
SMART SPECIALISATION STRATEGIES: AN ONLINE PLATFORM FOR STRATEGY DESIGN AND ASSESSMENT

Anastasia Panori¹, Nicos Komninos², Christina Kakderi¹ and Katharina Fellnohofer³,⁴

¹ Intelspace Technologies SA, Balkan Center Building C
Thessaloniki, 57001, Greece

² URENIO Research, Aristotle University of Thessaloniki
Thessaloniki, 54124, Greece

³ Research and Innovation Management GmbH
Neumarkt an der Ybbs, Austria

⁴ Lappeenranta University of Technology
Lappeenranta, Finland

Keywords: smart growth; regional development, smart specialisation, strategy; platform, information flow

Strategy design and implementation is a complex and demanding effort and takes multiple forms depending on the organisation and the context of the initiative. Large companies, NGOs, utility companies, cities and regions, governments and international institutions, all these organisations use strategic planning methods and design strategies to succeed in their mission. Strategy design is characterised by uncertainty and ambiguity and requires transdisciplinary knowledge and skills, as there is a plurality of values and opinions to bridge within the organisation, many possible futures, and power games between interest groups internally and externally.

Information systems that support strategy design are becoming mainstream, but also more and more complex. A literature review of information systems for strategic planning reveals a series of factors that influence their success and shortcomings. Apart from pure information systems and dataset feeding the strategy with data, many other IT-based strategy design tools have become available, offline and online. They are used either as e-learning assistants or as step-by-step roadmaps to strategy elaboration.

Within this framework, the present paper focuses on Research and Innovation Strategies for Smart Specialisation and on online, web-based, environments that can support the design, implementation, and assessment of such strategies.

Smart Specialisation Strategies (S3) constitute the main growth approach of the European Union for the period 2014-2020. These strategies should be formulated by a process of discovery and innovation: as a process of ‘choosing races and placing bets’ rather than ‘picking the winners’. Consequently, strategy interventions should be informed and precise as possible, guided by evidence appropriate to the context, and outcomes that should be monitored and evaluated using quantitative and qualitative metrics and data. The elaboration of Smart Specialisation Strategies is exante conditionality for the ERDF investments of the Thematic Objective 1 (Strengthening research, technological development and innovation), but also it is relevant to exante conditionality of the Thematic Objective 2 (Enhancing access to, and use and quality of information and communication technologies) and TO 3 (Enhancing the competitiveness of small and medium-sized enterprises). Exante conditionalities are commitments that should be fulfilled in order to get financial support from the European Structural and Investment Funds.

The Online S3 Platform that we discuss in this paper is designed to address challenges and shortcomings of S3 implementation and assessment. It has been developed in the framework of a Horizon 2020 project (ISSI-4-2015). It is a web environment composed 30
software applications that enable a community of organisations, stakeholders, and users to go through the six stages of strategic planning, elaborate an informed S3 strategy, and monitor its implementation and impact (www.onlineS3.eu).

Deploying a connected intelligence approach, the Online S3 platform uses smart assistants and roadmaps to standardise and automate the tasks of strategy elaboration; give access to databases guiding the strategy formulation by evidence and datasets; and enable participatory design that awakes the potential for collaboration among users and organisations. With all these features, the Online S3 Platform creates a community of actants (people, organisations, machines) of higher creativity, effectiveness and collective intelligence. The paper will present the process and methods for the Online S3 platform development and the software applications and tools that support the S3 tasks and activities.
A MULTISTAKEHOLDERS MULTICRITERIA DECISION SUPPORT PLATFORM FOR ASSESSING URBAN FREIGHT TRANSPORT MEASURES

Efthia Nathanail

Transportation and Logistics Laboratory (TTLog)
University of Thessaly, Department of Civil Engineering
Pedion Areos, GR-38334
Volos, Greece
+30 24210 74164, enath@uth.gr

Keywords: freight transportation, city logistics, smart solutions, multicriteria evaluation, decision making

Urban road freight transportation significantly affects the quality of life in urban areas. City logistics constitute a major component in the urban economy, and when smartly implemented they may contribute in the city sustainability and liveability by alleviating traffic congestion and mitigating emissions and noise impacts. The present research aims at deepening the knowledge and understanding of urban freight transportation (UFT), and enabling guidance provision for selecting and implementing effective and sustainable policies and measures in a city. This is seen from the prism of an integrated evaluation framework, which has been developed for city logistics policies and measures. The framework assesses the complexity of UFT systems, through selected performance indicators, taking into account divergent stakeholder interests, conflicting business models and operations. Evaluation components are formulated in a hierarchical process; sustainability disciplines (economy and energy, environment, transportation and mobility, society), applicability enablers (policy and measure maturity, social acceptance and user uptake), criteria and indicators, capturing the lifecycle impact of the policies and measures. An index is estimated and reflects each evaluation component and stakeholder category; the overall performance of the policy and measure for the city is depicted in the Logistics Sustainability Index.
SIMULATING CONGESTION ON PUBLIC TRANSPORT NETWORKS

Guido Gentile

Sapienza University of Rome
DICEA, Via Eudossiana 18 – 00184 Rome Italy
guido.gentile@uniroma1.it

Keywords: dynamic network loading, public transport networks, vehicle capacity constraints, service run assignment, passenger queues at stops

Modelling the within-day dynamic of public transport systems is crucial for optimal real-time operations and predictive passenger information, as well as for off-line planning of the service.

In these contexts, the classical frequency based models (Nguyen and Pallottino, 1988; Spiess and Florian, 1989; Gentile et al., 2005) do not match some crucial requirements, such as: complying with strict capacity constraints, representing the congestion of passengers and vehicles at stops, providing the loads of single runs.

Schedule-based models using space-time networks, or diachronic graphs (Nuzzolo and Russo, 1998), offer a proper option for operation, but are not suited to reproduce congestion phenomena that affect travel times, because they are founded on the assumption that timetables are reliable. On the other hand, strategies and frequency based behaviour are observed in practice when users have no possibility or convenience in timing their arrival at stops with those of vehicles (Bell et al., 2012; Trozzi et al., 2014).

Some efforts have been made in the past to cope with single issues (a review of those can be found in Gentile and Noekel, 2016), but a comprehensive framework where to represent in a fully macroscopic model all relevant phenomena is still missing. The only available methods are based on agent microsimulation (Cats, 2011) and mesoscopic simulation (Leurent et al., 2012), which present some intrinsic limits of stochasticity, complexity and calibration.

In this paper we present a new kind of dynamic assignment model for public transport, including transit and pedestrian networks, that is capable of representing single runs, whose schedule is possibly affected by congestion. To this end we avoid introducing explicitly a diachronic graph, relying just on a spatial/functional graph, like in frequency based models.

More specifically, we here extend to transit networks the framework of the Link Transmission Models, so far applied only to road networks. The focus of LTM is the propagation, affected by congestion, of flows on the network, for given route choices. In this framework, both schedule based and frequency based behaviours can be implicitly simulated by properly setting time-varying splitting rates.

The core of the proposed Transit Link Transmission Model (TLTM) is the node model, which aims to reproduce the flow conflicts (congestion) occurring at bus stops and rail platforms, such as: passengers that fail-to-board or fail-to-sit due to vehicle overcrowding, vehicles queuing to serve a stop, doors opened longer to allow passengers alighting and boarding.
Session 1

Transport for Smart City
FROM TRAVEL TIME AND COST SAVINGS TO VALUE OF MOBILITY

Tatiana Kováčiková¹, Giuseppe Lugano², Ghadir Pourhasem³

University of Žilina, ERA Chair project on ITS
¹tatiana.kovacikova@erachair.uniza.sk
²giuseppe.lugano@erachair.uniza.sk
³ghadir.pourhasem@erachair.uniza.sk

Keywords: Value of travel time (VTT), time budget, daily travel pattern, time-use

Research on Value of Travel Time (VTT) is perhaps the most developed area within the studies on value of time. This knowledge has traditionally been regarded particularly valuable by decision-makers, transportation planners, engineers, and economists in the context of projects aiming at enhancing transportation infrastructure. As everyone spends much time on the move, engaged in leisure or work activities, travel time represents one of the largest costs of transportation.

Current VTT definitions and methodologies for its assessment and subsequent recommendations focus on time and cost savings related to the personal “Travel Time Budget” (TTB), the constant amount of time one invests in daily mobility. Less known is instead what value of travel time means for the end users, in relation to their needs, expectations, and lifestyles. Travel needs and preferences vary, for instance, people do not always consider more meaningful or pleasant time that is spent more efficiently or productively. One’s time valuation fluctuates, also for the same activity performed in different circumstances: time remains a largely subjective entity influenced by endogenous and exogenous factors. As perceived quality of time influences individual well-being (Mogilner and Norton, 2016), it is important to understand and reflect on own time-use, for instance to adjust habitual behaviour and to consider alternative choices that would better define individual’s needs, goals, and expectations.

The objective of this paper is to present how the MoTiV project recently granted by the EC within H2020 addresses time value following the emerging approach of estimating VTT from the perspective of a single individual with a unique combination of personal characteristics, habits, preferences, and expectations, in contrast with the classical viewpoint of the economic theories and utility maximization hypothesis. Its approach aims at achieving a broader and more interdisciplinary conceptualisation and understanding of VTT emphasising its “behavioural” component.

References
CONTRIBUTION TO THE IMPROVEMENT THE OPERATION OF AN URBAN RAILWAY LINE.
CASE STUDY: CONSTANTINE TRAMWAY

Kahlouche Abdelaziz, Chaib Rachid

Laboratory of transportation engineering and environment
Department of transportation engineering
Frères Mentouri University, Constantine, Algeria
+213776560836, kahloucheaziz@yahoo.fr

Keywords: urban railway transportation, adequacy offer / demand, optimization, tram of Constantine

The road transportation mode is being criticized more and more because of its major negative impact on the environment and the public health. Therefore, for the prospect of sustainable development, the attraction for the collective mode of transport has increased. The common urban mode of transportation (subways, tramways) has been undergoing major developments over the years because they are seen as better sustainable means of transportation. In big cities, the use of the public transport is unavoidable for several reasons: First, it improves the quality of the environment and at the same time protects energy resources. The tramway, for example, generates no atmospheric pollution, unlike cars. Furthermore, the use of the public transport allows the reduction of road congestions and the costs of transportation. Globally, it generates economic and social profits.

Constantine as a major city in Algeria profited from a modern urban means of transportation- the tramway, a line with a double track length of approximately 8 km comprising of 10 stations, which aim at improving the city’s public transport. This line increases the accessibility to the users of the zones and has a direct influence on the zones it serves. As it is a new mode of transportation in Algeria, improving the quality of its services and the satisfaction of its users represent the challenge to be taken up by the authors to encourage the citizens to increase their use of the public transport instead of the much preferred private means. For Constantine tramway to continually compete effectively, with reduction of road congestion and improved transportation offer in the city, the optimization of the following is essential:

- The attractiveness of the line through competitive offers, regularity, commercial speed and capacity.
- The economic viability of the line through a redistribution of resources and a better matching of its offer to its demand.

In this context, this work aims to propose a new optimization method for the operation of Constantine tram, based on the already achieved operating period. The objective of this work is to diagnosis the current operation of Constantine line and its performance, in order to improve adequate offer/demand. This work will be the first analysis of the tramway, a newly integrated mode of transportation service in Algeria.

References

SYNCHRONISATION OF TIMETABLES FOR PUBLIC BUS LINES USING GENETIC ALGORITHMS AND COMPUTER SIMULATIONS

Vitalii Naumov

Cracow University of Technology, Transportation Systems Department
str. Warszawska 24, 31155, Krakow, Poland
+48889976456, vnaumov@pk.edu.pl

Keywords: public transportation, timetable, synchronisation, genetic algorithms, computer simulations

Synchronisation of timetables for public transport is one of the main directions to enhance a quality of transportation services. Synchronised schedules of public transport lines could significantly reduce time spent by passengers waiting at transfer nodes for the next trip. Besides the increased quality of services, it leads to improvement of the vehicle’s performance.

According to the commonly used approach, the problem of the timetables’ synchronisation is being presented as an integer programming optimisation problem. Recently, in such a formulation, this problem was solved with respect to fluctuating passenger demand and different capacity of vehicles in order to minimize both the expected total passenger waiting time and the observed passenger load discrepancy (Lie and Ceder, 2016), in order to maximize passenger transfers and minimize bus bunching along the network (Ibarra-Rojas et al., 2016), and with objective to achieve a maximal synchronization amongst the buses and metro (Shen and Wang, 2016). Due to the complexity of the synchronization problem related to its big dimension, standard methods of an integer programming optimisation not always could be used for solving it in the real-world conditions. For this reason, artificial intelligence methods are being applied in order to obtain an acceptable heuristic solution, such as the ant colony model in combination with fuzzy logic methods (Teodorović and Lučić, 2005) or genetic-based algorithms (Wu et al., 2016).

In this paper, we propose a model of the bus lines synchronisation based on simulation of the public transport lines with genetic algorithms used as a tool to obtain the optimal solution. The proposed approach considers stochastic nature of the public transport technological processes and provides in a short time a solution close to optimal. The developed model is implemented in Python within the frame of a class library available in open access.

References
MODELLING THE LOCATION OF CHARGING INFRASTRUCTURE FOR ELECTRIC VEHICLES IN URBAN AREAS

Larisa Grackova¹, Irina Oleinikova², Gaidis Klavs³

¹ Riga Technical University, PhD student
Riga, Latvia, 11 Krivu street, LV-1006
+371 67558628, larisa.grackova@inbox.lv

² Institute of Physical Energetics, Smart Grid Research Centre
Riga, Latvia, 11 Krivu street, LV-1006
+371 67552011, irina@edi.lv

³ Institute of Physical Energetics, Laboratory of Energy System Analysis and Optimisation
Riga, Latvia, 11 Krivu street, LV-1006
+371 67558681, energy@edi.lv

Keywords: Electric vehicle; charging station; road transport; location assignment problem

The studies about establishing charging stations network in urban area by means of simulations are conducted by researchers in different countries. Different algorithms and limits are used in their models with the main attributes being: the providing the population with vehicles, the average daily mileage of a vehicle, the distance between the destinations, number of individual trips, opening hours and parking lot availability, technical indicators of the distribution network and etc.

This research attempts to develop a model for the optimal location of charging stations and distribution network in urban areas from an electrical vehicle user’s point of view. The proposed model focuses on the interaction between people’s behaviour, urban infrastructure and the power supply system. The input data, the charging station types and the models of road electric transport rely mainly on publically accessible data.

To evaluate the optimal connection points for charging stations the optimal transport theory algorithm was used. The performance of the model is implemented governed by the following criteria:
• The behaviour of car owners at the parking places within 24 hours is reviewed and analysed by cluster analysis.
• Technical indicators: charging types and the most common models of road electric transport are accepted for the calculations.
• The infrastructure of the charging stations is formed on the basis of the urban construction taking into account the location and distribution scheme of the transformer substations.
• The dynamics of changes in harmful emissions from vehicles development was investigated using the COPERT IV program as well.
• In accordance with two criteria - the optimal time of the battery charging (the degree of charging necessary for the owner of vehicles) and the number of charging stations (charging types – slow, medium, fast) at the places of traditional parking - the load necessary for the charging process is estimated (power consumption).

To provide the best solution during the process, the load is analysed, several options are tested and then the final choice is presented.

Having received the final version of the location of the infrastructure at the considered geographical location in the Calculation phase, the low, medium and high penetration demand for charges is estimated.
The load on transformers, voltage limits and parking availability patterns are taken into account to establish an optimal load pattern for EV charging-based reliability. This methodology has been applied to a residential low-voltage system.

The main finding of this work is that the number of fast charging stations needed for the urban is quite low. In its turn, the slow charging stations form a big part of the overall number of charging stations. Also, the results indicate that a smart charging schedule for EVs leads to a flattening of the load profile and peak load shaving.

Acknowledgements

This paper has been supported by the Latvia National Research Programme 2014-2017 "LATENERGI".

References

THE SYSTEM OF THE SCHOOL ROUTES’ DEVELOPMENT AND THEIR SAFETY ASSESSMENT

Irina Makarova1, Ksenia Shubenkova2, Vadim Mavrin3, Aleksey Boyko4

1,4 Kazan Federal University, Kazan, Russia
Naberezhnye Chelny, Syuyumbike prosp., 10a, +7-927-245-71-41, kamIVM@mail.ru
2 +7-960-059-73-65, ksenia.shubenkova@gmail.com
3 +7-927-671-90-26, vadim_mmite@rambler.ru
4 +7-927-491-15-59, boykoaleksey94@gmail.com

Keywords: school route, accidents, safety, multicriteria assessment, simulation

Children and teenagers are the most vulnerable road users among all types of city dwellers: 186 300 children become victims of the road accidents each year (World Health Organization, 2015). Since the main type of regular trips of children and teenagers are the trips to school, ensuring school routes’ safety is the main direction of the children’s safety improving. While solving this problem there are two main issues: the selection of the safest walking and cycling routes and ensuring safety of the school buses’ routes.

The program “Safe school route” is developed in many countries. Safe Routes to School programs began in Europe in the 1970s. The special attention should be paid to the projects of such cities, as Ljubljana (CIVITAS Initiative, 2013), Nova Gorica (Slovenia) (Eltis, 2016), Belgrade (Serbia) (Pedibus, 2013), etc. In the U.S., a federal Safe Routes to School program was established in 2005.

In constructing the routes to school it is necessary to choose the safest possible one. The categorization of the route can be performed according to the presence of different factors, complicating traffic conditions. Depending on the type of movement school routes may be walking, cycling, combined or by the School Bus. The combined route usually includes areas where the movement takes place by public transport, and the movement between the start (end) point and public transport, on foot or by bike. These areas are evaluated by different criteria groups, therefore, we propose a methodology a multicriterial evaluation of the safety of the route.

In the first stage the factors, which influence on the category of the route complexity, should be determined. The route assessment can be done with the help of a complex indicator, which is calculated as the weighted average:

$$K = \sum_{i=1}^{n} K_i \cdot \alpha_i$$

where \(K_i\) – the value of the \(i\)-th parameter, \(\alpha_i\) – weight of the index.

In order to summarize dissimilar indices in the formula their reduced values are calculated.

Adequacy of the route assessment will depend on the correctness of the selected factors and their combined inclusion. For example, the same route can be safer in the daylight than in the dark, in the summer than in the winter, etc.

Factors that influence on the safety of the walking and combined routes can include, first of all, the number and the type of crossings of the road. Despite the fact that pedestrian crossings are safe places for pedestrians where they are given priority, most often the deaths of pedestrians occur precisely during the crossing the road.
While developing routes of the school buses the factors that determine the level of the route’s safety can include the number of the areas of the route where accidents are likely to happen, statistical data on accidents, etc.

The selection of the best route relates to multicriterial optimization problems. To solve this problem it is necessary to use simulation methods as well as modern information technologies. The algorithm of the rational route selection as well as the algorithm of its safety assessment is offered in the article. Mathematical model of the school routes’ planning and the conceptual model of the system of school routes’ control and their safety’s assessment are also presented in the article. Proposed system is aimed at reducing the risks of dangerous situations while pupils travelling to school.

References
1. CIVITAS Initiative (2013) Safe routes to schools. Available at: http://civitas.eu/content/safe-routes-schools
THE IMPACT OF SELECTED ROAD FREIGHT TRANSPORT MANAGEMENT MEASURES FOR THE SOCIETY AND ENVIRONMENT

Tatjana Vasiljeva¹, Michael Minx²

¹ RISEBA University, Riga, Latvia
Tatjana.Vasiljeva@riseba.lv
² KEDGE Business School, France, Kedge
Michael.Minx@gmail.com

Keywords: road freight transport, telematics system, key performance indicators

Nowadays logistics, supply chain management and usage of various transport become the key components of every company constituting a considerable percentage of the overall costs that a company incurs in its daily business. Logistics accounts amount up to 15 percent of total expenditure of the largest industry sectors (Ameknassi et al., 2016) when the proportion of transportation achieves one to two thirds of the total costs of logistics. (Kherbach and Mocan, 2016). Gros (2016) believes that effective functioning of flow of goods is not conceivable without a functional transport.

The given research is focused on the studying the importance and the irreplaceable function of the freight transport industry with focus on transportation of goods by road.

Methodology of the research: Scientific and fundamental literature critical analysis; primary data gathered by Quantitative method (questionnaire) and Qualitative method (semi-structured interviews), Data analysis and Interpretation of the results. The research period was March – April 2017, when 129 respondents had answered the questionnaire and the managers of transport companies were interviewed.

The authors of the given research have formulated the conclusions and recommendations for three research questions (RQ).

RQ1: How road freight transport affects the society and how the community perceives the incentives to lower the impact of road freight transport on the society? RQ2: What management measures can be taken in order to ameliorate the fuel consumption KPI and what is their effectiveness? RQ3: What effect telematics has on road freight transport KPIs?

Practical implication: the results of the research could be valuable for top management of transport companies and other practitioners giving several recommendations for setting relevant key performance indicators (KPI) as effective management measures.

References

Session 2

Sustainable Aviation and Maritime Transport
RISK ASSESSMENT OF EMISSION ABATEMENT TECHNOLOGIES FOR CLEAN SHIPPING

Sina Atari¹, Gunnar Prause²

¹,² School of Business and Governance, Tallinn University of Technology
Akadeemia tee 3, 12618 Tallinn, Estonia
¹ +372 56388855, sina.atari@ttu.ee
² +372 53059488, gunnar.prause@ttu.ee

Keywords: SECA, green shipping, risk management, abatement investments, scrubber

Since 2015 Sulphur Emission Control Areas (SECA) were established in Northern Europe including the Baltic Sea where ships must use low sulfur fuel content not exceeding 0.1%. Consequently, ship-owners from Baltic Sea Region (BSR) currently face the challenge to comply with the SECA regulation which can be realized by two alternative solutions, namely by using to low sulfur fuel or by installing an exhaust gas scrubber. The technical abatement solutions are often related with high investments for the ship-owners which need strict evaluation from the investor’s side in order to achieve the investment goals. But the business decisions of technical realization are linked to risks.

Literature review reveals shortcomings in the investment risk evaluation for shipping sector in emission control areas so that the research of this paper is dedicated to recognize the existing investments risks, to clarify the essential investment calculations and to consider the risk attributes that need to be noted between the maritime stakeholders and ship-owners to get ready for adapting and complying with the new SECA directives. This would assist ship owners to simply choose and make the right investment decisions under uncertain business situations and reduce the risks of investment to the minimum.

The paper is based on primary and secondary data sources which were gathered by the authors during an EU project on the implementation of SECA regulations in BSR. The empirical measures include expert interviews, focus group meetings with specialists from shipping industry and case studies. The main findings of the research are presented in a comprehensive compilation of identified risks attributes in form of an analytical framework which discusses the categories of investment risks, value at risk as well as historical and parametric evaluation of risks.
STRATEGIC ENERGY PARTNERSHIP IN SHIPPING

Eunice Omolola Olaniyi¹, Patrick Gerber², Gunnar Prause³

¹,³ Tallinn School of Economics and Business Administration, Tallinn University of Technology
Ehitajate tee 53, 12616 Tallinn, Estonia
² EP Consulting OÜ, Jaama 12-4 11621 Tallinn, Estonia
¹ eunice.olaniyi@ttu.ee, ² info@epconsulting.ee, ³ gunnar.prause@ttu.ee

Keywords: Clean shipping, Emission reduction, EnviSuM project, SECA regulation, Maritimes Energy savings

The International Maritime Organisation (IMO) is employing a global clean shipping approach to reduce shipping emissions and to improve the Maritime’s carbon footprint. One of the important measures to achieve these objectives was the establishment of Sulphur Emission Control Area (SECA) in special parts of the world including Baltic Sea Region (BSR). Since 2015, ships are allowed only to use fuel with a maximal sulphur content of 0.1% in this area forcing the ship operators to use special bunker fuel like LNG or to invest in expensive abatement technologies like scrubbers.

Until now, most of the shipping companies utilised the low oil prices and used sulphur-reduced fuel, which are more expensive than the usual heavy fuel oil (HFO) to avoid the high investment costs and risks of other compliance technology. However, predictions are that oil prices may increase in which case ship-owners who have started using the LNG or the scrubber’s technologies will enjoy a competitive advantage over others due to the higher margins that can further increase with additional investments into energy efficiency. A new approach for ship-owners to safeguard their competitiveness on the transport market will be through the establishment of strategic energy partnership consisting of the ship owner and one or more other partners that will finance the necessary investments in the abatement technologies for all parties to obtain mutual benefits.

This paper tackles the research objective of how the strategic energy partnerships in the context of SECA regulations might look like and the way the strategic energy partnerships in shipping sector have to be structured to be successful. The research will focus on the scrubber technology and other related energy partnership models for the maritime sector. Since the authors participate in the EnviSuM project, which is on the assessment of the technical efficiency and the socio-economic impact of clean shipping solutions of the SECA regulations in BSR, the research will be empirically validated by expert interviews, survey results and case studies.
SMART AND SUSTAINABLE CROSS-SECTORAL STAKEHOLDER INTEGRATION INTO MACRO-REGIONAL LNG VALUE CHAIN

Laima Gerlitz1,4, Robert Philipp2,4, Anatoli Beifert3

1,2,3 Wismar Business School, Hochschule Wismar, University of Applied Sciences: Technology, Business and Design / Department of Business Administration, Wismar, Germany, Philipp-Müller-Str. 14
1 +49 3841 753-7297, laima.gerlitz@hs-wismar.de
2 +49 3841 753-7297, robert.philipp@hs-wismar.de
3 +49 3841 753-7634, anatoli.beifert@hs-wismar.de
4 Tallinn University of Technology, Ehitajate tee 5, Tallinn, Estonia

Keywords: LNG, value chains, clean shipping, alternative fuels, strategy, clusters

Since the introduction of lower sulphur content with no more than 0.10% in the Sulphur Emission Control Areas (SECAs) from 1 January 2015, the Baltic Sea Region (BSR) is increasingly becoming subject to search for new economically and environmentally competitive and survival strategies. This challenging situation is jeopardised by the fact that the BSR stands for a flagship maritime region in Europe in terms of good economic, social and environmental performance.

Paradoxically, an economic wellbeing and good environmental performance has been jeopardised due to intense shipping practices, ship operations and services, which, in turn, resulted from intensifying globalisation, trade and transport interactions. Echoing the International Transport Forum at the OECD (2015), waterborne transport will grow with 327% by 2050, thus producing 238% more CO₂ emissions. In Europe, freight volumes will increase by 2050 by 216% with 174% CO₂ emissions, respectively. Besides, there will be an enormous shift in commodity transportation. This is also expected in the BSR, even despite its current forerunner position among the European Regions (Ketels and Pedersen, 2016).

In order to sustain, and much more important, to improve the overall eco-system performance of the BSR, Liquefied Natural Gas (LNG) has been recognised as one of transitional measures, alternative strategies and business opportunities in maritime shipping and the entire transportation and energy system. LNG might become a viable stepping-stone alternative solution for business. It might be also considered as a regulation-driven demand to comply with environmental regulations that aim to achieve the goals set by 2020–2050.

Yet, just a few studies record approaches on LNG use as opportunity, value proposition leading towards emerging value chains that integrate different transport modes and business sectors, and where LNG is recognised as value proposition for all stakeholders involved. This bears a clear research gap. As a response to this, ‘Go LNG’ ERDF part-financed INTERREG V project aims at reducing technological, knowledge and business gaps by providing operational and strategic approach.

In line with the project, this paper sets out to provide with the grassroots concept on how the emergence of integrated LNG value chain in the BSR can be facilitated. Building a macro-regional transport value chain that connects into one chain different transport modes, diverse technological solutions and customers with varying needs in a smart and sustainable way, an integrated and sustainable LNG value chain might emerge. The concept addresses issues on opportunity recognition, value generation and proposition from LNG as an alternative. Additionally, peculiarities of emerging LNG value chain in the region are explored, evaluated and discussed.
The research employs qualitative research approach (case study). Building upon theoretical treatises on transport and business value chains, cluster and stakeholder network theories, researchers compare traditional LNG value chains and arrive at new forms emerging as a result of macro-regional and multidisciplinary stakeholders’ business interactions.

This makes the contribution of this paper more interesting and efficient, since the concept can be utilised by business stakeholders, transport and energy planners, managers and policy makers. It places also contribution to the scientific research, which is likely to be dominated by the single use of classical concepts and approaches. The proposed concept delivers rather a cross-sectoral approach addressing different needs of various involved stakeholders that act in transportation and energy system. The authors claim that this way is much more feasible, as the transport and energy sectors are not detached from intertwining per se and therefore cannot be treated isolated from one disciplinary perspective. It is rather an issue of an integrated cross-disciplinary and cross-sectoral perception, a network-oriented and experience sharing eco-system perspective.

References

BYPASS TURBOJET OPERATING PERFORMANCE SIMULATION BASED ON SIMILARITY PRINCIPLES

Vladimir Labendik¹, Sergey Yunusov², Alexander Kolbasov³

¹² Transport and Telecommunication institute
Riga, Latvia, 1 Lomonosov street,
¹ +371-29754804, Labendiks.V@tsi.lv
² +371-26435655, Yunusovs.S@tsi.lv
³ Rusline Technics LTD, Moscow, Russia
A.Kolbasov@rusline.aero

Keywords: bypass turbojets, operating performance, scaling theory, mathematical models, throttling, control systems

The possibility of using scaling theory when simulating operating performance of gas turbine-powered aircraft is considered. Scaling theory becomes especially significant when carrying out mathematic modelling of processes and phenomena running within air propulsion system controls.

It has been suggested to control thrust and engine fuel consumption by using similar modes of engine core (EC) and propulsion unit (PU) operation when calculating altitude-airspeed performance, with the subsequent usage of those values as basic ones under relative presentation of throttle performance (Labendik et al., 2000). As a criterion of control – thrust parameter – the usage of pressure drop in turbo compressor for a turbojet and in by-pass fan for a turbofan is proposed (Labendik et al., 2001).

It is noted that the similarity of EC and PU operating modes within GTE is individual. It may not extend to the entire engine, but it is feasible if there is no similarity of operating modes of the engine input and output modules. For example, if we consider similar operating modes of engine cores within a subsonic mixed-flow turbofan system, we may say that, at the critical flow of gas from uncontrolled exhaust system, the similarity of modes applies to the rest propulsion modules as well – like the turbofan proper and mixing chamber.

With respect to such a mode corresponding to the maximum rating, the formula of altitude and height variation of the engine thrust power has been developed. This expression can be used as a basic one to plot throttle characteristics of engine. By applying permanent values of a specific engine to that expression, we may include it into the algorithms of the flight navigation computer. Moreover, it was found that the dependence of the value of the relative throttle thrust on the relative pressure drop in turbocharger is a linear single-valued dependence at a specific flight Mach number.

To exercise engine control according to aerodynamic performance, it is necessary to determine the required thrust for different heights and flight speeds. Knowing the required thrust for a given flight mode, you can determine the absolute value of throttle traction. In general, it turns out that the thrust of a turbojet engine at any altitude and speed of flight can be derived, based on a fairly simple master curve.

A peculiar feature of presentation of throttle characteristics obtained is a strictly linear nature of engine throttle change, which is actually observed under all the engine operating modes. Therefore, for any ground-fixed mode of engine operation with the critical flow of gas from the jet nozzle, similar in-flight thrust rating may be established with a constant rotating speed of turbo-compressor.

Moreover, a method for determination of basic parameters (thrust and fuel consumption) has been considered with respect to a mixed-flow, twin-spool turbofan with a high bypass ratio, using similar mode of engine-related module. However, the method can be used only at critical
flow of gas from common nozzle. A method for direct finding the in-flight basic altitude-
velocity performance of engine has been proposed according to a unique formula which is based
on bench-scale mode indicators.

A benchmarking study of throttle propulsion performance of PS-90A engine at different
speeds and flight altitudes was carried out. Their linear character is determined as a function of
the fan pressure ratio as well as a slight rotation of the characteristics with respect to the number
M. At the same time, a satisfactory coincidence of the calculated values obtained by the
proposed procedure with those obtained by the traditional method of calculating altitude-speed
characteristics is recorded. Throttle characteristics relative to the basic similar mode of the
engine must be built for each specific engine in the form of dependencies on the degree of
pressure increase in the fan. These dependences are linear, but they have different slopes of the
lines.

It is convenient to use such generalized algorithms instead of approximations in airborne
computers – especially, in adaptive predictive systems for controlling manoeuvring airborne
vehicles and also in mathematical support of systems for diagnosing aviation gas turbine
engines (Yunusov et al., 2014).

References

through using similar mode of its operation. Proceedings of the International Workshop
“Aviation Reliability”, AvR’2000”, May 9-10, 2000, Riga, Latvia. Aviation Institute of

with major by By-Pass ratio aloft. Abstracts of the 7th International Conference “Airplanes

Gas Turbine Engines: Improvement of Models and Methods for Diagnosis of Gas Path of
Gas Turbine Engines. LAP LAMBERT Academic Publishing. Saarbrucken, Deutschland/
Germany, pp. 196.
TIME SERIES ANALYSIS AND PREDICTION STATISTICAL MODELS FOR THE DURATION OF THE SHIP HANDLING AT AN OIL TERMINAL

Julia Rudnitckaia¹, Tomáš Hruška²

¹ Department of Information Systems BUT, Faculty of Information Technology Brno, Brno, Czech Republic, Božetěchova 1/2, irudnickaia@fit.vutbr.cz
² Department of Information Systems BUT, Faculty of Information Technology IT4Innovations - Center of excellence Brno, Brno, Czech Republic, Božetěchova 1/2, hrus@fit.vutbr.cz

Keywords: time series, statistical models, ARIMA, time prediction, ship handling, oil terminal

This work relates to the whole series of papers aimed at creating a marine transport and logistics process map. This map is a reflection of a real process model (descriptive model) with the possibility of extension (scaling process), determination bottlenecks (traffic jam), detecting of deviations for operational response, representation of different perspectives (control-flow, resources, performance). Also, the map can be used as a basis for prediction and decision making systems. As the object of the study, the port module was chosen, namely its component part - the oil terminal. The analysed process includes the whole ship handling from the moment of its arrival to the port (activity Notice received) till the departure (operation Pilotage). Today there are a huge number of ways to model the processes and the main aim is searching of optimal and effective methods of modern intelligent analysis (from the field of Machine Learning, Data Mining, statistics, Process Mining) for building a process map. In the article (Rudnitckaia, 2017a), the process model in the form of an undirected graph for both general ship handling and the cargo one was constructed. Further in the article (Rudnitckaia, 2017b), effective methods for detecting outliers in data and methods of its handing were described.

The main point of this paper is to conduct research of time series and, then, to build statistical prediction model based on obtained characteristics. Such investigation is often conducted in medicine and economics. Practice shows, that the studying of such issues in marine transport logistics area is in demand. The investigation of the time series makes it possible to control the process that generates this series, to clarify the mechanism, situated in the basis of the process, to clear a number of outliers, and also to make predictions for the future based on knowledge of the past (Anderson, 2011). Today there are several dozen prediction models (not including hybrid ones) (Chuchueva, 2010). The choice of a suitable model depends both on the distribution of the data and on the useful information that it will bring.

At the beginning of the article, the analysed time series is presented, which shows the distribution of the ship handling duration for the last 3 years. The main components of the time series, an explanation of their values and their effect on the prediction model are given below. In this article, the famous statistical model auto regression integrated moving average (ARIMA) (Box et al., 2015) was chosen for the prediction. The paper presents the results of its application to the port data, the advantages and disadvantages are indicated. To assess the quality of the model, the cross-validation method is selected.

This analysis is not multicriteria and is conducted on the basis of one parameter - the ship handling duration. Since the whole period of ship handling is analysed, and not only cargo handling, the quantity of cargo and cargo type is not taken into account. The forecast can be called short-term, because it is based on historical data and any changes in the organization of processes or in the port infrastructure will lead to changes in the time series. In the future, it is also planned to apply structural prediction models (ANN, Markov chains, CART, GA) to
identify the most effective method. Moreover, adding of the new process attributes can improve the results of the model. Such analysis will lead to the creation of decision-making rules, determination of measures to improve the quantitative and qualitative dimensions of the process (in our case this is the ship handling duration).

Acknowledgements

This work was supported by The Ministry of Education, Youth and Sports of the Czech Republic from the National Programme of Sustainability (NPU II); project IT4Innovations excellence in science - LQ1602.

References

EVALUATION OF THE RISK MANAGEMENT ISSUES IN THE SEAPORTS OF LATVIA AND LITHUANIA

Darius Bazaras1, Ramūnas Palšaitis2

1, 2 Transport Engineering Faculty, Vilnius Gediminas Technical University
Plytinės 27, Vilnius LT-10105, Lithuania
1 +370 699 34797, darius.bazaras@vgtu.lt
2 +370 698 16448, ramunas.palsaitis@vgtu.lt

Keywords: ports; risk analysis; planning

Enlargement of international business and economic relations between countries are directly connected with the growths of international cargo transportation. Ports located in the Latvia and Lithuania act as a mediator in the expansion of trade connections of the most important transportation corridors between East and West.

Significance of the biggest Latvia and Lithuania ports as transport system hubs can be extended if it will be generated as safe and more favourable environment for business transforming ports as transit points to the logistics services. Transportation security, cargo safety and cost are the main factors influencing transit flows territorial distribution and stability. In pursuance to enhance the Baltic states importance in the European business context it must be created more liberal conditions for the transit cargo transportation through the Latvia and Lithuania ports and the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.

Risk assessments are very important to both logistics operators and Rescue Services and other Civil Protection, such as Customs, Border Guard, Coast Guard and Police and environmental agencies. Effective transportation and the transportation safety risk management in transport hubs can increase interoperability in transporting goods and persons in North–South and East–West connections based on increased capacity of transport and logistics actors.

For these reasons there is necessity to make the Latvia and Lithuania ports with hinterland infrastructure complex activities and service quality analysis in parallel with the analysis of the improvement of the interoperability of resources in case of emergencies and created the model for an all involved actors resource and risk management in emergency situations.

The problem aspects analysed in this publication cover diverse types of risks and factors pertaining to accidents in Latvia and Lithuania seaports. The ongoing international project HAZARD of the BSR INTERREG program provides favourable conditions to assess situations under analysis, data collection and formulation of respective scientific assumptions (Project Hazard 2017). To briefly present the project, it is worth noting that ports, terminals and storage facilities are often located close to residential areas, thus potentially exposing a large number of people to the consequences of accidents. The HAZARD project deals with these concerns by bringing together rescue services, other authorities, logistics operators and established knowledge partners.

HAZARD project aims at mitigating the effects of emergencies in major seaports in the Baltic Sea Region. The types of safety and security emergency include, for example, leakages of hazardous materials, fires on ships at port, oil spills in port areas as well as explosions of gases or chemicals.

Latvia and Lithuania ports are playing significant role in the serving transit transport flows in the East–West transport corridor. The biggest part of goods transported through the ports are transit goods: Klaipeda port - 41 %, Latvia ports - 57.8 % which belong to dangerous goods categories. Ports activities management system interfaces with the indicators connected
with the transportation safety and security in the port and are analysed insufficiently. The creation of the methodology of the assessment emergency situations risks in the ports will support multimodal transport safety issues including prevention and elimination of undesirable events (failure, accident, collision, disaster), minimization of their appearance risk and mitigation of their consequences.

References


Session 3

Reliability, Safety and Risk Management
RISK MANAGEMENT OF INNOVATIVE PROJECTS:
NEW ASPECTS

Alina Konovalova

P.G. Demidov Yaroslavl State University
Yaroslavl, Russia, ul. Sovetskaya, 14
89159694024, alinakonovalova9@gmail.com

Keywords: risk, risk management, innovative project, project implementation

Project-based approach is one of the most widespread approaches to promotion of innovations. Risk management in innovative projects is one of the most difficult tasks in project management due to high degree of uncertainty which is intrinsic to innovative projects. Depending on the phase of innovation’s life cycle, the parameters of innovative projects’ risk management change, which, in turn, results in the need to use various methodical tools.

Research in risk management of innovative projects usually faces with following difficulties:
- the innovative projects’ risk system, risk assessment and risk treatment methods directly and closely depend on the area of innovations’ application;
- on different phases of innovative project’s implementation a set of risks and risk-generating factors, which, in turn, requires different methodological tools of risk assessment and risks analysis (Marle and Gidel, 2015);
- risks, as an economic category, are heterogeneous, having the dynamic nature; as a result, the structure of risks, as well as their impact on the project’s key parameters may change in the course of time. These risk features are enhanced by the degree of uncertainty intrinsic to innovative projects (Allen and Gale, 1994);
- most risks of innovative projects are not subject to quantitative analysis with the use of mathematical models (e.g., a group of technical, technological, legal risks, force-majeure risks etc.)
- risk assessment methods described in the literature are discrete, and mechanical joining of commonly used methods of risk analysis and assessment is often impossible due to methodological separateness thereof;
- risk assessment operates static project data or the statistical sample is insufficient to effectively apply statistical methods of risk assessment;
- non-applicability of the probability theory based on the classic standard distribution for consideration of subjective (axiological) probabilities, intrinsic to innovation processes (Nedosekin and Abdulaeva, 2010).

To eliminate this issues the research develops the system of innovative projects’ risk management, which implies consistent and systematic realization of management stages and matching of assessment results with the risk treatment steps, taking into account the innovative nature of considering projects.

The survey contributes to achievement of the goal through solving following tasks:
- identification of key risks of innovative projects, which are intrinsic to the core project phases;
- adaptation, enhancement and development of methodical tools for assessment and analysis of the key risks of innovative projects;
- elaboration of enforcement actions matching with risk assessment results.

The developed risk management algorithm has visible advantages:
- it operates a set of risks subject to quantitative measurement and assessment;
- it includes the minimum required set of correlating assessment methods with the
The purpose of reduction of efforts required for the estimates and receipt of reliable results;
- it is based on the study of subjective axiological probabilities rather than beta distribution, which allows to estimate the statistical non-homogeneity of risk probabilities and innovativeness of the studied projects;

Generally it operates the parameters, which are uniform in project planning; so it may be adapted to different areas of innovations.

**References**

AN EMPIRICAL ANALYSIS OF TIME HEADWAYS ON TWO-LANE ROADS WITH MIXED TRAFFIC

Rupali Roy¹, Pritam Saha²

¹,² Indian Institute of Engineering Science and Technology
Shibpur, Howrah 711103, India
¹ +91-9804177397, rupaliroy.nit@gmail.com
² +91-9831942049, saha.pritam@gmail.com

Keywords: Two-lane roads; heterogeneous traffic; time headways; mixed distributions; goodness-of-fit

Time headway is defined as the time interval, expressed in seconds, between successive vehicles as they pass a point on a lane or roadway. It is an important microscopic traffic flow parameter which plays a fundamental role in many traffic engineering applications, such as capacity and level of service analysis, safety studies and also in simulation issues (Saha and Roy, 2017). Accordingly, there is a need to describe headways by a suitable statistical model (Ye and Zhang, 2009). Conventionally, negative exponential distribution is used for modelling headway data. However, there have been a number of researchers who reported the use of several other models in order to explain the headway distribution pattern more explicitly. This is quite relevant when the prevailing traffic is heterogeneous in character and car-following interaction is frequent at increased flow level, as usually observed on two-lane roads.

Over the years, traffic analysts across the globe have reported the necessity of investigating time headways more explicitly and they suggested several methods of headway modelling at different operating conditions. Principally, such models may have two forms: single statistical distribution and mixed models of two or more distributions (Zhang et al., 2007). The first one could be reasonably appropriate in the event of low flow when the traffic interaction is insignificant, whereas the second one characteristically exhibits its aptness if such interaction is considerable. This is attributable to the fact that although a single distribution is simple and easy to apply, there are several instances when performance of such distributions was not observed satisfactory due to their limited capabilities in approximating shorter headways.

Notably, most of the studies reported so far in regard to this are based on homogeneous traffic, thereby, making it intrinsic to investigate the effect of heterogeneity in the distribution models. Further, such effect aggravates in the event of heavy flow when interaction between vehicles is considerably high. This has been the motives of the present study wherein a field study was conducted on a two-lane highway in India. Observations indicate a large proportion of shorter headways in the data set and thus, manifest the need of modelling shorter and longer headways separately, thereby, developing a mixed model. The present study, consequently, made an attempt to interpret mixed distributions for modelling car-following headways on two-lane roads.

Empirical observations at moderate and heavy flow indicate that in the heterogeneous traffic existence of both following and free (non-following) vehicles is significant; this is because of wide variation in vehicular and driver characteristics which eventually results in frequent formation of platoons and a consequent increase in the proportion of shorter headways. Modelling of such data was, thus, hypothecated by a mixed model considering following and free components of headways separately. A comparative study with a series of important mixed models was conducted; they include Cowan M3, M4, Generalized Queuing Model, Semi-Poisson Model and Double displaced negative exponential distribution. The Double displaced negative exponential distribution and Cowan M4, were found to exhibit statistical validity in terms of goodness-of-fit test; K-S test with 5% level-of-significance was used as an appropriate measure of goodness-of-fit.
References


ADVANCED STRUCTURAL HEALTH MONITORING AND DIAGNOSTICS OF TRANSPORT, INDUSTRIAL AND ENERGY FACILITIES

Aleksey Mironov¹, Deniss Mironov¹, Igor Kabashkin²

¹ Vibroakustikas laboratorija, Riga, Latvia
  info@viblab.lv
² Transport and Telecommunication Institute
  1 Lomonosova street, Riga, LV-1019, Latvia
  kiv@tsi.lv

Keywords: Multi-patch Operational Modal Analysis, Structural Health Monitoring, Industrial structures, Structural diagnostics

Monitoring of transport, industrial and energy objects is important factor of operation safety and economic efficiency. Wind generators, radars, lifting/hoisting machines, ships and aircrafts are samples of such objects. All of them have two principal components: structural one that takes up loads, and operating aggregates doing useful work.

Actual monitoring systems to control aggregates of objects use operational integrated parameters like power, temperature, pressure, speed, etc. Such parameters are not able to detect an incipient failure of an aggregate and a fortiori to provide monitoring of its supporting structure. Therefore, for monitoring and diagnostics state-of-the-art systems apply dynamic signals of operating objects, including vibrations, deformations, pulsations, etc. Instantaneously varying in time dynamic signals respond to any small modification of an aggregate and may be indicators of failure. Proper data collection, development and interpretation are the main challenge for machines diagnostics techniques. The paper considers actual problems of typical aggregates of complex objects and an optimal approach based on the Vibropassport™ machine diagnostic technology.

Following a machine diagnostics in recent years the use of dynamic parameters becomes more applicable for Structural Health Monitoring (SHM). Applying low frequency parameters of vibrations measured on bridges and other structures someone develops monitoring techniques. Further development and propagation of SHM systems is complicated by needs in application of many expensive transducers and measurement channels. New technical solution for dynamic signals measurement (piezo-film deformation transducers), interrogation for data acquisition and advance approach to data interpretation (Operational Modal Analysis - OMA) allow further advancing of SHM systems.

New approaches to both aggregates and structures monitoring allow creation of advanced combined system for complex objects diagnostics. Such system using combined sensors network (CSN) and advanced data development techniques allows monitoring the states of both a structure and aggregates as a single object. To have the best cost-quality ratio, the CSN system needs application of most effective diagnostic techniques of machines and structures diagnostics from one side, and the most versatile and budgetary tools for measurement and data development.

Common and technical requirements to advanced monitoring and diagnostic system are considered based on practical application to operating radar tower in airport Riga. The prototype of the monitoring system is considered that is a combination of Vibropassport™ machine diagnostic techniques and Operational Modal Analysis (OMA) based SHM system using networked spatially distributed deformation sensors. Research study and natural scale system development stages are discussed. Experimental tests and diagnostic techniques successful application results are considered.
The condition-based maintenance (CBM) strategy with continuously condition-based monitoring with proposed CSN technology, is discussed in the paper. Markov chain reliability model for CBM strategy are analyzed. The paper introduces a decision-making approach for design of optimal integrated diagnostic architecture that combines maintenance decisions with CSN-based diagnostic system architecture and its integration with SHM mechanisms for achieving efficient system for maintenance and lowering life-cycle cost of study objects.
ESTIMATION AND EVALUATION OF RISK IN THE RAILWAY INFRASTRUCTURE

Piotr Smoczyński¹, Adam Kadziński²

¹,² Poznań University of Technology
Pl. Marii Skłodowskiej-Curie 5; 60-965 Poznań, Poland
¹piotr.d.smoczynski@doctorate.put.poznan.pl
+48695408949; fax +48616652204
²adam.kadzinski@put.poznan.pl

Keywords: risk analysis, safety management systems, railway infrastructure

Management of railway infrastructure in the European Union (EU) has to be performed in accordance with the regulations of the Railway Safety Directive, i.e. it has to be covered by a safety management system. The legislation specifies criteria which have to be met by such a system, the first being the implementation of risk-related tools. In fact, assessment of risk is seen as the basis for proper safety management system design, necessary for defining its objectives (Demicola et al., 2004). The concept of risk in railway infrastructure maintenance is studied from technical (Podofillini et al., 2006), as well as organisational aspects (Vatn and Aven, 2010).

The terminology used in the field of risk differs noticeably across scientific disciplines (Aven and Kristensen, 2005). In engineering context, risk assessment can be divided into two main parts (Aven, 2015):
- risk analysis: identification of hazards and estimation of their risk,
- evaluation of risk against predefined acceptance criteria.

There are numerous methods applied to assess risk, e.g. Failure Mode and Effect Analysis (International Electrotechnical Commission, 2006) and models used in occupational safety (Polski Komitet Normalizacyjny, 2011). All of them can be formally described in a unified way with the use of a generic risk model (Kadziński, 2013). Alternatively, adapting the generic risk model can be used to adjust the risk assessment to the specific domain.

In the paper we show a proposal of a risk model designed for estimation and evaluation of risk, which could be performed by railway infrastructure maintenance staff to identify the most urgent needs for maintenance works. For this reason, we propose to split railway lines into segments, according to their accessibility by emergency services:
- segments, where tracks are located at the same level as their surroundings,
- segments, where the tracks are in cuttings or on embankments,
- segments on bridges, viaducts etc.

Our proposal contains of five risk estimation criteria related to the possibility of hazard activation, as well as its anticipated consequences. The risk can be expressed as:

\[ R(z_k) = a_i \cdot r_i \cdot \sum_{i=2}^{5} a_i \cdot r_i, \]  

where \( z_k \) denotes the \( k \)-th hazard \( z \) which risk \( R \) is being estimated; \( a_i \) denotes the weight and \( r_i \) denotes the value of the risk component according to the criteria \( i = 1 \ldots 5 \). One of the criteria depends on the type of segment.

We believe that the model presented in this paper can be used as a basis for further discussion with specialists in the field of railway infrastructure maintenance.

Acknowledgements

All presented work is realized within the research project “Contemporary problems of operation, maintenance and safety of rail transportation systems”, No. 05/52/DSMK/0266,
co-financed by the Dean of the Faculty of Machines and Transport, Poznan University of Technology.

References

SHARED RISKS AT INTERFACE BETWEEN RAILWAY UNDERTAKINGS AND INFRASTRUCTURE MANAGERS

Piotr Smoczyński¹, Adrian Gill²

¹,² Poznan University of Technology
Poznan, Poland, Pl. M. Sklodowskiej-Curie 5
¹ piotr.d.smoczynski@doctorate.put.poznan.pl
² +48 61 6652017, adrian.gill@.put.poznan.pl

Keywords: risk; safety; safety management; safety management system; railway safety

The tendency of introducing safety management systems can be observed in many domains of human activity. In high-risk domains such as railways it would be highly desirable. The state railways were divided into independent entities which should compete and cooperate at the same time. Competition is needed for lowering the prices and generally making this means of transport more accessible, as proposed by the European Commission in the relevant white paper (European Commission, 2011). Cooperation, however, results directly from the railway system properties, where vehicles of several undertakings must share the same tracks and other infrastructure elements. The opposing goals of competition and cooperation are to be managed with the help of safety management systems, which were made mandatory for all the infrastructure managers and railway undertakings.

Even though safety-related research has been successfully conducted for many years, there is still no unified terminology for describing key categories and/or terms used in safety management. This is particularly true of terms such as hazards and their sources and risk. For example, Aven (2010) compares definitions of risk used across some scientific disciplines and proposes dividing them into three distinct categories. The approach used in Polish railway context treats risk as a concept based on events, consequences and uncertainties. In classical definitions the risk is a modelled, quantitative concept and depends on the probability of the activation of the hazard under assessment, as well as on severity of its foreseen consequences.

We conclude that the formalized description of the categories and/or the terms (especially hazards) should improve understanding of their nature and thus make the application of risk reduction measures more effective. Thus we propose a novel, standardised representation for describing so called ‘shared risks’, i.e. the hazards with sources, possible risk reduction measures and/or consequences which are not covered by one safety management system. In case of railways, we can distinguish three subdomains, which are covered by the proper safety management systems. Two of them are managed by an infrastructure manager and a railway undertaking, whereas the third one are the surroundings: road traffic, pedestrians, inhabitants, etc. The relationships between hazard sources, hazards, risk reduction measures and consequences are beginning to be much more complex if they are in different subdomains, e.g. covered by different safety management systems. In addition, the state like hazard can be dependent on one or several variables. It can have one or several different causes (called hazard sources or risk factors) and all the causes must occur at the same time to activate the hazard. The causes of hazards we observe in analysis domain as a physical, chemical, biological, psychophysical, organisational or human factors which presence, state or properties are the cause for formulating the hazard (Kadziński, 2013).

We consider that our concept will promote the cooperation of independent railway entities and can be used by them to guide potential interventions which aim to lower the risk in common-managed railway domain.
Acknowledgements

The research work financed with the means of statutory activities of Faculty of Machines and Transport, Poznan University of Technology, 05/52/DSPB/0259.

References

ASSESSMENT OF ROAD SAFETY MORALE: SURVEY ANALYSIS FOR HUNGARY

David Baranyai¹, Adam Torok²

¹,² Budapest University of Technology and Economics, Department of Transport Technology and Economics
Műegyetem rkp 3. St. IV. 408., Budapest, H-1111, Hungary
¹ david.baranyai@mail.bme.hu, ² torok.adam@mail.bme.hu

Keywords: traffic safety, questionnaire, undefended traveller, correlation

200 people - 129 women and 71 men filled out my questionnaire of 21 questions about Hungary’s traffic safety. The average age of the respondents is 37.7 years. Considering the level of education of the respondents more than 2/3 is learning in higher education at present, or has already graduated from the higher education (high school/BSc, university/MSc) or has even higher education. 86% of the respondents have some kind of a driving license. In respect of the undefended pedestrians traffic was given similar evaluation as passenger cars (6.84), while moving with motorbike and bike was evaluated around 5.7-5.9. In total road traffic safety position of Hungary was given an average evaluation of 5.82 on a 10-point scale. The respondents drive 6800 km on the average every year. They walk 2.4 km and cycle 6.1 km every day. The respondents gave about twofold overestimation of the yearly fatal road accidents in Hungary and they underestimated the accidents with serious outcome by 30%. The average of the responses referring to accidents with light outcome is almost equal to the real data. As to the question to the respondents whether the pedestrians and the cyclists are exposed to greater risks in traffic than the motorized vehicles (passenger cars, lorries...) 72 % of the participants answered yes. It can be stated that the respondents better observe the rules at a crossing with signal lamp when they are cyclists, than when they are pedestrians. 4 % of the respondents themselves suffered a road accident and there were 41% of them whose direct relatives suffered a road accident with personal injury in the period between 2009 and 2015. The number of accidents that happened to the direct relatives of these 82 respondents is 147. These included 84 accidents with light outcome, 36 with serious outcome and 27 accidents were fatal. It became clear during the correlation test that there is no considerable difference in the evaluation between those having or not having a driving license; the age and sex do not affect traffic safety judgement, but when examining the sex it was found that men gave safer traffic evaluation of Hungary. In addition to sex we found a slightly medium dependency on the residence. People living in the capital gave the highest value to the examined parameter. People feel weaker traffic safety with the smaller category of the settlement. It can be stated from the correlation index of 0.3 - 0.4 between traffic safety of pedestrians and cyclists, that the respondents gave consequent answers, because who gave higher evaluation to traffic safety, that gave higher value to the individual situations, too.

References


5. IBM (2014) *IBM SPSS Statistics 22 Core System User's Guide*


RISKS ASSOCIATED WITH THE USE OF HIGH-STRENGTH TITANIUM ALLOYS IN TRANSPORTATION SYSTEMS

Mykola Chausov¹, Pavlo Maruschak², Olegas Prentkovskis³, Myroslav Karpets⁴

¹ National University of Life and Environmental Sciences of Ukraine
   Kyiv, 03041, Ukraine

² Ternopil National Ivan Pul’uj Technical University
   Ruska 56 str., 46001, Ternopil, Ukraine
   Maruschak@tu.edu.te.ua

³ Vilnius Gediminas Technical University
   Plytinės g. 27, LT-10105 Vilnius, Lithuania
   olegas.prentkovskis@vgtu.lt

⁴ Frantsevich Institute for Materials Science Problems, National Academy of Sciences of Ukraine,
   Krzhizhanovs’kogo 3 str., Kyiv, 03680, Ukraine

Keywords: impact-oscillatory loading, dynamic nonequilibrium processes, (α + β) titanium alloys, mechanical properties

On an example of testing sheet high-strength (α + β) titanium alloys with different percentages of α and β phases, the danger of using titanium alloys with a large α phase content in transportation systems subjected to impact-oscillatory loading is shown. Under impact-oscillatory loading, dynamic nonequilibrium processes (DNP) with self-organization of the structure can be realized in titanium alloys. As a result, depending on the initial percentage of α and β phases in alloys, the impact-oscillatory loading can significantly affect fluctuations in the initial plastic deformation of the alloys upward or downward without appreciably reducing the strength of the alloy.
ADVANCED VIBRATION DIAGNOSTICS FOR PERSPECTIVES OF HELICOPTER TECHNICAL MAINTENANCE

Aleksey Mironov, Pavel Doronkin and Alexander Priklonsky

D un D centrs, Riga, Latvia
info@ddcentrs.lv

Keywords: vibration diagnostics, helicopter, technical maintenance

This paper considers different aspects of advanced vibration diagnostic system development, validation, promotion and application. Authors discuss the list of tasks for such system from the helicopter technical maintenance and repair point of interest. Main problems and possible solutions are considered, including uniform diagnostic platform for board and ground systems, life cycle traceability for helicopter aggregates, single survey diagnostics etc. The general view on advanced system is presented, based on the state-of-the-art and advanced techniques of vibration diagnostics and SHM. Resolution levels for helicopter power unit aggregates are considered based on solutions of the high-resolution diagnostics collected under Vibropassport™ brand. Authors discuss operating demonstrators of diagnostic techniques as well as application cases as the main tools for advanced system promotion and market entering.
Session 4

Statistics and Modelling in Transport Applications
MARKOV-MODULATED LINEAR REGRESSION: TASKS AND CHALLENGES IN TRANSPORT MODELLING

Nadezda Spiridovska

Transport and Telecommunication Institute
1 Lomonosova Str., Riga LV-1019, Latvia
+371-67100594
Spiridovska.N@tsi.lv

Keywords: Transport modelling, regression models, Markov-chain based models, Markov-modulated linear regression, external environment

Different models and modelling techniques are used in all four stages of the classical transport model. Regression models are widely used in two of them, i.e. in trip generation modelling and transport choice modelling (modal split). Still probabilistic-statistical models generally accept that parameters (regression coefficients in our case) of the model remain unchanged throughout the period of the process of viewing the model. However in practice these parameters usually changing randomly.

Markov-Modulated linear regression brings the idea that the regression model parameters do not remain constant throughout the period of model viewing, but vary randomly with the external environment, the impact of which is described by a Markov chain with continuous time and final state set. This assumption seems quite natural, because the "external environment" is a random in every day’s sense of this word.

This study attempts to identify the advantages and disadvantages of using Markov-modulated linear regression models exactly in transport modelling, comparing with classical regression models and stochastic Markov-chain based models as well. The research gives a vision of Markov-modulated linear regression model’s place in the transportation field, describing new tasks and challenges when facing to the different circumstances such as missing data or big data.

Acknowledgements

This work was financially supported by the post-doctoral research aid programme of the Republic of Latvia (project no. 1.1.1.2/VIAA/1/16/075 “Nontraditional regression models in transport modelling”), funded by the European Regional Development Fund.

References
SPATIOTEMPORAL BIG DATA CHALLENGES AND SOLUTIONS FOR TRAFFIC FLOW ANALYSIS

Dmitry Pavlyuk

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
+371 29958338. Dmitry.Pavlyuk@tsi.lv

Keywords: spatiotemporal models, big data, traffic flow modelling

Nowadays a wide network of distributed sensors and tracking devices provide overwhelming amount of geospatial data with high velocity. Modern urban traffic flow data include high-resolution values from hundreds traffic sensor loops, installed in different geopoints; thousands GPS car routes from traffic and navigation applications; millions of traffic-related short messages in social networks. As a result, traffic data volume and dimensions grow rapidly and data become more heterogeneous, which make application of conventional methods difficult and inefficient (Vlahogianni et al., 2015). Recently developed methods of big data processing also fairly weak and inefficient for spatiotemporal data as most of them don’t support even basic spatial properties and relationships. The problem of efficient big data processing and utilisation for modelling become even more important in combination with real-time requirements, peculiar to traffic analysis (Xu et al., 2015). Automated traffic lights control, variable speed limits and other methods of active traffic management require results of data processing in real-time, and weakly developed background of spatiotemporal big data processing creates obvious obstacles for their effective application.

In addition to general big data challenges, spatiotemporal data processing also poses statistical and computational challenges (Shekhar et al., 2015). Mining information from spatiotemporal datasets and estimating of statistical model parameters is more difficult than solution of corresponding problems for traditional data due to the complexity of spatiotemporal data types and relationships (Cressie and Wikle, 2011). Another related problem comes from continuous nature of spatiotemporal data, while classical statistical approaches normally assume discrete data.

In this paper we review recent techniques of spatiotemporal big data processing, focusing on their application to real-world traffic flow datasets. We identify most important methodological shortages of spatiotemporal big data processing, which can be considered as directions for intensive interests of the scientific community.

Acknowledgements

This work was financially supported by the post-doctoral research aid programme of the Republic of Latvia (project no. 1.1.1.2/VIAA/1/16/112 “Spatiotemporal urban traffic modelling using big data”), funded by the European Regional Development Fund.

References

WIDE-SCALE TRANSPORT NETWORK MICROSCOPIC SIMULATION USING DYNAMIC ASSIGNMENT APPROACH

Mihails Savrasovs¹, Irina Pticina², Valery Zemlynikin³

¹,²,³ Transport and Telecommunication Institute
Riga, Latvia, Lomonosov street 1
¹ +37167100584, Savrasovs.m@tsi.lv
² +37167100590, Pticina.i@tsi.lv
³ +37167100584, doggvalera@gmail.com

Keywords: simulation, traffic, dynamic assignment, wide-scale network

Traffic microscopic simulation is a powerful decision supporting tool, which could be applied for wide range of tasks. In a past microscopic traffic simulation was used to test local changes in transport infrastructure, but the growth of computers performance allows now to simulate wide-scale fragments of the traffic network. But this leads to the problem of how to simulate such a complex network. One of the possible solutions is to apply dynamic assignment (DA) approach in simulation. The DA is the approach, which is used to define the paths for the traffic flows throw the network. But use of DA puts additional tasks in phase of model development and application: 1) DA require use of origin-destination matrix (OD), it means that such OD matrix should be estimated; 2) the calibration process of the DA is complex, time-consuming and intuitive process, but to get a valid model for further use, this process should be completed obligatory. The goal of the current paper is to presents the case-study from city of Riga (capital of Latvia), which demonstrates the application of dynamic routing approach in the complex network simulation with use of DA. The simulation was completed in PTV VISSIM simulation software. VISSIM dynamic assignment module has a number of parameters and options, which could be used to control the behaviour of the model and do the calibration to get the valid model. There are a number of recommendations in the reports and guidelines (FHWA, 2012), (Transport for London, 2010) and software manuals (PTV Planung Transport Verkehr AG, 2012), how to set up parameters for dynamic assignment. But there are no one document which unites all recommendations of DA application in VISSIM, so the additional goal of the paper is to aggregate all the information regarding recommendations of VISSIM dynamic assignment module configuration.

Acknowledgements

This work was supported by Latvian state research program 2014-2017 project "The next generation of information and communication technologies (NexIT)".

References

STUDY ON RIGA PUBLIC TRANSPORT SERVICE RELIABILITY BASED ON TRAFFIC FLOW MODELLING

Irina Yatskiv¹, Irina Pticina², Kateryna Romanovska³

¹,²,³ Transport and Telecommunication Institute, Riga, Latvia, Lomonosov street 1

¹ Jackiva.I@tsi.lv
² Pticina.I@tsi.lv
³ kateryna.romanovska@inbox.lv

Keywords: public transport, reliability, punctuality, indicator, traffic model

Service quality in urban public transport system (PTS) is a matter of significant importance because an improvement of quality level can attract further users and reduce car dependency. It is important to measure the perceived quality offered by public transport for further developing data-driven and user-oriented strategies for improving quality level and planning solutions.

The objective of this research is the investigation an aspect of public transport service quality. The paper presents a methodology of assessment of reliability of Riga Public Transport System services using microscopic traffic flow modelling and constructing on the models outputs composite indicator. The system of indicators analysing the reliability on different levels in hierarchy: route -> transport mode -> PTS are developed. The set of indicators including descriptive characteristics of Travel Time, Arrival Time, Probability of non-delay etc are estimated on simulation models for down level of hierarchy: for each route of public transport. Then with calculated weights for routes the indicators are grouped in composite indicator of reliability for mode of transport and further - for UTS in whole. The routes weights are estimated on attributes like passenger volumes, route length, frequency, number of stops; the weights of transport modes - on passenger volumes and number of routes.

The proposed approach allows modelling and incorporating factors that influence the reliability such as weather, congestions, number of passengers etc. for evaluating reliability indicators on model.

Authors use the simulation model of Riga public transport system fragment developed on PTV VISION VISSIM software and using data from Riga traffic survey conducted at 2016.

The implementation this type of assessment provides Riga transport authority useful information about non-robust PTS fragments in context of reliability of PTS service.
CONTROLLING THE CYCLES OF THE TRAFFIC LIGHTS IN THE LONG RUN

Alexander Novikov¹, Andrei Katunin², Ivan Novikov³, Anastasia Shevtsova⁴

¹,² Orel State University named after I.S. Turgenev
st. Komsomolskaya 95, 302026, Orel, Russia
novikovan@ostu.ru, katunin57@gmail.com
+7-915-508-05-08

³,⁴ Belgorod State Technological University named after V.G. Shukhov
st. Kostyukova 46, 308012, Belgorod, Russia
ooows@mail.ru, shevova-anastasiya@mail.ru
+7-905-878-35-32, +7-910-321-81-77

Keywords: transport planning, methods of forecasting, population level, level of motorization, method of forecasting

Transportation planning is one of the most important directions for the effective functioning of the entire state. The transport system of cities is one of the directions for assessing economic efficiency, therefore, its coordinated work should be developed taking into account the long-term period of operation. Today, in the Russian Federation, transport planning and transport systems are given special attention. Due to the fact that the planning of many cities was carried out without calculating the current level of motorization, today this leads to a number of acute problems. In addition to effective functioning, special attention is paid to road safety. To date, the Russian Federation has a long-term federal target program, whose main goal is to reduce road deaths by 2020 by 28% (Federal targeted program, 2013). Achieving this goal should be carried out in a comprehensive manner, with consideration of all possible factors that have a negative impact on the transport situation.

The main purpose of this paper is to consider possible approaches to forecast changes in the transport situation, taking into account the long-term period of operation. In the Russian Federation, regulatory documents already exist that recommend using integrated schemes of traffic management in transport planning (Rules for the preparation of projects and schemes for organizing traffic, 2015). These schemes imply the development of several possible scenarios for the development of the transport situation in urban agglomerations and their evaluation by many criteria in order to determine the most possible (optimal) scenario for the development of the transport system. The main issues in the implementation of transport planning in urban agglomerations is the long-term functioning, which can be determined using the method of forecasting the intensity increase.

According to the analysis of scientific sources, there are a large number of approaches to determining the predicted value, in the work of Professor E.V. Dinges (Dinges, 2016) four methods are described in detail:
- method of extrapolation;
- method of multifactor forecasting;
- gravitational methods;
- methods of modelling (Shiftan, 2000).

The analysis of each group of methods showed that each of them has its own specific area of application. According to the performed studies of the application of each of the listed methods, when performing transport planning, the methods most relevant to the first group are the extrapolation method. Extrapolation is a method of scientific research, which is based on the dissemination of past and present trends, patterns, links to the future development of the forecasting object. Extrapolation methods include the moving average method, exponential smoothing method, least squares method.
The complexity of using these methods lies in the lack of a large amount of data on intensity for different years, this value is in constant change and is determined from past periods, on the basis of which it is possible to build a forecast of its change is not possible. In this connection, the author's team in the course of the research found that the very magnitude of the intensity directly depends on the population density. Data on the number of people are recorded annually, therefore, having determined the relationship of this parameter with the traffic intensity within a certain research object, it is possible to get the forecast value for a long-term period of operation.

For research and development of the forecast method, the densely populated district in the Belgorod region - the village of Dubovoe - was chosen. Using the example of a particular research object, it was established that the population of the population allows the method of medium squares. Calculations showed high accuracy of this approach.

In the course of the study within the framework of a specific facility, the authors established a direct relationship between population growth and the level of motorization, which makes it possible to determine the coefficient of increasing traffic intensity for a long-term period.

Using the developed forecasting method allows to determine the level of growth of motorization and express it through the intensity increase coefficient, which makes it possible to establish the predicted value of the intensity for a long-term period.

To assess the changes in the main parameters of the traffic flow in order to determine the prospective direction of using certain schemes of traffic management, especially when taking into account their complexity, it is necessary to determine these parameters, taking into account their future growth, taking into account the forecasting methods.

References

MODELLING KINETICS OF DYNAMIC CRACK PROPAGATION IN A GAS MAINS PIPE AS CYCLIC RANDOM PROCESS

Iaroslav Lytvynenko¹, Pavlo Maruschak¹, Olegas Prentkovskis², Andriy Sorochak¹

¹ Ternopil National Ivan Pul’uj Technical University
Ruska 56 str., 46001, Ternopil, Ukraine
maruschak@tu.edu.te.ua
² Vilnius Gediminas Technical University
Plytinės g. 27, LT-10105 Vilnius, Lithuania
olegas.prentkovskis@vgtu.lt

Keywords: model, cyclic random process, dynamic pipe fracture, crack propagation rate

The approach to the mathematical analysis of fracture toughness of the gas mains steel is proposed, which allows obtaining informative features of the quantitative evaluation of the dynamic pipe fracture kinetics, taking into account the stochastic and cyclic nature of the process. It creates the possibility to model the kinetics of crack propagation in the gas mains pipe and analysing individual stages of its growth.
Session 5

Multi Criteria Decision Making in Transportation
MULTI CRITERIA DECISION MAKING IN LIFE CYCLE MANAGEMENT OF MODULAR SHIPS WITH TEST SYSTEM

Igor Kabashkin¹, Andrejs Zvaigzne²

¹ Transport and Telecommunication Institute
Lomonosova 1, Riga, LV 1019, Latvia
kiv@tsi.lv

² Latvian Maritime Academy
12-k Flotes Street, Riga, LV-1016, Latvia
Andrejs.Zvaigzne@latja.lv

Keywords: modular ships, life cycle, test system

Modular construction is one of the popular methods used in shipbuilding industry. The modular ship construction (MSC) requires better than normal quality assurance that must be provided with special product testing. Test-related information is generated throughout the product life cycle for each level in the system hierarchy. The present paper introduces a multi-level decision-making approach for design of optimal test architecture for achieving efficient system for lowering life-cycle cost of modular ship construction. The effectiveness of such approach is investigated through the optimization of test system architecture for known reliability and economic dependence during life cycle of MSC.
THE ANALYTIC HIERARCHY PROCESS (AHP):
PROSPECTS FOR APPLICATION IN SUPPLY CHAIN MANAGEMENT

Valery Lukinskiy¹, Vladislav Lukinskiy²

¹² National Research University Higher School of Economics (HSE)
St. Petersburg, Russia
007(812)644-59-11(+61517)
¹ lukinskiy@mail.ru
² vladas27@mail.ru

Keywords: decision making, analytic hierarchy process (AHP), supply chain

Based on the analysis of the works (Bowersox and Closs, 1996; Lukinskiy and Lukinskiy, 2015; Saaty, 1990; Saaty, 1996; Taha, 2011), two approaches can be distinguished on the basis of which the logistics intermediary (LI) is selected: analytical, implying the implementation of choice using models that include a number of parameters, which characterize LI; expert, which is based on the assessments of an expert for the parameters characterizing LI, and describes the procedures for obtaining integrated expert assessments (ratings).

In turn, the expert approach includes at least three main methods: a ball-rating evaluation; the analytic hierarchy process (AHP) and the general mediator selection algorithm.

Let us consider the AHP in more details.

The most expedient way, in our opinion, to generalize the numerous AHP studies is by the formatting of a morphological table and the corresponding block diagram. It is known that the morphological analysis provides for the division of the problem into subsystems (characteristic features of P_i) and elements (alternatives to the realization of the features of A_ij). On the basis of the table, it is possible to investigate the significant (conceivable) number of variants, resulting from the construction of the AHP, which will allow, in turn, to take into account unobvious variants that can be missed with a simple search.

To realize the advantages of morphological analysis, it is advisable to supplement it with a block diagram that allows to concentrate the directions of the search for the most promising combinations of features and alternatives.

Thus, the AHP, despite its obvious benefits, requires further research so as it can be successfully applied in the management of supply chains.

References
METHODOLOGY FOR ASSESSMENT OF ELECTRONIC PAYMENT SYSTEMS IN TRANSPORT USING AHP METHOD

Ivana Olivková

VŠB - Technical University of Ostrava, Faculty of Mechanical Engineering
Ostrava, Czech Republic, 17. Listopada 15
+420 597 323 122, ivana.olivkova@vsb.cz

Keywords: Electronic payment system; public transport; multicriteria evaluation of variants; AHP method

The article deals with the quality of electronic payment systems in public transport. In this case, one of the expert methods of multicriteria evaluation of variants must be used. The AHP (Analytical Hierarchy Process) method was selected for evaluating the variants of electronic payment systems. This method is currently one of the most frequently used multicriteria assessment methods thanks its completeness, simplicity and wide range of uses.

The method AHP uses the decomposition of a complex unstructured situation into individual criteria, which are arranged in a hierarchical structure. This method was used to determine the weights of criteria that were set based on both carrier and passenger requirements. Saaty's paired comparison method was used at each level of the hierarchical structure to compare each criterion with the other criteria. The result of the comparison is the weight of the individual criteria.

In the next subchapters of the article partial evaluation of variants of electronic payment systems was made, the synthesis of these evaluations was presented and the most suitable variant was chosen. Finally, the advantages and disadvantages of the AHP method and the recommendations regarding its use in practice are mentioned.
INTELLECTUALIZATION OF THE SPARE PARTS SUPPLIER SELECTION BY THE ANALYSIS OF MULTI-CRITERIAL SOLUTIONS

Irina Makarova¹, Ksenia Shubenkova², Polina Buyvol³, Eduard Mukhametdinov⁴

¹,²,³,⁴ Kazan Federal University
Kazan, Russia, Syuyumbike prosp., 10a, 423822 Naberezhnye Chelny
¹ +7-927-245-71-41, kamIVM@mail.ru phones
² +7-960-059-73-65, ksenia.shubenkova@gmail.com
³ +7-927-450-86-05, skyeyes@mail.ru
⁴ +7-927-244-21-65, funte@mail.ru

Keywords: supplier, estimate, reliability, super-criterion, multiobjective problem, multi-criterial analysis

The quality of automobiles efficiency maintaining is largely determined by the effectiveness of the system providing dealer and service centres with spare parts. To minimize risks in the logistical system associated with late or substandard delivery of spare parts it is necessary to analyze the characteristics of suppliers and the distribution of the flow of requests for spare parts, taking into account the reliability factor of the supplier received by the control centre of the firm service system.

When evaluating the supplier’s reliability, many of the authors highlight the factors coming to the forefront when considering alternatives in decision-making. There are different methods proposed for multi-criteria analysis. Thus, the review (Ho et al., 2015) reports of researches using analytical and empiric methods for selecting of strategic suppliers. In other research of Dey, Bhattacharya and Ho (2015) it is said that evaluating of strategic supplier performance is one of the important functions within a supply chain, with the integrated QFD-AHP method being effective but needing a customized approach to adopt it within the industry. The authors Chai and Ngai (2015) were the first to implement the use of fuzzy methodology in the selection of suppliers. The authors Sarkis and Dhavale (2015) report that expert estimation is often made difficult by insufficient volume of available expert samples.

Despite the diversity of approaches, all these methods are based on expert estimation regarding the choice of priorities. The main drawbacks of these approaches are the element of subjectivity. The main factor in choosing a supplier should be its reliability, which is determined not only by the reliability of compliance with the terms of deliveries and organization of logistical processes, but also by the reliability and quality of the spare parts themselves.

The notion of “reliability of delivery” includes minimizing the delivery time in compliance with all requirements and logistical conditions. Delivery time can depend both on the decisions’ quality (choice of the optimal route and traffic schedule, choice of the transport type and the type of transportation, etc.), and on the characteristics of supplier location.

Since the choice of a specific supplier should take into account the ratio of characteristics such as price, delivery time, spare part quality, the decision-making process for selecting a supplier of a specific spare part is a multiobjective problem.

This implies the introduction of a super-criterion, i.e. a scalar function of a vector argument, also called a linear convolution.

Separating from the spare parts array those that constitute the group “interchangeable”, and having solved the task of the super-criterion optimization, the control centre of the dealer-service network can choose the supplier or the group of suppliers.
References


Session 6

Smart Solutions for Supply Chain Management
MODELS OF INVENTORY MANAGEMENT IN MULTI-LEVEL DISTRIBUTION SYSTEMS

Valery Lukinskiy¹, Vladislav Lukinskiy²

¹,² National Research University Higher School of Economics (HSE)
St. Petersburg, Russia
007(812)644-59-11(+61517)
¹ lukinskiy@mail.ru
² vladas27@mail.ru

Keywords: inventory management, integrated models

Traditionally, the theory of inventory management deals with the case of ‘isolated’ warehouses. In the supply chain, the central company (warehouse) is allocated, which deals with the processes of replenishment and consumption of reserves, determines the optimal periodicity of supply, the volumes of supplies and the size of the insurance stock. In other words, in such calculation models, it is assumed that decisions in the field of inventory management, taken with respect to the considered or so-called ‘isolated’ warehouse, will not affect the situation with the stocks of other participants in the supply chain.

A fundamentally new method for accounting for integral relationships between elements is the model of S. Axsäter (2006). Using the example of a two-level system for placing stock of a linear configuration, a dependence was obtained to determine the optimal order quantity, which was called the ‘echelon EOQ model’. The principle of operation of the echelon models is the same as for the classical model of the optimal order size (Harris, 1913).

The continuation of Axsäter’s research was reflected in scientific work of Lukinskiy et al. (2017), where modified variants were provided. They allow considering the following processes features: correlation variants of holding costs at the different system levels, various strategies of inventory warehousing and order multi-nomenclature.

The analysis of perspective directions of development of logistical integration within the framework of allocated logistics paradigms allows to establish the importance of the formation of mechanisms of management of integrated logistic functions, and also functional complexes. The complexity of the problem is determined by the variability of the types of interaction between levels in the investigated multi-level distributed systems, which in turn result in the variety of models of inventory management. They can be divided into three main subgroups: the first is with independent processes, the second is with coordination and the third - integrated models. Nowadays, supply chains, which are represented by the distribution system, are widespread in practice. The most common of them are two-level ones with a central supplier at the second and a certain number of companies at the first level. However, of practical interest are multilevel systems of the distribution configuration in which multi-nomenclature stocks are located.

References
THE PREDICTION MODEL OF EXPRESS LETTER-MAILS SENT BY DOMESTIC POSTAL SERVICES

Matej Pechota¹, Mária Matúšková²

¹,² University of Žilina
Žilina, Slovakia, Univerzitná 8215/1, 010 26
¹ ++412/41/5133145, matej.pechota@fpedas.uniza.sk
² ++412/41/5133145, maria.matuskova@fpedas.uniza.sk

Keywords: postal services, prediction model, express letter-mail, universal postal service, postal operator

Nowadays is necessary to improve postal services to be more competitive company on the postal market. Postal operator should deeply analyse situation on the market due to increased trend of electronic communication. The prediction model should be implemented, after analyse. We focused on express letter-mail sent by provider of universal postal service in this article, in this case Slovak post. Through prediction of this model, postal operator will be able to predict amount of express letter mails in selected period and also to predicted income in estimated amount of sent letter-mails.

Acknowledgements

VEGA 1/0721/15 Research on the impact of postal services and telecommunication convergence on regulatory approaches in the postal sector.

References

2. Achimský, K. (2011) Quality of postal services: Fórum manažéra, ISSN 1336-7773
THE DEVELOPMENT OF MODELS OF SUPPLY CHAIN MANAGEMENT IN RETAILING

Tatyana Odintsova, Nataliya Kocherjagina, Olga Ryzhova

Saratov State Technical University named after Yuri Gagarin
Saratov, Russia
007 (8452) 99-85-36
Odintsova.tn@mail.ru; sstu_ko4@mail.ru; helgaryzhova@gmail.com

Keywords: supply chain management, retail, modelling, algorithm

The modern phase of national retail trade is characterized by a high level of logistic costs, reduced consumer activity owing to the deteriorating economic situation in the country by market changes and active trade development. In the new context of national economic governance established patterns of supply chains in the retail cannot meet the new challenges. All this makes the actual development models of supply chain in retailing, design and use of different alternatives for the configuration of their network structure in order to achieve the maximum competitive advantage and strengthen market position.

Study and synthesis of theoretical research in the field of supply chain management allowed us to identify and articulate the specifics of supply chains in the retail trade. Organization and management of circuits of deliveries based on the integral approach to the rational movement of all types of flows in a circuit, creating a unique customer value, fully transparent, end-to-end distribution of risks and rewards members, mutual cooperation, a high degree of information sharing in the common endeavour to minimize the total cost of the whole chain (Stock and Boyer, 2009).

The supply chain retailers represent a complex network structure with distributed over a wide area of production, storage and transportation facilities, including a large number of suppliers and retail sales outlets. Integration and business process management in the supply chain provides a focus company.

Under high dynamics and patterns of demand external supply chain management retail requires a configuration change (reengineering) network, as well as the redesign of their structure, based on the use of combined methods of modelling. In practice, meeting the challenges of supply chain management requires simultaneous use of various concepts, methods and modelling tools.

The specificity of integrated commodity flows and business processes management in chains of retailers due to the complexity of the parameters (complex assortment, limited implementation period, seasonality, etc.) requires the development of analytical tools for modelling supply chains (Lukinskiy and Lukinskiy, 2012).

Formed by the authors of the design model of supply chain network design retailers, takes into account both the cost of the supply chain to achieve the selected format and restrictions associated with their administration.

Synthesis and analysis of various approaches to modelling supply chains allowed to clarify design of supply chains algorithm in networked structures of retail trade. The algorithm consists of the following steps:

- Analysis of commodity groups;
- Classification of resources;
- Analysis of suppliers;
- Selection of suppliers by type of commodity flows;
- The choice of strategy for each product group deliveries;
- Design of supply chains, taking into account sample suppliers depending on product groups;
- Designing business processes;
- Inventory Planning, taking into account the selected product groups and creating insurance reserves;
- Modelling supplies on the basis of demand forecasting;
- The effective delivery.

Modelling of supply chain network design using the proposed model has the following benefits: availability of goods, which is very susceptible to the buyer; increased responsiveness to inventory to sudden changes in demand; minimization of lost profits.

References
FACTORS INFLUENCING LOCAL FOOD SALES THROUGH GREEN PUBLIC PROCUREMENT IN REZEKNE MUNICIPALITY

Anda Zvaigzne¹, Inita Krivašonoka², Inta Kotāne³

¹,³ Rezekne Academy of Technologies
Atbrivosanas aleja 115, Rezekne, LV-4601, Latvia
¹ +37126307669, andazvaigzne@inbox.lv
³ Latvian Rural Advisory and Training Centre
Riga street 34, Ozolnieki, Ozolnieki rural territory, Ozolnieki municipality, LV-3018, Latvia
+37163050220, inita.krivasonoka@llkc.lv
³ +37129415644, inta.kotane@rta.lv

Keywords: local food products, factors influencing sales, green public procurement

In recent years both in the world and in Latvia, food consumption as close to the production site or local food is increasingly discussed among scientists and the general public. According to a number of authors, the demand for local products increases, and localness is one of the latest trends in the global food market (Knight, 2011).

Local food systems, in which the production, processing, sales and consumption of food products take place within relatively small distances, make a significant positive effect on the local economy (Kneafsey et al., 2013).

The economic aspects of local food depend on the performance of local farmers, and the demand for local and regional food has become the key driver in the farm- and community-based economy, creating new jobs and contributing to economic growth (Gómez and Zhang, 2000).

The research aim is to examine the factors that hinder local food sales through green public procurement in Rezekne municipality.

Local food systems support the local economy. The purchase of food from local farmers positively affects local entrepreneurship, while providing a significant income source for the local farmers; in this way, the viability of many small local agricultural holdings is maintained (Brown and Miller, 2008). Unlike large industrial-scale farms, small family farms prefer spending their revenues on local products (e.g. seeds, agricultural goods etc.); furthermore, food that has been grown, processed and supplied locally (e.g. for local schools), creates jobs and, in this way, stimulates the local economy (Halweil, 2002). Higher local economic activity and a greater number of jobs generate more tax revenue and create a stronger economic basis to support other enterprises and related institutions.

In Europe, the independent New Economics Foundation situated in London did a study on the economic effects of shopping habits, comparing shopping at a supermarket and a community-based agricultural system, such as, for example, the use of farmer produce in school catering. The study found that if choosing local produce, at least a twofold greater amount of finances remain in the local economy (Brown et al., 2013).

In the world and in Latvia too research studies (Krivašonoka and Siliņa, 2015; Krivašonoka and Zvīrbule, 2016) have been done on how the introduction of green public procurement (GPP) stimulates the development of a local region. GPP is an instrument that directly contributes to an increase in local produce sales.

The research results showed that there were various factors that hindered local produce sales through green public procurement in Rezekne municipality. The most important ones might be divided into two categories: local municipality factors and the wish of and the opportunity for local enterprises to participate in GPP.
Research methods used: monographic, descriptive, analysis, synthesis, statistical analysis, a sociological method – an expert survey. The present research was performed based on the results of the survey of experts, research papers and other information sources.

The research was elaborated with the financial assistance of Rezekne Academy of Technologies provided through a research grant for the „Opportunities for the Green Public Procurement of Food by Municipal Institutions in Rezekne Municipality”.

References
DETERMINATION OF PARAMETERS FOR FORMING RIGHT ALLOCATION OF ITEMS IN PICKING AREA

Raitis Apsalons, Genady Gromov

Transport and Telecommunication institute, Transport and Logistics department
Riga, Latvia, Lomonosova 1
+371 26527874, raitis.apsalons@inbox.lv, gromov@tsi.lv

Keywords: picking process, replenishment of items, picking route, locations, right allocation of items, criteria of allocation

Nowadays globalization is connected not only by use of different modes of transport or intermodal and multimodal transport, but also by development different methods of logistics in warehousing area. Right planning, organizing and controlling of picking process becomes vitally important. The key indicator for choose of any picking technology in the warehouse appears velocity of order lines picked per paid man hour. If number of order lines picked per paid man hour is relatively small, usually primitive picking technologies are used. Such picking technologies support physical picking system: walk and pick (Tomkins, 2003). Picking technologies here are: the paper picking, RFID picking or more developed picking technologies such as: visual picking, picking by voice (Harper, 2017). In this paper it is discussed picking area (PA) which is located into storing area (SA). This means that one row rack storing system available in the definite warehouse. Picking process will be realized by picking handling units (HU) and customer units (CU). The ground level and first level of pallet racks are used as PA. The one picking location of each item consists of 2 pallets: 1 pallet on ground level and second one on the first level of rack. The replenishment is appropriated for moving the items from SA to PA to avoid stock – outs in picking time interval. Therefore if definite item in picking location achieve critical level, replenishment starts by the signal in warehouse management system (WMS). This approach is called as Red Card principle (RCP) (Apsalons, 2012). The main purpose of paper is to determine one or more criteria for forming right allocation sequence of items into picking addresses corresponding by picking route. The definition of the scientific problem is to approve that those criteria for forming right allocation sequence of items into picking addresses can diminish total picking travel distance. The object of the research concerns the picking process. The subject of the research is allocation sequence of items into picking addresses.

At first for each item (SKU – stock keeping unit) at least one picking address has planned in PA (Rushton and Walker, 2007). The replenishment process can be realized by use of approaches of the layout of items in PA: either by the single picking location for each single item, when replenishment is realised in picking process or by various picking locations for each single item, replenishment is realised just only before picking process or after it. At the second there are several routing strategies, but not all of them are suitable for any situation (ERIM, 2017). The third, there are several picking methods (Dukic and Oluic, 2005). The fourth, authors have proposed criteria for forming right allocation sequence of SKU into picking addresses corresponding by picking route (Apsalons and Gromov, 2015). The criterion 1: the number of orders for each SKU. The criterion 2: the average volume of each SKU per picked order. The criterion 3: the total revenue of each SKU per quarter (forming of quarters depends on seasonal aspect). The criterion 4: the group of brands of SKU. The criterion 5: the key accounts of consumers. The criterion 6: the key accounts of suppliers. The criterion 7: the average turnover of each SKU in a day. The criterion 8: the size of each SKU. The criterion 9: the gross weight of HU or CU.

We would like to stress that this list of criteria does not mean that in warehouse for planning right allocation sequence of items into picking addresses corresponding by picking
route only one single criterion could be used. The logical algorithm of forming right allocation sequence of items contains various criteria. It has been developed by authors. However a choice of appropriate criteria and forming logical algorithm is unequivocally. It depends on picking systems, storing systems, from the speed of the turnover of each SKU, etc. There are some serious questions which will be as guidelines for building right allocation sequence of items into picking addresses corresponding by picking route: what is level of similarity of SKU; are items intended or ordered by few clients or delivery points; what kind of warehouse systems and racks will be planned in PA; what is the impact of size, weight and volume of each SKU; what is capacity of picking cars used in picking process; what is the impact of turnover of each SKU?

References
THE IMPORTANCE OF MAPPING REGIONAL DISPARITIES AND REGIONAL DEVELOPMENT: CASE STUDY OF THE ICT SECTOR IN THE SLOVAK REPUBLIC

Emilia Madudova

University of Žilina
Žilina, Slovak Republic, Univerzitná 1, 010 2, Žilina
00421415133116, Emilia.Madudova@fpedas.uniza.sk

Keywords: regional disparities; regional development; ICT sector

The paper deeply describes regional disparities of the ICT sector in the Slovak Republic and the importance of measuring these disparities due to the unequal localization of ICT firms in the individual regions of the SR.

Regional development contributes to increasing the region's competitiveness and reducing economic and social disparities. This should lead to economic, territorial and social development. Regional development cannot coincide with economic growth, but the economic growth can be defined as the main factor of the regional development. In order to describe the state of regional development, it is necessary to map regional disparities.

The existence of disparities leads to lower production and scarce use of available resources as well, but also differences in living standard. Differences in the standard of living lead to higher crime and to the excitement and dissatisfaction. Given the chosen and above-mentioned effects, the state needs to act and promote regional development through the regional policy in sectors, which are able to achieve positive economic profit in the future.

Automotive and ICT industries are the driving force of the Slovak Economy. The ICT industry in the Slovak Republic (according to the Statistical Office of the Slovak Republic) has been one of few industries in which the employment has continuously grown. This sector has the lowest unemployment rate of all sectors of the economy in the SR as well. As concerns a number of exports, the ICT sector follows the automotive industry by a narrow margin, with the relative share of imports as well as exports of the Slovak ICT sector being one of the highest in the world.

The results show, that that location of ICT firms in individual regions of SR contributes to higher employment, rising living standard and other positive economic influences conducive to economic growth in the regions and contributes to regional development.

Many authors have already been interested in concepts that include a variety of phenomena that can be evaluated through quantitative and efficacious indicators. This paper primary focuses on regional disparities and growth in the sector of ICT through the quantitative research (Localization Index, Localization quotient, Coefficient of specialization, Coefficient of concentration, Gini coefficient and Theil index).

Recent studies of European countries indicate that the contribution of the ICT sector to the regional economy slows the economic growth. On the other hand, some economists have recognized that technological change is one of the most important forces driving economic growth, together with human capital and knowledge accumulation. This conclusion can be found, for instance, in incorporated a knowledge factor as an input in the production function and found that, instead of generating a traditional diminishing returns on production function, human capital supports increasing return to scale investigated the output multiplier for ICT sectors and compared its value with the non-ICT sectors in the European economy and presented comparison between these two groups.

As findings shows, the ICT sector is the driving force of the Slovak economy and boosts economic development. All these factors mentioned above are the reasons why to pay attention to regional disparities in ICT sector in the Slovak Republic is so important.
Acknowledgements

This paper is published according to grants No. 1/0693/16 and 5/KS/2017.

References


Session 7

Intelligent Transport Systems
THE MAIN CHALLENGES OF WINTER ROAD SERVICE TO BE SOLVED WITHIN THE FRAMEWORK OF INTELLIGENT TRANSPORTATION SYSTEMS

Boriss Jelisejevs

Institute of Transportation Structures, Riga Technical University
Kipsalas st. 6B/6A, LV-1048, Riga, Latvia
+371 28354313, b.jelisejevs@gmail.com

Keywords: intelligent transportation systems (ITS), traffic information, road maintenance

Winter road maintenance as a set of routine network operations has a huge influence on mobility in snowy regions, providing certain safety level for road users and even possibility in critical weather conditions. Winter works’ budget for Latvian national roads for the last 5 years annually is about 20.5 mill.Euro or around 30% from all the allocations, aimed for road maintenance. This is still in-house service, that’s why it is strongly related to legacy approach, where innovations are not widely used there. The another bodies (mainly local municipalities) take care about their roads and especially big cities are facing with even higher and intensively customized winter service requirements, than Latvian road industry in general. In spite of quite well developed regulations and management processes, provisional criteria of service here still might be subjective, than it is for such thematically close, but much more discrete process, as construction works. The latest legislative incentives introduced proactive strategy (preventive anti-skid treatment of roads) in 2016, however there is not enough knowledge and tools to bring such method to practice, e.g. to be sure that decision-making is optimal for all the valid cases.

ITS already have a well-structured scope and clear development paradigm on pan-European level, that meet the challenges of road winter service also, bringing additional data and analytics to the field. The paper outlines the functional model, where the actual needs of winter operations meet ITS facets. As ITS is directly aimed to support road users and provide adaptive traffic management firstly, auxiliary processes may derive useful items, arisen from such principal topics as: big data, open data, indirect detection methods and industrial automation. Breakdown of the main problems, their mutual relations (including hierarchy) and potential solvers are listed in the proceeding. There is also the latest output from the author’s leaded project SmartE67 on use of variable message signs in hazardous weather conditions.

Acknowledgements

The paper covers research topics, worked out within the PhD thesis “Improvement of road winter maintenance model in Latvia".
EFFECTIVE WIRELESS COMMUNICATIONS FOR V2G APPLICATIONS AND OBJECTS IN MOTION

Aleksandr Krivchenkov¹, Alexander Krainyukov¹, Rodion Saltanovs²

¹Transportation and Telecommunication Institute
Lomonosova str. 1, Riga LV-1019, Latvia
+371 29210689, krivchenkovs.a@tsi.lv, krainyukovs.a@tsi.lv

²TransfoElectric SIA
+371 27178331, tankist@inbox.lv

Keywords: WPT-V2G, compensation, 802.11, network simulation, packets delay, effective wireless communications

Electrical Vehicle (EV) requires the development of a Vehicle to Grid (V2G) communication system for managing the EV charging sessions. In V2G systems when Wireless Power Transfer (WPT) technology for contactless energy transfer to mobile objects is used charging process takes place for vehicles that are really in motion. In this case for energy transfer support wireless data transfer channel between vehicle and is used and it is necessary to use some standard wireless technology for wireless network.

There are some restrictions for data transfer that bring real-time processes in WPT-V2G system. Data network architecture, the restrictions for data packets delay and jitter for technologies based on standard IEEE 802.11 are under consideration.

For WPT with technology ICPT (Induction Coupled Power Transfer) "compensation" mechanism can be used. It is based on periodic measurement of certain parameters in the inductively coupled circuits for their further correction with the aim to maintain the efficiency of energy transfer. In a specific for WPT use case the data exchange between modules can be used for managing the process effectiveness. Our objective was to determine the specific requirements for the wireless data transmission channel used in effective compensation process.

The nature of links based on the radio channels, the access to the shared resource of these channels, interference between them, and changes in SNR (Signal to Noise Ratio) cause variable available bandwidth, variable packet delay, variations in delays packet loss rate. This may prevent to the correct operation of time-sensitive control of compensation.

It is well known that the delay introduced by the network may degrade control performance or just make such control quite impossible (Krivchenkov and Saltanovs, 2014). The analysis and good estimation of the network bandwidth together with network latency will facilitate robust system designs.

In publication (Krainyukov et al., 2017) such analysis for the networks based on 802.11 standards was presented. In this paper the performances of the network based on 802.11 standards with influence of SNR (Signal to Noise Ratio) that is changed due to the motion of communicating objects is under consideration.

The analytical model for estimations and simulation model of the network is used for the network characteristics calculations. For simulation GPSS (General Purpose Simulation System) environment is used. The statistical data of total application data delivered to their respective destination every second, characteristics of link latency and others have been collected from the simulations. In different numeric experiments payload, wireless architectures, distances between hosts, physical layer radio link characteristics were changeable.

By analysing data from analytical, simulation and physical experiments some recommendations are made for choosing appropriate configuration parameters of 802.11 networks to achieve satisfactory relationship between bandwidth and packet delay for the WPT-V2G applications.
References


POSSIBILITY TO ENSURE AN OPTIMAL READABILITY OF RFID IDENTIFIERS PLACED ON LOGISTICS UNITS

Jiří Tengler\textsuperscript{1}, Peter Kolarovszki\textsuperscript{2}, Zuzana Kolarovszká\textsuperscript{3}, Marko Periša\textsuperscript{4}

\textsuperscript{1,2,3} University of Žilina, Faculty of operation and economics of transport and communications, Department of communications
Žilina, Slovak republic, Univerzitná 1, 010 26
\textsuperscript{1} +421 513 3121, jiri.tengler@fpedas.uniza.sk
\textsuperscript{2} +421 513 3119, peter.kolarovszki@fpedas.uniza.sk
\textsuperscript{3} +421 513 3120, zuzana.kolarovszka@fpedas.uniza.sk
\textsuperscript{4} University of Zagreb, Faculty of Transport and Traffic Sciences, Department of Information and Communications Traffic
Žagreb, Croatia, Trg maršala Tita 14, 10000
+385 1 2457 915, marko.perisa@fpz.hr

Keywords: RFID, logistic unit, readability, RFID tag, optimization

RFID technology is a part of automatic identification, which is increasingly playing an important role in all areas of the national economy. This article deals with research of passive RFID technology in conjunction with logistic unit and their optimal reading. In order to ensure the optimal readability of RFID identifiers, it is necessary to deal with parameters that effect it. The aim of our research was to identify the most important parameters that affect the readability of the RFID identifiers. Thus, not only the influence of a particular parameter, but their combination. The main parameters we examined were the speed of the RFID antenna, logistic unit content, location of the RFID identifier on the logistic unit, type of RFID identifier, number of RFID antennas, RFID antenna position, auxiliary reflective surfaces and more. Part of this article is also a complete description of the measurement methodology and evaluation of the data. At the end of this article, we design and describe the optimal parameter settings for optimal reading of RFID identifiers for logistic units. These proposals are implemented in 5 case examples.

Acknowledgements

This article was supported by projects:
- Institutional Research 6/KS/2017 – Postal container with smart technology;

References

and transport engineering, Belgrade, Serbia, November 2016. Belgrade: City Net
   active and passive UHF RFID tags. Transport and Telecommunication. Vol. 17, pp. 144-
   154. DOI 10.1515/ttj-2016-0014
   traceability of logistics items through new technologies. Procedia - Social and Behavioral
WEIGH-IN-MOTION BY FIBRE-OPTIC SENSORS: PROBLEM OF MEASUREMENT ERRORS COMPENSATION FOR LONGITUDINAL OSCILLATIONS OF A TRUCK

Alexander Grakovski, Alexey Pilipovecs

Transport and Telecommunication Institute
Riga, Latvia, Lomonosova 1, Riga, LV 1019, Latvia,
+371 67109394, avg@tsi.lv

Keywords: weigh-in-motion, fibre-optic sensors, measurement errors, longitudinal oscillations

Methods and systems for weighing in motion (WIM) are practically used for automatic control of the weight of vehicles passing by the road from the end of the 20th century (Malla et al., 2008). Modern types of sensors (piezoelectric, quartz), as well as fiber-optic sensors (FOS) allow to measure the total weight of the machine with relatively high accuracy of about 1-2% as the sum of the weights of all axes.

However, when measuring the weight of each axis separately (as it is required to check the compliance of the load values to each axis with the law), measurement errors can reach 10-20%, which is not permissible and introduces limitations of WIM’s capabilities to preselection aims only (allocating potentially overloaded transport for subsequent verification by official stationary weighing).

The functionality of new generation fibre-optic sensors (FOS) is based on changes in the parameters of an optical signal due to deformation of the optical fibre under the weight of a passing vehicle. Recorded signals from a group of FOS of a passing truck with various speeds and known weight of preliminary weighed reference vehicle are used as an input data. The results of a truck tyre surface contact patch reconstruction allows to the axle weight-in-motion estimation with the accuracy of less than 10% (Grakovski et al., 2015).

Moving vehicle’s dynamics model of “inverted lever pendulum” and the impacts of external conditions (speed of vehicle, temperature, tyre width etc.) as well as the longitudinal and transverse oscillations as the main source of measurement errors are in the focus of this research. The shapes of tyre footprint form, pressure and weight distribution along the footprint length are being estimated and discussed in order to extract and compensate the longitudinal and transverse oscillations of tractor’s, trailer’s, each axle’s and wheel’s “gravity centre” with the aim to decrease the estimation errors to the level till 1-2% of each axle’s real weight.

Acknowledgements

This research was granted by state of Latvia project “The next generation of information and communication technologies (NexIT)” (2014-2017).

References

EXPERIMENTAL STUDY ON DISTRIBUTED ROAD TRACKING SYSTEM FOR ROAD TRAFFIC REGISTRATION

Alexander Dudko\(^1\), Irina Yatskiv\(^2\), Yasushi Kiyoki\(^3\)

\(^1\) Keio University  
Tokyo, Japan, Endo 5322  
aleksandrsdudko@gmail.com

\(^2\) Transport and Telecommunication Institute  
Lomonosova street 1, Riga, Latvia  
jackiva.i@tsi.lv

\(^3\) Keio University  
Tokyo, Japan, Endo 5322  
kiyoki@sfc.keio.ac.jp

Keywords: traffic accidents, road safety, smart city

Annually, hundreds of thousands citizens are dying because of road traffic crashes. Only in 2015 year there were 1.25 million road traffic deaths globally caused by car accidents. Moreover, road traffic deaths among pedestrians, cyclists and motorcyclists are intolerably high. In the era of technology the number of cars in the world is constantly growing, therefore safety on roads is becoming very important nowadays. Although road traffic injuries have been a leading cause of mortality for many years, most traffic crashes are both predictable and preventable. There is considerable evidence on interventions that are effective at making roads safer: countries that have successfully implemented these interventions have seen corresponding reductions in road traffic deaths (World Health Organization, 2015).

According to the global status report on road safety 2015, in the last three years, 17 countries have aligned at least one of their laws with best practice on speed, seat-belts, drink–driving, motorcycle helmets and child restraints. While there has been progress towards improving road safety legislation and in making vehicles safer, the report shows that the pace of change is too slow. Urgent action is needed to achieve the ambitious target for road safety. One of the most important factors for road safety is cars movement speeds. As average traffic speed increases, so too does the likelihood of a crash. If a crash does happen, the risk of death and serious injury is greater at higher speeds, especially for pedestrians, cyclists and motorcyclists.

For the purpose of speed regulation and punishment of violating drivers, roads police department is installing speed radars. However, modern car speed radars do not solve the problem of speeding, because drivers slow down directly before the known place where the radar is located, and increase speed again after passing the radar. Such fact makes the efficiency of the radar very local, and it becomes very expensive to cover the whole area with this kind of radars to regulate the cars speeds on roads.

This paper describes a smart city system of road traffic tracking to support next generation of urban transport based on techniques of Image Processing, 3D Vision, Big Data Analysis, and other novel ICT technologies. The paper describes the construction of the system, its reference architecture, and contribution to the environmental and socially important impacts. System aims to advance the existing smart city transport by means of raising urban innovations to maximize road laws enforcement and minimizing the negative effects like traffic accidents.

References

The International Archives of the Photogrammetry, Remote Sensing and Spatial


INTRODUCING FIXED-WING AIRCRAFT INTO COOPERATIVE UAV COLLISION AVOIDANCE SYSTEM

Dmitrijs Lancovs

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
+371 2955 4900, dmitrijs.lancovs@outlook.com

Keywords: unmanned aerial vehicles, automatic dependent surveillance–broadcast, unregulated airspace, collision avoidance system, simulation

Unmanned aerial vehicles (UAV) have become popular means of carrying light payloads for survey, mapping, delivery and various other purposes. Collision avoidance mechanisms are being actively researched, but current UAV technology and size restrictions prevent solid, reliable results in this field (Lancovs, 2015). A solution is required, based on commercial off-the-shelf hardware, that would provide this missing capability.

A cooperative broadcast transponder system was proposed (Lancovs, 2016a). This system would be classified as “Class A” in manned aviation based on potential for human injury or death in case of failure, requiring a specific level of reliability (Won Keun Youn et al., 2015). Such reliability should be guaranteed across the whole operating range of the system.

A stepwise approach to designing such system was proposed (Lancovs, 2016a), starting with initial operating range and updating it by integrating various internal and external factors at each stage of modelling. U|g|CS mission planning and flight control software (SPH Engineering, 2016) was used, and model was verified and validated (Lancovs, 2016b).

First results of modelling for multicopter craft were produced (Lancovs, 2017), establishing operating ranges of ideal transmitter and receiver in a deterministic, noiseless environment, with a completely reliable channel. Such operating range is based only on physical capabilities of unmanned aircraft to avoid a collision at a set of encounter scenarios.

This article introduces fixed-wing airframes into the simulation and updates initial operating range requirements, performing simulation across all the previous scenarios with fixed-wing UAV encounters against other fixed-wing UAVs as well as multicopters.

Initial operating range requirements were updated. No significant changes in operating range were observed, and it still is several orders of magnitude shorter than that of automatic dependent surveillance-broadcast (ADS-B). Transmitters and receivers operating within this range exist and are used on commercial UAVs, albeit for different purposes. Therefore a collision avoidance system for small commercial UAVs is feasible, and both energy, weight and insulation requirements should be readily met with currently available commercial off the shelf hardware.

References


Session 8

Telematics
QUANTITATIVE ANALYSIS OF THE COMPETITIVE ENVIRONMENT IN THE ELECTRONIC COMMUNICATIONS SECTOR

Lucia Madleňáková¹, Mária Matúšková¹, Radovan Madleňák¹, Paweł Droździej²

¹ University of Žilina
Univerzitná 1, 010 26 Žilina, Slovakia
++421 41 5133125, Lucia.Madlenakova@fpedas.uniza.sk

² Lublin University of Technology
ul. Nadbystrzycka 38 D, 20–618 Lublin, Poland

Keywords: concentration ratio, electronic communication, Herfindahl-Hirschman Index, protection of competition, regulation

The application of the rules for the protection of competition in electronic communications is linked to the monitoring of the competitive environment. The competitive structure of the industry is of a diverse nature depending on the number and size of the actors involved in the sector. One of the forms of the competitive structure is the concentrated sector.

The contribution is devoted to the problem of determining the degree of concentration in relation to indicators typical of the electronic communications sector. At present, concentration monitoring is very important. The reason is the significant impact of the incumbent on some relevant markets, which is not particularly desirable from the point of view of end-user protection or existing barriers to entry. So, this situation is primarily in the countries of Central and Eastern Europe, even though the market has been fully liberalized for several years. The rapid growth of technologies in this sector is a significant factor in the growth of concentration too.

An important part for the determination of "concentration ratio" is represented by models, methods and procedures for identifying absolute or relative concentration. They differ substantially in the way they take into account the number of subjects who are the carriers of the indicator under observation. Sectoral concentration analysis is conducted through indexes. They monitor the competitive behaviour of the entities operating on the relevant market. This analysis provides information on the structure of the market to regulators and makes recommendations for market regulation. "The concentration ratio of the strongest subjects" (the US Department of Justice has been using it since 1968), and the Herfindahl-Hirschman Index of concentration (HHI) is most commonly used in electronic communications. At this time, it is also important to look at the relative concentration in relation to the unequal distribution values of key market indicator in the relevant market. For this case, we present a variation coefficient and dispersion ratio in the contribution.

Acknowledgements

VEGA - 1/0721/15 Research on the impact of postal services and telecommunication convergence on regulatory approaches in the postal sector.

References


THE ANALYSIS OF THE SYSTEM THAT INCLUDES TWO FERROMAGNETIC SPHERES IN OUTER MAGNETIC FIELD

Yury A. Krasnitsky

Transport and Telecommunication Institute
1 Lomonosova str., LV-1019, Riga, Latvia
krasn@tsi.lv

Keywords: bispherical coordinates, Laplace’s equation, magnetic field among the spheres

Influence of bodies with finite dimensions onto outer field structure presents significant interest both for scientific and technological purposes. However this problem has precise solution only when that body has a surface that is described in a conformed coordinates systems. Isolated conducting/dielectric spheres or cylinders are usual objects of choice for exploration, while significantly less attention is devoted to ferromagnetic bodies. The only case of precise solution for two-body system is when both bodies are spheres and bispherical coordinates are used. In this formulation, the solutions, both for metal and for dielectric spheres, have already been found. See, for example, (Бухгольц, 1961; Aldridge and Oldenburg, 1989).

In this paper, an attempt is made to evaluate certain properties of a system of two identical ferromagnetic spheres based on the solutions mentioned above, using the dual-permutability property of the Maxwell equations. The solution presented, in particular, qualitatively describes a gap in cylindrical cores used in magnetic frame antennas. It could also be used for the evaluation of properties of spherical heat accumulators. Such accumulators sometimes are placed into waveguides for the purposes of study of microwave heating etc.

References
MODEL OF WIRELESS DATA NETWORK
IN GPSS LANGUAGE

Aleksandr Krivchenkov

Transportation and Telecommunication Institute
Lomonosova str. 1, Riga LV-1019, Latvia
+371 29210689, krivcenkovs.a@tsi.lv

Keywords: IEEE 802.11, wireless network simulation, GPSS model

There are different technologies that are used in wireless data transmission networks. Some of them are based on standards IEEE 802.11 (Wi-Fi), 802.15.1 (Bluetooth), 802.15.4 (ZigBee). When wireless networks are designed for many network applications it is very important to have correct knowledge about main relationships between network and traffic architecture, conditions of transmission and parameters of data transfer. Such transmission parameters research is difficult to perform on basis of experiments and analytical and simulation models are often used. Such models for wireless networks are useful also for educational purposes.

The informative models for an example (Clark, 2016) based on MATLAB® Simulink® environment simulate only Physical and partially Data Link levels of the wireless channel. And it is not sufficient for understanding the network processes. Here we need to apply models based on Queuing theory but they are not developed enough.

In our consideration data transmission network simulation model is designed to determine the effects on the characteristics of the wireless data networks of factors that were not taken into account in the analytical model. In simulation model there is also an opportunity to analyse the dynamics of channel parameters when interacting objects are moving.

A simulation model was developed on the basis of GPSS (General Purpose Simulation System). It accommodated a number of parameters, what are defined by data transmission network architecture, traffic in it, applied wireless technology, the characteristics of the channel. The results of the preliminary modelling of wireless technology (Wi-Fi, Bluetooth, ZigBee) was contained in the work (Krivchenkov and Sedykh, 2015). In (Krainyukov et al., 2017) is published version of the model that takes into account the mobility of objects. In our discussion a large modernization of models allowed to get channel throughput, delays in the transfer of packages, distribution function of delays, jitter, and the number of packets sent with errors in different conditions.

In this publication the model is described step by step. Developed simulation model allows assessing the effects on the characteristics of the data transmission network of factors that were not included in an analytical model. Compare models within a certain range of settings showed good agreement (of order 2%).

References
Session 9

Innovative Economics
INDUSTRY 4.0 - FOR SUSTAINABLE DEVELOPMENT OF LEAN MANUFACTURING COMPANIES IN THE SHIPBUILDING SECTOR

Anatoli Beifert¹, Laima Gerlitz¹, Gunnar Prause²

¹ Wismar University of Applied Sciences: Technology, Business and Design
Wismar Business School
Philipp-Müller-Str. 14, 23966 Wismar, Germany
anatoli.beifert@hs-wismar.de; laima.gerlitz@hs-wismar.de

² Tallinn University of Technology
Department of Business Administration
Akadeemia tee 3, 12618 Tallinn, Estonia
gunnar.prause@ttu.ee

Keywords: Industry 4.0, SME networks, new business models, Smart Supply Chains

Current political incentives, targeted initiatives from business and scientific community have brought the so-called industrial renaissance on the top agenda in the innovation driven economies, emphasising the role of the industrial sector as a key driver for job and innovation growth, as well as improvement of productivity and research infrastructure. In fact, industry generates 80% of the EU private innovations and 75% of its exports. Yet, a closer look reveals that the global share of European manufacturing value added dropped from 36% in 1991 to 25% in 2011. Currently, the EU industry accounts for only about 15% of the total gross value added, so that many manufacturing initiatives have been started all over the world, driving for re-establishing and regaining an industrial share in the economy. A promising approach seems to be matching of virtual and real worlds, i.e., strengthening the linkage and interplay between IT, internet and manufacturing leading to concepts of smart production and logistics. In Germany, the most important industrial EU country with an industrial gross value added of about 30%, this approach has been called “Industry 4.0,” whereas comparable initiatives outside Europe are called “Advanced Manufacturing Partnerships” or “Internet of Things” for the USA, and “Made in China 2025” for China, respectively.

Industry 4.0 aims at developing cyber-physical systems and dynamic production networks in order to provide with flexible and open value chains in the manufacturing of complex mass customisation products in a small series up to lot size 1. In addition, Industry 4.0 business models target energy and resource efficiency, shortening of innovation and time-to-market cycles as well as a rise in productivity, thus increasing the envisaged value-added. In this sense, Industry 4.0 represents nothing less than the fourth industrial revolution, comprising 3D printing, big data, i.e., all ingredients needed to facilitate smart manufacturing and logistics processes. Thus, Industry 4.0 shall bring the competitiveness in the manufacturing and high-tech sectors back to the Western industrial countries. This bears also a promising perspective on the macro-regional level, e.g. for the Baltic Sea Region (BSR). The region shows the highest innovation level among the EU macro-regions, sophisticated ICT infrastructure and has highly qualified workforce. The role of entrepreneurs and small and medium-sized enterprises (SMEs) in international supply chains have been mainly restricted so far to second – tier suppliers – or to highly specialised service providers. Industry 4.0 may change the situation, because the smart production and logistics solutions are expected to touch the entire supply chain from product design and development, operations management and logistics to distribution. Consequently, Industry 4.0 requires new business models and structures together with new concepts for managing information and business administration taking into account the perspective of internationally operating entrepreneurs and SMEs. Currently, companies have started to gain first experience with concepts like production in networks or smart logistics. They also begin
developing new organisational structures and models to benefit more from opportunities that the new technology offers.

Examining current developments and implementation of Industry 4.0, this paper discusses new business opportunities for entrepreneurs and SMEs to increase benefit potential from newly emerged Industry 4.0 business models and how they could be integrated in innovative SME networks. The authors reflect upon the literature on Industry 4.0, smart supply chain management, social network theory by combining with key theoretical insights from strategic management and business modelling. Using qualitative research approach (case studies and expert interviews), the authors presents the results of selected topical and practice-driven EU projects from the BSR. Theoretical and practical contributions are proposed and discussed.
CORPORATE GOVERNANCE DISCLOSURES: 
THE CASE OF LATVIAN COMPANIES LISTED ON BALTIC STOCK EXCHANGE

Ieva Kozlovska

Transport and Telecommunication Institute
Lomonosova street 1, Riga, LV-1019, Latvia
+371-67109389, Kozlovska.I@tsi.lv

Keywords: corporate governance, voluntary disclosures, annual report, performance, Latvian listed companies, Baltic stock exchange

There are studies showing inconclusive results toward mutual influence between corporate governance and company’s performance. There are studies with a strong positive relation, others with a negative one or even the third category of studies concluding that there are no any relationship at all (Pintea and Fulop, 2015, p.94). Nevertheless most of studies show the positive link between corporate governance and company’s performance, there are also ones showing mixed results or even no any mutual relationship between corporate governance and company’s performance. Therefore, mechanisms of corporate governance do have influence on company’s financial performance – some positively, others in a negative way. This research paper studies whether there is any mutual relation between corporate governance disclosures and performance of Latvian listed companies on Baltic stock exchange. The research is based as on the analysis of theoretical literature and research papers within the area of corporate governance disclosures, its influence on companies’ performance as on analysis of corporate governance codes and annual reports of Latvian companies listed on Baltic stock exchange. Results of this research might be of interest for academic researchers as well as educators and practitioners of companies’ annual reports analysis. Conducted research enabled to define new recommendations relating corporate governance disclosures of Latvian listed companies on Baltic stock exchange.

References

THE INFLUENCE OF VISUAL SMOG ON DRIVER DISTRACTION DURING NIGHT

Radovan Madleňák¹, Dominika Hoštáková¹, Martin Hudák¹, Anna Rudawska²

¹University of Žilina
Univerzitná 1, 01026, Žilina, Slovak Republic
radovan.madlenak@fpedas.uniza.sk

²Lublin University of Technology, Lublin 20-618, Poland

Keywords: visual smog, eyetracking, night driving, driver’s behaviour

The most common cause of traffic accidents is driver distraction. In our previous researches, we have shown that digital billboards can take the driver attention during the daylight driving. Therefore, the aim of this paper is to research how can visual smog influence the driver behaviour during the night. The same road stretch near Žilina has been chosen for measuring the driver distraction by visual smog.

The results of visual smog and traffic accidents analysis on the selected road is included in the beginning of paper. The eye tracking glasses has been used as a method for measurement of the gaze of driver’s eyes in night conditions. We compared the results from previous daylight measurement with night measurement results.

According the comparison of results, we can state that special forms of visual smog has big influence on the driver behaviour that can lead to traffic accident especially in night conditions.

Acknowledgements

This contribution was undertaken as part of the research project 1/0721/15 VEGA Research on the impact of postal services and telecommunication convergence on regulatory approaches in the postal sector.

References

Scientific Conference, Kaunas, Kaunas University of Technology, ISSN 1822-296 X, pp. 565-561.


CORPORATE INCOME TAX IMPACT ON THE COMPANY'S 
FINANCIAL FLOW

Ilze Sproģe¹, Aina Joppe²

¹ Transport and Telecommunication Institute
Lomonosova street 1, Riga, LV-1019, Latvia
+371-29253929, sproge.i@tsi.lv
² University of Latvia
Aspāzijas bulv. 5, Riga, LV-1050, Latvia
aina.joppe@lu.lv

Keywords: corporate income tax, budget revenue, company income, cash-flow

Latvia applies the classical system of payment of corporate income tax (CIT), in which corporate income tax is calculated for the taxation period based on the profits earned by the enterprise.

Corporate income tax is a direct tax and it is withheld from companies, organizations, the regulation of the economic processes in the country and directly to the taxpayer. The number of companies that pays CIT are growing in Latvia and the world, so it is important to determine the optimal rate and because it affects the financial flows of the company (Prohorovs, 2017).

From the theoretical aspect, CIT in total revenue with other taxes provides budget revenue, is an important factor for investors and affect the investor's decision to invest in a particular company, the industry and the national economy as a whole.

The tax rate is the tax on a specific size of taxable units, considered very substantial tax element. CIT allows the State to intervene actively in economic processes, successfully using tax instruments. CIT assets are used for investment activity framework to develop small businesses, attract foreign capital, giving discounts and setting tax rates.

Directly CIT allows the State to make extensive use of tax methods to regulate the economy and serves as a source of revenue to the State budget, to act effectively on investment flows and capital growth. It is an important instrument of economic regulation as a result of either increased or decreased interest of host production or provision of services. Personal income tax and corporate income tax both are taxes in income tax group, but they perform different functions.

A tax on the net cash position can, from an economic perspective, be classified as a consumption or expenditure tax. The discussion of such taxes is mature, yet the first proposals for such taxes stem from the 1970-ies. Since then, various academics have contributed with more elaborate proposals for Cash-flow taxes. Cash-flow taxes take several forms but are usually classified in three main categories (Experiences with cash-flow ...):

- Cash-flow tax on "real" business activity: the R-based Cash-flow tax. The tax base of an R-based Cash-flow tax is set on sales, less purchase of material, goods and services, wages and fixed assets.
- A cash-flow tax on real and financial transactions: the R+F-based Cash-flow tax combines taxation on real transactions and on financial transactions. Its tax base is the same as for R-base Cash-flow tax, adding received borrowing and interest less repayment in borrowing and interest paid. Unlike an R-based Cash-flow tax, the R+Fbased Cash-flow tax can be applied to the financial sector.
- A cash-flow tax on distribution of dividends ("stock") minus the net receipts on issued shares: the S-based Cash-flow tax. The tax base includes distributions of a corporation to its shareholders. Cash inflows resulting from the issuance of new shares decrease the tax base, while a repurchase of shares increases it. Cash inflows or outflows from or to the corporations from third-party transactions are not taxable.
References

THE ROLE OF PRODUCTIVITY IN INCREASING LATVIAN COMPETITIVENESS

Ilze Sproģe¹, Sandra Jekabsone², Irina Skribane³

¹ Transport and Telecommunication Institute
Lomonosova street 1, Riga, LV-1019, Latvia
+371-29253929, sproge.i@tsi.lv

²,³ University of Latvia
Aspāzijas bulv. 5, Riga, LV-1050, Latvia
² sandra.jekabsone@lu.lv
³ irina.skribane@lu.lv

Keywords: added value, labour cost, productivity, competitiveness

Productivity is the main key factor for Latvia to increased prosperity, ensuring efficient use of resources. Due to limited availability of resources and the increasing competition in the global markets, it is important for Latvia to support its economic growth through increased productivity.

Since 2010 the productivity of Latvia’s economy has been at the level of 40-45% of the EU average (Eurostat Database, 2017). Although in recent years productivity growth rate was faster than the EU average, but labour costs grew almost twice the rate and this can adversely affect competitiveness of Latvia. A further increase in labour costs is inevitable in the open labour market conditions, therefore, strengthening the competitiveness of Latvian is largely determined by the ability to reduce the productivity gap with the advanced economies.

One of the main challenges for Latvia is the creation of new competitive advantages that are associated with investments in the latest technologies, innovation, research, human capital, efficient allocation of resources and redistribution that comes with the behavioural changes of economic subjects. Increasing entrepreneurs’ motivation is a major structural change in policy making. Economic structural transformation process is largely dependent on the quality of the institutional framework (legislation, state aid and economic and political institutions), which provides goods and resources market efficiency, minimizing the redistribution process costs and risks, thereby strengthening the country's competitive benefits.

The aim of the research is to assess the potential for productivity growth to improve competitiveness of Latvia to identify the main obstacles that limit the attraction of resources and redistribution of higher value-added products and prepare recommendations for policies on the micro, sectoral and macro level.

Research methods to be used in the research: Literature review on the productivity, empirical analysis of data. The main research sources include the information available in the databases of the CSB and Eurostat, as well as the studies and publications on the productivity by the Ministries of Economics Republic of Latvia, Bank of Latvia, European Commission (Pashev et al., 2015), OECD, World Bank and IMF.

Results of the analysis highlighted the potential economic policies to improve productivity on the micro, sectoral and macro level. One of the main conditions for a balanced development of the economics is the ability to reduce the productivity gap, achieving the most rapid productivity convergence with the EU average, while maintaining high wage increase rates. This can be done either by attracting additional investments, which is currently problematic considering investors' uncertainty, or to increase total factor productivity through structural reforms, improving innovation capacity, efficient use of resources and developing the high-tech industry.
References


CUSTOMER SATISFACTION WITH BANKING SERVICES AND ITS ESTIMATION

Ishgaley Ishmuhametov

Transport and Telecommunication Institute
1 Lomonosova str., Riga, LV-1019, Latvia
Ishmuhametovs.I@tsi.lv

Keywords: satisfaction with services, corporate clients, research methodology, intra-bank procedure

The increased competition in the banking market led to the fact that most of the banks began to pay special attention not only to price, but also to non-price competition methods. Marketing strategies are more focused on the maximum satisfaction of customers and improving the quality of services to adapt the bank branches to the constant changes in the external environment, to keep and maintain cooperative relationship with those who already use banking services, and to attract new ones.

Satisfaction as a subjective evaluation represents the difference between consumer’s expectations and his perception of the real experience of using a product or service of the company. The higher the expectations of the client, the harder it can be to achieve his complete satisfaction. Therefore, organisations need to focus their efforts not only on improving the quality of the goods and services and servicing the customers, but also on the situation when the statements about the company’s product does not exceed its actual possibilities. The customer satisfaction and provision of the services corresponding to the expectation are capable of forming satisfaction via building long-term partnerships between the Bank and its clients.

The special attention is paid to the corporate clients of the banks, when banks act as partners of their customers in the system of equal contractual relationship in accordance with the principle of the modern economy. According to Zhukov (2010) the needs of corporate clients are so diverse that their effective satisfaction requires structuring the market of bank services. Satisfaction of a legal entity with the services of the bank is also based on satisfaction and subjective evaluation of specific people who have the direct contact with the bank and who sign the payment documents (Manrai and Manrai, 2007). According to Danchenok and Denisova (2009), the client begins to form his subjective evaluation after the first experience of consumption, using the following criteria:

- qualitative primary (reputation of the Bank, reliability, etc.);
- quantified regular (monthly, operational, and other types of tariffs, fees for services, etc.);
- quantitative irregular (one-time payment for withdrawal, for early termination of the contract, etc.);
- qualitative secondary (personal liking for the staff, availability of parking, etc.).

There are a number of contemporary techniques used to study and evaluate the level of customer’s satisfaction. The most well-known is SERVQUAL, SERVPERF, BANKSERV, CSI, EPSI, method of J.J. Lambin, etc. (Melnic, 2016; Lambin, 1993). The choice depends on many factors: what kind of information the company needs; the scope of the research; possibilities of the study implementation; budget, etc. The situation for banks is more complicated by the fact that initially all methods were calculated for implementing within the consumer sector of the economy, but not financial one.

The author of the paper considers existing methods employed to estimate the customer’s satisfaction based on the analysis of their advantages and disadvantages. There presented the results of the study accomplished with the method of J.J. Lambin, which has been modified to overcome the shortcomings of the selection of aspects and deviations of assessment of their
variability. There also proven the practical applicability of the method and possibility of its employment in the intra-bank procedure of assessing the level of satisfaction of corporate clients. The obtained results can be useful not only for banks in general, but they also can be applied in the operation process by managers of branches and operational offices for monitoring, timely detection and correction of problem areas of cooperation with corporate clients.

References
SOCIALLY RESPONSIBLE INVESTING AND PUBLIC PENSION FUND PERFORMANCE IN LATVIA

Irina Kuzmina-Merlino¹, Svetlana Saksonova²

¹ Transport and Telecommunication Institute
Lomonosova street 1, Riga, LV-1019, Latvia
+371-67109389. Kuzmina.I@tsi.lv

² University of Latvia
19 Raina Blvd., LV-1586, Riga
saksonova.svetlana@gmail.com

Keywords: social responsibility, social investing, performance, pension fund

Socially responsible investing, having become widespread in the financial markets, is seen as a mechanism facilitating the creation of basis for sustainable development of economy and society. With interest growing in sustainable investing, it’s great to see the positive financial performance of many of the funds (Krosinsky and Robins, 2016). Investing in the Latvian financial and capital markets, taking into account the principles of social responsibility, is of great importance for the development of the stock market, increase of transparency of the financial business, solutions to environmental problems, as well as improvement of the quality of life. The authors of this article maintain the view that when drafting the investment portfolio not only the standard criteria of funds analysis should be applied but also the conformity of the social orientation with the ethical principles should be considered. This article reveals the essence of socially responsible investment and its relevance; the traditional criteria of social responsibility of international investment have been summarized, a set of evaluation criteria defined, and their application to the 2nd pillar pension fund in Latvia attempted. The authors' conclusions are based on the analysis and synthesis of scientific and economic literature, the official statistical data, and research of opinion of the Latvian population.

References

THE ISSUES OF INCREASING THE EFFECTIVENESS OF TEACHING COMPARATIVE ECONOMICS

Juris Baltgailis

Transport and Telecommunication Institute
Lomonosova 1, Riga LV-1019, Latvia
+371 29 24 24 91
Baltgailis.J@tsi.lv

Keywords: Gross Domestic Product (GDP), Credit Ratings Agencies (RCAs), indexes, consumption

What is GDP? It is a macroeconomics index reflecting the market value of all final goods and services produced over a year’s period in all branches of economy in the country, to be consumed, exported, or accumulated, irrespective of the national identity. The of the used agents of production Nobel winners discovered suddenly that market production was not a criterion of well-being. Mixing up the two notions can bring about erroneous conclusions on the degree of people’s prosperity and can result in wrong political decisions. The material life standard is more closely connected with factors of real income and consumption; production can be expanding while income can be going down, and vice versa, if one takes into account capital amortization and revenues that are repatriated from the country or come into the country in the form of investments or other types of receipts. (Stiglitz et al., 2010).

In our opinion, it is necessary to switch from analysing the GDP of countries to analysing all available ratings and indices, which will allow us to get a more accurate picture, as well as to receive students’ qualitative knowledge and to learn delicate analysis of the international economy processes while studying the mechanism of rating and index formation.

There are a lot of alternative and more convenient statistical tools in the world that allow to get a more realistic picture of economic comparisons of different countries. The purpose of the article is to reflect the world's existing rating systems, to give them a crisp analysis, to critically justify their application.

Offer to use both state and corporate ratings and indices, which help to more accurately reflect the real economic situation and overcome the shortcomings that exist when using indicators of gross domestic product!

There are many problems in reflecting the real state of the economy when using credit and investment ratings. The main role for the Credit Rating Agencies is to secure and guarantee companies’ or financial products’ creditworthiness, both from lenders’ and investors’ perspective. There are several examples of scandals which have affected the reputation of CRAs: Worldcom or Enron, where CRAs rated the companies as “investment grade” just days before they went into bankruptcy; rating of the collateralised debt obligation market and the current situation in some of the European countries. The European Central Bank implies that the downgrading of the sovereign credit rating of Greece has contributed to worsen the situation and to spread the problems to adjacent countries with weaker fiscal policy such as for example Ireland, Portugal, Italy and Spain (De Santis, 2012).

Here, you also need to supplement the research with a wider range of different ratings.

Inclusion of the whole set of existing ratings and indices in the educational process will improve the preparation of students for work in the global economy.

References


SUSTAINABLE ISSUES OF BUSINESS GROWTH IN POWER INDUSTRY

Liudmyla Batenko¹, Dmytro Yakovenko²

¹,² Kiev National Economic University named after Vadym Hetman
54/1 Prospect Peremogy, Kyiv 03057, Ukraine
¹ +38067 2736906, batenkoludmila@gmail.com
² +38097 9411123, yakovenko.do@gmail.com

Keywords: sustainability, power industry, coal combustion products utilization

Business development is a crucial factor of the growth of the company nowadays. A defined business development strategy becomes a competitive advantage of the company, which differentiates it on the market and lead it to the best financial results. Now it is crucial not to lose the social and environmental role of the company as well, which together disclose the sustainability of the business.

One of the spheres of economy, which is faced with sustainability issue, is power industry. Besides economic issues it deals with the coal combustion products utilization (the annual production of these wastes in Ukraine is more than 300 million tons), minimization of the carbon emissions while producing electricity etc. In recent study by Yashnenko I. (2013) it was discovered that vertical integrated companies in the industry, which supply themselves with coal are dealing with another problem – huge coal mine emissions to the atmosphere, which reaches significant billions of cubic meters in the world annually (in Ukraine – more than 1.4 billion m³).

DTEK, which is the monopolist on the electricity market of Ukraine suffers from the tough social-economic situation in the country, nevertheless declares growing achievements in their sustainability policy – growing share of renewable generation and utilizing the growing amount of by-product. The goal of this article is to identify and describe those activities and propose DTEK the set of alternatives to boost its sustainable business growth.

References
STRATEGIC MANAGEMENT ISSUES FOR SMALL AND MEDIUM BUSINESS

Kirill Kunitsky

Kyiv National Economic University named after Vadym Hetman
75 Zhylyanska Street, 01032, Kyiv, Ukraine
+380636325385, kirill.kunitsky@gmail.com

Keywords: Strategic management issues, small and medium business (SMB), model of strategic management, KPIs

Instability in global and domestic economy increases the requirements for the efficiency of enterprise management. This is especially true for small and medium-sized business (SMB), since most of them work under significant resource restrictions and growing competition. Taking into account the fact that small and medium-sized businesses form significant potential for domestic economy development, there is an urgent need to develop methods for improving management efficiency exactly of such enterprises.

In this context, particular importance in management of enterprise matters development of effective development strategy and its further implementation at all levels of management. However, in practice, effective implementation of strategy is tough for a large number of enterprises at SMB.

The PwC survey, conducted in 2014 among more than 500 global companies, showed following results in Harvard Business Review (2017): 55% of managers say their companies are not focused on implementing the strategy, 42% say that company’s strategy requires employees to work on a large number of conflicting priorities. This leads to a slower pace of business development and threat to loss market position especially at SMB.

In this regard, we observe need to formulate strategic management model of enterprise at SMB, which will harmonize strategic tasks and ongoing management, as well as priorities in allocating resources for solving long-term and operational tasks.

The strategic management model formation aims to introduce process of strategic planning and further implementation of the strategy as a system of interconnected elements and to develop, on basis of this system, practical recommendations for improving effectiveness of strategic management at SMB (Ostervalder, 2015).


One of the key principles of SMB success is effective work with personnel, since dependence on individual as higher, as smaller personnel of enterprise. Therefore, it is extremely important to show each employee that success of company lies in his personal success. It could be shown through expanded decomposition system of any enterprise main goal to daily tasks of each employees.

Each hierarchical link in company must have its own goals and key performance indicators (KPIs) that fully reflect this line performance and fully align with next and previous levels of goals and metrics. Necessary element of effective business management system is control and deviation mechanism.

Each metric and target must be controlled by the subject outside this link. When irregularity take place, it is necessary to apply mechanisms for system (part of system) return to normal state.

Practice of small and medium-sized business shows that the more each employee motivated to achieve their own results and goals, the more company wins, provided that goals of each employee are synchronized with goals of company. Thus, in order to create effective management system of enterprise at SMB it is necessary to build each of system’s individual elements, and then establish their interconnection.
References

THE NEW TRENDS IN USAGE OF E-COMMERCE TOOLS FOR COMMUNICATION WITH TARGET GROUPS IN SME SECTOR IN BALTIC REGION

Ina Gudele

RISEBA University,
Meza Street 3, Riga, LV 1048, Latvia
EKOSOC 5.3.2
+371-27842437, ina.gudele@riseba.lv

Keywords: e-commerce tools, social networks, small and micro enterprises; entrepreneurship; start-ups

In last thirty years was much more innovations in business processes than in some last centuries. Internet and different electronic commerce tools totally changed way of doing business processes, marketing and communication with existing and potential customer groups.

After introduction of the social media was created the new type of marketing– electronic word of mouth or e-WOM, what totally changed traditional marketing strategy and adapted it to virtual world.

Nowadays e-commerce is a strategic cost effective tool for small and micro enterprises marketing activities. Particularly small and micro entrepreneurs are active users of social media and Internet in Baltic States and all factors positively support development usage of e-commerce in entrepreneurship in SME sector.

The purpose of this article is to introduce with phenomena of social network usage in small and medium enterprises marketing activities as an effective tool of e-commerce. The author used qualitative and quantitative research methods including judgemental sample analyses of small and medium enterprises in Baltic and literature review on e-commerce and electronic word of mouth method usage in social networks. The author analyses collected data from enterprises in SME sector using social networks for communication with customer’s groups for business development and factors influencing usage of social networks.

The author provides the proof to the assumption that social networks are one of most effective e-commerce tool in product marketing and development of enterprises. Almost 87.5% of respondents from small and medium enterprises sector are using social networks as an effective e-commerce tool for communication with different customers’ groups. The author has identified the growing role of electronic word of mouth as an impact factor influencing small and medium enterprises development.

Acknowledgements

Thank the project EKOSOC.LV for support with data collection and providing information of existing researches in this field in Latvia.

References

THE CONCEPT OF STRATEGIC COMPETITIVENESS
EVOLUTION IN CONDITIONS OF INNOVATIVE MODEL
OF ECONOMIC DEVELOPMENT

Anton Kaspirovych

Kyiv National Economic University named after Vadym Hetman
75 Zhlyanska Street, 01032, Kyiv, Ukraine
+380507656459, a.kaspirovych@constructor.biz.ua

Keywords: strategic competitiveness, competitiveness management, competitive advantage

In the conditions of changes acceleration in economy and reduction cycles of innovation advantage at market, it occurs increasing of attention, both entrepreneurs and scientific community, to the concept of strategic competitiveness. According to objects diversity of strategic competitiveness, this concept acquires different semantic content, which significantly adds individuality to any attempts to use it in scientific research or on practice.

Recently, in scientific publications began using the notion of strategic competitiveness as enterprise promising capabilities, which sufficiently narrows its semantic content.

The purpose of this study is to clarify the notion of strategic competitiveness in context of innovative economy formation.

The competitiveness concept is a leading researches issue of many prominent economists, in particular (Ansoff, 1989), (Fatkutdinov, 2003), (Shershnyova and Oborska, 1999) and others who studied theoretical origins and applied aspects of competitiveness formation. But there are little papers about strategic competitiveness. The first steps towards analysis and attempts to explain the concept of strategic competitiveness were made in paper of Shpanko (2007).

Despite existence of various theoretical and applied researches, problems of identifying and managing strategic competitiveness remain fragmentarily investigated. This issue is especially acute in a rapid cycle of innovation, which requires enterprises to be resilient in internal processes and adapt to changing environment of market.

The concept of strategic competitiveness has not only have theoretical component, but also used as a tool for analysis. In order to obtain analytical results and to make managerial decisions, it is necessary to provide a qualitative characteristic of the strategic competitiveness components configuration (Smolin, 2015).

Promising and potential character of strategic competitiveness reflects ability of enterprise to compete using competitive advantages that will remain in strategic perspective.

The main feature of the strategic competitiveness potential is presence of stable competitive advantages at enterprise, quantity and quality of which will ensure their "stability" during strategic period.

The strategic period should be considered as time during which changes take place in the competitive environment that can effect on fixation of this type enterprise competitiveness at this market.

The factors of these changes are new competitor’s emergence speed that can significantly affect composition of existing enterprises at market, and management quality of enterprise itself, individualized characteristics which indicate objective ability to adapt in environment changes.

Strategic competitiveness reflects a probabilistic perspective market player to maintain and implement a range of competitive advantages that will ensure its competitiveness in strategic period.

The prerequisites for recognizing strategic competitiveness of enterprise are:
- The nature of the break-even activity dynamics in strategic retrospective period;
The degree of competitive advantages stability to negative environmental changes, which is qualitative characteristic that reflects potential for maintaining competitiveness. Thus, enterprise competitiveness definition acquires «strategic» character and determines place of company at market in long run. The complexity of practical calculation complicates strategic competitiveness management process, which determines further movement of study in direction of economic and mathematical foundation of this indicator.

References

SOCIAL MODELS AND THEIR INSTABILITY DUE TO THE PROPERTIES OF COMPLEX EVOLUTIONARY SYSTEM

Yelena Popova

Transport and Telecommunication Institute
1 Lomonosov Str., Riga, Latvia

**Keywords**: Social model, Complex Evolutionary System

Every country follows the certain social model provisions in organising its social system. The system of taxation, social insurance, public services are organised according to this model. The “old” European countries belong to the definite social models, and these models are accurately determined, while the social models of post-soviet countries are quite disputable. The paper considers the arguments for placing the Baltic countries in special group with some peculiarities of social model and also discusses the instability of any social model due to the fact that Social Model definitely belongs to the class of so called “Complex Evolutionary Systems”.

DIGITAL DRIVERS OF THE ADVERTISING MARKET: THE RUSSIAN REALIA

Nina Trubnikova¹, Natalia Konovalova²

¹ RUDN University
Moscow, Russian Federation, Miklukho-Maklaya str.6
ninavdimov@mail.ru
² RISEBA University
Riga, Latvia, Meža str.3
natalija.konovalova@riseba.lv

Keywords: marketing communications, crisis, digital technologies, media, advertising market, content

The purpose of this research is to analyse one of the most rapidly growing segments of the media industry - the digital market and the drivers of its growth. The authors use the example of Russia - a country with a dynamically growing advertising market, which is an indicator of the economic situation.

The authors show that the transformations intensify the development of the segment of Internet communications and span all the traditional segments of the communications industry - television, radio, press, and out-of-home communications. The accompanying changing forms of relations between the key market players - advertisers, media companies, communications agencies, and research companies - are presented in the work as evidence of this transforming impact.

The managers would clearly realize that the absence of control systems on the part of communications structures may lead to the loss of interest in Internet advertising on the part of the key advertisers. Achieving transparency of new communications formats can only be made possible by means of coordinated actions of all the interested market participants. That is why reaching such a consensus is a relevant task of the modern Russian communications management.

This study adds to the literature by studying the technological nature of digital drivers together with their transforming impact under the influence of socioeconomic factors. So, efficient digital communication requires complex managerial actions.
ADJUSTMENT OF BANKING ACTIVITY ACCORDING TO BASEL III REQUIREMENTS: EXPERIENCE AND PROBLEMS OF EASTERN EUROPE COUNTRIES

Natalia Konovalova¹, Nina Trubnikova²

¹ RISEBA University
Riga, Latvia, Meža str.3
+371 29215208, natalija.konovalova@riseba.lv

² RUDN University, Moscow
Russian Federation, Miklukho-Maklaya str.6
+79166126205, ninavadimovna@mail.ru

Keywords: nonmonetary regulation, growth rates of GDP, capital minimum requirements, liquidity minimum requirements

Adjustment of banking activity is one of key problems in our times and is acquiring a particular importance both for banks themselves and their shareholders and also for customers and depositors. Therefore in order to ensure reliable operation of commercial banks and prevent their vulnerability to economic insecurity, the supervisory bodies are continuously improving the methods of and approaches towards the management of bank risks accenting a paramount importance of capital adequacy and liquidity.

The objective of the research is to identify the impact of Basel III regulation methods on the banking system stability and economic growth.

The main results of the study are the identification of positive and negative aspects of banking activity regulation according to Basel III requirements and the obtaining of evidences from Eastern Europe countries about consequences of nonmonetary regulation of banking activity.
Session 10

Education and Training in Engineering
CAREER MANAGEMENT IN A TECHNICAL UNIVERSITY
AS AN ESSENTIAL FACTOR INFLUENCING ITS
COMPETITIVENESS

Yulia Stukalina
Transport and Telecommunication Institute
1 Lomonosova str., Riga, LV-1019, Latvia
+371-26714382, fax: +371-67100660, Stukalina.J@tsi

Keywords: Technical university, career guidance and counselling, competitive advantage

Career management is often regarded as a peripheral activity in a university compared to education and research that, in turn, are considered to be central activities of a higher education institution. As a result, career guidance services are not properly coordinated with other services provided by a university. However, contemporary higher education trends (a bigger focus on research and innovation, growing popularity of lifelong learning, intensified university–business collaboration, increased contribution to the society and social responsibility, etc.) make education managers create competitive strategies aimed at generating sustainable competitive advantage in the international education market. It is vital for the development of a modern university, since global competitive forces are now reformatting the higher education industry (Rust and Kim, 2012).

In this context, career management should be viewed as a special focus area of the university’s comprehensive strategy. It is also determined by the fact that nowadays, students expect to have a more rewarding return on their investment in higher education in terms of both academic quality and employability, as the transition from higher education to the international labour market may sometimes become a problem. Consequently, modern universities must be more flexible for meeting the expectations of new populations of learners (The State of Higher Education 2014: Executive Summary, 2014), adapting their policies and tools to the requirements of knowledge-based economies (COM, 2007) 61 final: A Coherent Framework of Indicators and Benchmarks for Monitoring Progress towards the Lisbon Objectives in Education and Training, 2007). Collaboration between universities and industry should be strengthened at national and regional levels (COM, 2003) 58 final: The Role of the Universities in the Europe of Knowledge, 2003).

This paper discusses some issues related to career management in a contemporary technical university. In the paper, it argued that career guidance and counselling can be regarded as an essential factor influencing its competitiveness in the international education market.

References
DEVELOPMENT OF THE TRAINING COMPLEX WITH THE CONTENT IN THE FORMAT OF ONTOLOGIES

Ilya Stepanov, Valeriy Khabarov

Siberian Transport University
Novosibirsk, Russia, 630049 D. Kovalchuk 191
+7 923 153 2020, step_il@mail.ru

Keywords: Ontology, distance learning, railway branch, semantic web, knowledge base, representation of knowledge

In spite of the fact that knowledge is realized as an important strategic resource of ensuring the competitive advantages by the economic agents of economy branches, the possibilities of technologies of knowledge management aren’t used fully in practice.

There is a problem of management and standardization of knowledge at this stage of developing the information society. It is caused by the variety of information resources which contain the treatments which are quite often contradicting each other. The additional factors, which stimulate this requirement, are globalization of economy and close international cooperation.

The format of ontologies is offered as the standard of knowledge description. This format allows a person perceive information. It also can be interpreted by the inferencing engine (Berners-Lee et al., 2001). OWL (Web Ontology Language) is taken as a basis of language.

Online resource is offered as a platform for working with knowledge. It contains the instruments for working with ontologies with the help of a limited natural language and also for examining the representation of ontologies in a format of narration or thesaurus.

These actions have been made for organization of independent work of teachers with the editor of ontologies for optimization of work on filling the knowledge base:

- developing the simple syntax for describing ontologies on the basis of a limited natural language;
- developing the intuitive and clear multilingual interface;
- basic structures and relations have been specified.

One of the tasks solved during realization of a resource was providing a possibility to an unprepared user to work with ontology. This unprepared user has no skills in engineering and has no knowledge and experience while working with such kind of the software.

There is a need of recording the logical expressions while realization of ontologies. They give the possibility to show the complex sentences or conditional facts in ontology. OWL-DL and safe rule constructions are provided for such situations in the OWL standard. (Motik et al., 2005).

Information has to be organized in the form of triplets (Object – Relation – Subject) for correct recording of ontologies. All information has to fit structurally into this construction.

Separately it should be noted that this software is the first multiuser editor of ontologies with the web interface. A process of applying the ontologies in educational process helps to standardize the knowledge.

References

LEARNING ANALYTICS AND SOFTWARE ENGINEERING COMPETENCES

Boriss Misnevs¹, Aliaksandr Puptsau²

¹Transport and Telecommunication Institute
Riga, Latvia, 1 Lomonosova str.
Misnevs.B@tsi.lv
²European Humanities University
Vilnius, Lithuania
alexander.puptsev@ahu.lt

Keywords: e-CF Framework, 'big data', study progress, Management Information System, knowledge discovery

This paper examines and focuses on some issues and questions how to use Learning analytics in the measurement, collection, analysis and reporting of data related to Software Engineering (SE) competences obtained by master students at an university (Misnevs and Yatskiv, 2016). The paper's authors review some results of iSECRET Project with the goal to introduce Data Mining approach for better control of the teaching process based on remote competences evaluation (Misnevs, 2017).

Rebecca Ferguson (2012) connects the progress of analytics for learning with a development through the increasing interest in 'big data' for business intelligence and the rise of online education focused around Virtual Learning Environments, Content Management Systems and Management Information Systems for education, which saw an increase in digital data regarding student background and learning log data. This development afforded the opportunity to apply 'business intelligence' techniques to educational data.

The research is focused on evidencing progress and professional standards for accountability systems used in Software Engineering Master Program with emphasis on professional competences defined by e-CF Framework (e-CF, 2017).

The main emphasis is done on information infrastructure needed to perform effective Learning Analytic at SE Master Program level.

The knowledge discovery process, defined with the stages Selection, Pre-processing, Transformation, Data mining and Interpretation/evaluation, was discussed in the sense of mapping on an existing University Management Information System.

In this paper an attempt to develop study anomalies detection approach was done. The approach is based on the pilot implementation of competence components remote measurement using SECEIP Portal (Misnevs, et al., 2017). The developed approach of Learning Analytics usage for SE Master program competences measurement may be used for re-engineering of Legacy University Management Information Systems and University management executive staff training (Puptsau, 2016).

The research is part of the project “Implementation of Software Engineering Competence Remote Evaluation for Master Program Graduates (iSECRET)” run by TTI, contract No. 20151-LV01-KA203-013439, co-financed by EC ERASMUS+ program.

References
ENSURING THE ACADEMIC WORKFORCE AGE BALANCE AS A PERSONNEL MANAGEMENT TOOL

Oksana Pozdnyakova\textsuperscript{1}, Anatoly Pozdnyakov\textsuperscript{2}

\textsuperscript{1,2} Transport and Telecommunication Institute
Lomonosova 1, Riga, LV 1019, Latvia
+371-67100650, fax: +371-67100660
\textsuperscript{1} Pozdnakova.O@tsi.lv
\textsuperscript{2} Pozdnakovs.A@tsi.lv

Keywords: academic workforce, imbalance of the age level, aging of academic staff

Academic workforce is the most important element of the system of higher professional education. Social effectiveness and prospects for the development of higher education ultimately depend on the possibilities of reproduction of this social stratum. But in the recent decades there has been a certain imbalance in the age and qualification structures of the pedagogical potential.

First of all, it is manifested via the process of the aging of the academic personnel. In many countries the average age of professors now exceeds all other professional groups (Kaskie, 2016; Larkin and Neumann, 2012; Loomes and McCarthy, 2011; Druzhilov, 2011). This problem did not pass over Latvia. Every second Doctor of Sciences is older than 55 years (IZM, 2015). The situation is complicated by the fact that there is almost no middle and young generations of academic staff (Winchester, 2005; Clark and d’Ambrosio, 2005).

The researchers devoted to the problem of aging of academic staff, emphasize such strengths of the older generation, as the deepest theoretical knowledge, vast experience, but simultaneously the use of outdated methods as well as natural fatigue and “burnout” are mentioned as shortcomings (Gingras, \textit{et al}., 2008). In addition, the dominance of older academic layer in the staff may bring the significant financial costs to the university and it is beyond the fact that there will come a time when, by virtue of the natural causes, there will be no professors to teach the students (Clark and d’Ambrosio, 2005; Hugo and Morriss, 2010). Moreover, imbalance in the age structure leads also to the discontinuity in the reproduction of pedagogical faculty, and the difficulties of preserving scientific schools, transferring the traditions and research skills.

Therefore, one of the key tasks of the Universities is to find a replacement for the older generation of academic staff.

Consequently, there is a need for intensive involvement and retention of youth in the university departments. However, according to the survey conducted by the authors, the number of students wishing to pursue an academic career does not exceed 5\% of the total number of respondents. The remaining students explain their reluctance to become a teacher for a variety of reasons: lack of interest, low pay, the lack of possibilities of career progress, diffidence. These figures are quite typical (IZM, 2015) and are explained by the change in value guidelines (Onopriyenko, 2007). Perhaps, in the authors’ opinion, positive results will have not only additional rewards for conducting training sessions, but also for research developments. The young lecturer should be able to continue his education at Doctoral studies; therefore, the training load can be reduced while the salary is retained without changes. The creation of a clear and modern academic model of career development will contribute to the retention of young faculty.

At the same time, the work should be carried out to attract (with special emphasis on remuneration) the representatives of the middle generation to the education process, for example, those who implemented their capabilities in practical activities. It is necessary to
encourage a reasonable combination of the faculty work at the university and at the enterprise of the industry. At the same time, according to the authors’ view, it is expedient to provide business professionals with appropriate additional pedagogical training for the development of their teaching and research skills.

And, certainly, it is mandatory to use the rich experience and knowledge of retired professionals who will help to cope with the shortage of academic personnel. The key role of these employees, as the authors suggest, will be mentoring first of all, perhaps in the development of online textbooks. Also, some of the most effective strategies for retaining the older generation of the academic staff include such issues as part-time contracts with retention of retirement benefits, decent remuneration for the performed work.

Considering the fact that according to the forecasts of specialists, the problem of aging of the academic staff will be relevant for at least another three decades, it is necessary to provide the advanced planning of the alignment of the age balance of the academic personnel.

References
INTEGRATING INTERACTIVE TEACHING METHODS INTO ADR TRAINING COURSES SYSTEM IN ESTONIA

Jelizaveta Janno¹, Ott Koppel²

¹,² Tallinn University of Technology/ School of Engineering
Tallinn, Estonia, Ehitajate St. 5, 19086

Keywords: ADR regulations training courses, interactive teaching methods, educational technologies, distance learning, e-learning within in-service trainings

The role of educational technology in teaching today has a great importance due to combining large amount of information and communication technologies. Various methodological approaches as well as specific applications for distance education have already proved their effectiveness with regards to educational system at levels of secondary and higher education institutions. What comes to in-service trainings with focus on practice, it is much more complex to implement suitable interactive teaching methods and techniques effectively.

This paper studies issues related to implementing interactive teaching methods within existing ADR regulations training courses for drivers and dangerous goods safety advisers (DGSA) provided in Estonia. According to previous studies on this subject the role and possible outcomes of using interactive teaching methods within ADR regulations training courses are clearly underestimated by trainees. The results underline that methodological approach differs by learners’ category – drivers and DGSA. According to these results classical lecturing with the support of slide presentation is still an adequate and expected teaching method concerning drivers training. Learner-centred interactive methods (watching and analysing videos, using e-learning on a distance, solving case studies etc.) are more expected to be implemented within a classroom lessons and individual theoretical learning is clearly outdated with regards to DGSA training. The aim of this research is to identify what should be done in order to improve learners’ attitude towards interactive teaching methods within ADR regulations training courses system in Estonia. Blended learning methodological approach where digital media meets with traditional classroom methods is brought into focus as appropriate for Estonia’s case.

The paper presents a qualitative development research strategy based on previous studies regarding ADR regulations training courses in Estonia as well as on a comparative analysis of teaching methods applied within ADR in-service training in other European countries. In addition to theoretical background regarding well-performed adaption of various methodological approaches and technical applications for distance education, additional in-depth interviews with ADR training provider companies were performed. This detailed data collection provides an opportunity to shape better understanding what would be the teaching process with the integrated use of interactive teaching methods.

Considering the fact that the form of ADR in-service training program is according to common legal requirements (The European Agreement concerning the International Carriage of Dangerous Goods by Road) defined by compulsory theoretical topics and minimum learning hours only, it is free for ADR training provider companies to choose independently the methodological approach how to conduct the training itself. Results of this research can be divided into two practical outcomes. The first part of outcomes represents shaping the concept how to adapt certain interactive teaching methods and techniques into training process from the perspective of trainers. The second part of outcomes stands for the development of specific scenarios of training models for ADR regulations training courses. Different versions of training scripts combine theoretical topics and duration of training with interactive teaching methods and opportunities of educational technologies. Further researches related to this issue will focus on making recommendations on how to implement new methodological approaches within ADR training courses system in Estonia in practice.
References


MOBILE EDUCATION: NEGATIVE EFFECTS OF MULTITASKING

Kristīne Užule

Transport and Telecommunication Institute
Riga, LV-1019, Latvia, 1 Lomonosova st.
uzule.k@tsi.lv

Keywords: mobile education, Big Five model of personality, multitasking, interaction

While mobile education has a significant number of advantages, it also contains potentially hidden dangers. This paper is an attempt to draw attention to two important factors and their interaction that might impede mobile learning – personality traits that contribute to the development of unhealthy or problematic online behaviour and usage of mobile devices, which mostly is expressed in the development of addiction-like behaviour, and multitasking in online behaviour and usage of mobile gadgets. The research is based on earlier findings consistently with which personality types and traits were claimed to impact human interaction with the Internet and mobile devices, for example, extraversion was suggested to significantly impact people’s choice of mobile applications (Xu et al., 2016). Personality was further found to interact with psychological states, such as self-esteem, depression, anxiety etc, which might be correlated with problematic online behaviour and usage of mobile gadgets (Bianchi and Phillips, 2005; Takao et al., 2009), which in turn impede knowledge acquisition. As for some negative aspects of multitasking, they were found to correlate with people’s cognitive abilities to engage in deep critical thinking, which is based on deep or longitudinal concentration skills (Shao and Shao, 2012). According to Chen and Yan (2015), multitasking hinders learning because it causes rapid switches that result in imperfect selection of information and subsequent imperfect processing of information. Thus, by identifying personality types, traits, circumstances and multitasking aspects that might disruptively interact with the speed and quality of learning acquisition in specific ways in the online mode and through mobile devices, the paper offers recommendations aimed at minimizing learning risks in mobile and online education.

References
Invited Session 11

Identification, Classification, Implementation and Cryptography Problems of Various Complex Systems
AUTOMATIC GENDER AND EMOTION RECOGNITION SYSTEM AS IMPORTANT FACTOR FOR SAFETY IMPROVEMENT

Jacek Mazurkiewicz

Wrocław University of Science and Technology
Faculty of Electronics, Department of Computer Engineering
ul. Wybrzeże Wyspiańskiego 27, 50-370, Wrocław, Poland
Jacek.Mazurkiewicz@pwr.edu.pl

Keywords: gender recognition, emotion recognition, human face, safety system, picture analysis

The paper presents the analysis and discussion of gender and emotion recognition based on human face picture. The research combines different features selection techniques with the set of softcomputing classifiers. The goal is: not very complicated, fast and sensitive approach to create the basis for safety systems with correct “on-line” gender and emotion recognition. The already known differences between the female and male face are the starting point for discussion. The second path is focused on already known for physiologists emotional states visible in human face. The classic classifiers are in use, but focus is on sensible correlation between the feature extraction and the actual classification. The significant set of the results are discussed and the best solutions are pointed. All tests were realised based on the mixture: well known base of face pictures and the set of own collection. The proposed solution can be an essential tool for the monitoring systems, safety guards and systems to point the dangerous situations based on video data.
IMPLEMENTATION EFFICIENCY OF BLAKE2 CRYPTOGRAPHIC ALGORITHM IN CONTEMPORARY POPULAR-GRADE FPGA DEVICES

Jarosław Sugier

Wrocław University of Science and Technology
Faculty of Electronics, Department of Computer Engineering
ul. Wybrzeże Wyspiańskiego 27, 50-370, Wrocław, Poland
Jaroslaw.Sugier@pwr.edu.pl

Keywords: cryptographic algorithms, BLAKE2, FPGA, Spartan

Malfunctions caused by security violations in operation of contemporary IT systems are so common and frequent that in present dependability analysis they must be treated in the same way as traditional reliability theory considered “classic” failures. For this reason to improve overall system reliability today it is necessary to apply appropriate cryptographic methods. This paper deals with one such method – BLAKE2 hash function – and investigates its implementation in hardware.

The original BLAKE algorithm was a candidate proposed for the SHA-3 contest where it successfully qualified to the final round with other 4 algorithms, being praised for its high cryptographic strength and good implementation efficiency, especially in software. Although it was not ultimately selected in the final round as the winner, its earned good reputation made it a viable option for a hash method of choice in contemporary IT systems. Moreover, since extensive tests and cryptanalyses during the contest had proved that the original BLAKE proposal offered an unnecessary large security margin, in 2013 the authors, based upon experience gathered after the public evaluation, proposed an improved version of the method – called BLAKE2 – with modifications aimed mainly towards its simplification and optimization.

This paper deals with a specific modification in hardware realizations of this particular algorithm which eliminates the need for involved data paths distributing message bits among the round units by using auxiliary memory modules for repetitive storage of the message inside each round instance. The idea is implemented in realizations of the BLAKE2 algorithm in four different organizations: the standard iterative one and three high-speed loop-unrolled architectures with 2, 4 and 5 rounds instantiated in hardware. Together with standard (without RAM) implementations this produced a set of 8 test cases: after implementation in popular-grade Spartan-3, -6 and -7 devices from Xilinx their parameters allowed for exhaustive evaluation of the proposed modification. The results reveal that the modification outstandingly enhances size of all the tested architectures: on average, occupation of the FPGA array is reduced at least by half while the improvements in speed, although not so spectacular, are also visible. Additional analyses indicate that the method can also increase overall efficiency of routing, helps in implementation of the loop-unrolled architectures and strengthens optimizations introduced by the BLAKE2 version of the algorithm. Finally, adding the newest Spartan-7 device to the implementation tests (this family has been made available only in the first half of 2017) allowed to identify its extensive potential and make some interesting comparisons with the older Spartan-3 and -6 families.
PERFORMANCE COMPARISON OF OBSERVER DESIGN PATTERN IMPLEMENTATIONS IN JAVASCRIPT

Artur Zochniak¹, Tomasz Walkowiak²

¹ zochniak@protonmail.com
² Faculty of Electronics, Wroclaw University of Science and Technology, Poland
tomasz.walkowiak@pwr.edu.pl

Keywords: web application, JavaScript framework, performance analysis

Over years websites have evolved from simple text documents to dynamic applications with capabilities comparable to desktop applications. While the introduction of web applications increases portability and platforms independence - it has some performance issues. Motivation of this research to compare and find which of implementations of observer design pattern used for handling changes of the data has the highest performance. Accordingly to a research done by Akamai, 42% of men and 35% of women have decided not to use a company again as a result of experiencing a slow website (Everts, 2016), therefore the topic of performance might be considered as a crucial factor in modern web development, which aims to entertain users and generate profit.

In the introduction article touches the topic history of the Internet and how web pages have changed during years, shortly explains how web pages are built and how JavaScript makes web pages something more than just a website - a single page application (SPA).

Next chapter defines what are design patterns and describes the role and potential implementation of this design pattern. This chapter also lists some other software such as spreadsheets or distributed messaging solutions which rely on an observer design pattern implementation under the hood. Later data change detection is divided into four general types in JavaScript frameworks which are: manually rebuilding the view with on every request, partially manually updating the webpage, doing dirty checking for any change and introducing intermediate layer for increased performance while preserving full automation of change detection.

In next chapter popular frameworks are divided by the way how data can be changed and three ways of notifying about property value change in JavaScript programming language are explained.

Third chapter is about testing environment, how it is designed and how it was implemented by leveraging HTML floating frames; it also described how parameters are passed to the tests and it is said that tests take into account handling insertion of 100, 1000, 10000 and 50000 elements. Later AngularJS and EmberJS frameworks architectures are discussed in and are provided equivalents of observer design pattern implementations in those two frameworks simplified source code. At the end of this chapter is table with results, which proves that there are significant differences in performance of two solutions. Authors also try to correlate observed measurements with implementations. Last paragraph in this chapter mentions other approaches suggested by standardization groups or communities such as ShadowDOM proposed in the Web Components Specification or other frameworks: ReactJS and VueJS which avoid using synchronous browser's Document Object Model implementation by relying on, so called, virtual-dom.

Article is finished with a summary, which points out all the work which was done and gives a final verdict which framework is faster.

References
MULTISTAGE HAMILERSTEIN–WIENER SYSTEM IDENTIFICATION WITH THE HELP OF BINARY EXCITATION

Marcin Biegański, Grzegorz Mzyk

Wrocław University of Science and Technology
Faculty of Electronics, Department of Control Systems and Mechatronics
ul. Wybrzeże Wyspiańskiego 27, 50-370, Wrocław, Poland
Grzegorz.Mzyk@pwr.edu.pl

Keywords: Hammerstein–Wiener system, nonlinear system identification, nonparametric identification, least squares, kernel estimates, binary sequences

In the paper, we consider a problem of identification of Hammerstein–Wiener (N-L-N) system. The proposed strategy consists of 3 steps. Firstly, we identify the finite impulse response of the linear block in the presence of random input and random noise using both parametric and non-parametric identification tools (least squares and kernel estimate). Secondly, providing the same conditions, composition of nonlinear characteristics is identified with the use of kernel estimate. Next, special binary sequences are generated to recover second individual nonlinear characteristic. Then, the interactive signal between dynamic linear and second nonlinear block is estimated. Finally, we extract first nonlinear characteristic using standard algorithm for Hammerstein system identification (least squares and singular value decomposition). The method is illustrated in a simple simulation example.
TOWARDS CLARIN-PL LTC DIGITAL RESEARCH PLATFORM
FOR: DEPOSITING, PROCESSING, ANALYZING AND VISUALIZING LANGUAGE DATA

Marcin Pol¹, Tomasz Walkowiak², Maciej Piaœeki¹

¹ Faculty of Computer Science and Management, Wroclaw University of Science and Technology, Poland
² Faculty of Electronics, Wroclaw University of Science and Technology, Poland
marcin.pol@pwr.edu.pl

Keywords: natural language processing, language technology infrastructure, web based application, CLARIN

The paper presents an open source web application that connects and supports the research workflow new functionality of CLARIN-PL Language Technology Centre (LTC) (Piaœeki, 2014). LTC Platform is developed as a research place for processing, visualizing and depositing language data. It can connect and support the research workflow, enabling scientists to increase the efficiency and effectiveness of their research in connection to CLARIN services. The platform is a free and open source web application. Researchers can use it to collaborate, document, archive, share, and register research projects, materials, and data. Language Technology Centre Platform (LTCP) has been created as a standard CLARIN B-type centre and the Polish node of the CLARIN research infrastructure (CLARIN-PL). CLARIN-PL follows a bi-directional development model (Walkowiak and Pol, 2017) in which the requirements of the users is an driving important factor. It has started gradual expansion of the basic blue-print of the B-type centre towards a platform supporting digital research paradigm in language data analysis. It is aimed to support researchers and students in the fields of Humanities, Social Sciences and also Computer Science in work with natural language engineering and text mining. The platform brings researchers into a manageable, secure cloud environment. It is a tool that promotes open, centralized workflows by enabling capturing of different aspects and products of the research lifecycle, including developing a research idea, designing a study, storing and analysing collected data. It facilitates also publishing resources, tools and reports or papers in Internet with persistent identifiers (DOIs). Researchers can use LTCP to manage projects and collaborations, register their intermediate results their work and, during the later phase of a project, to deposit the official outcomes of the project. Repositories support mainly the final, depositing phase. The platform support data and materials depositing and archiving sharing by Lindat version of D-Space or their sharing in the earlier phases by NextCloud. Both applications were modified and expanded with new functionalities.

The core functionality of the LTCP is the possibility to create and develop NLP projects connected to CLARIN tools and applications. Users are able to set up a project for a particular paper or specific experiment or for the work of an entire lab. To create a project, users have to set up a free account with the D-Space (they can login via federation identity using shibboleth). Once logged in to the D-Space, users can upload files to NextCloud or D-Space. The latter is used to make projects/resources publicly available, while NextCloud was added in response to the users demands (and hesitation in too haste using of D-Space) for private or working projects/resources. In the case of depositing in D-Space CMDI meta-data are required, in NextCloud strongly suggested (e.g. as a source of data for supervised training or experiment management). In case of D-Space usage, the uploaded files receive a unique, persistent id., that does not need the case in NextCloud storage. Moreover, CLARIN-PL D-Space is connected to the unique long-term persistent archiving system developed by one of the CLARIN-PL partners. NextCloud supports controlled access, so project members can be assigned different
permissions: read only, read and write, and administrator. While the spirit of open science encourages making projects publicly available, NextCloud provides an option to make all or parts of a project public and export data to the D-Space. In general, private projects are not browsable. All exported public projects are visible by CLARIN Virtual Language Observatory (The CLARIN Virtual Language Observatory).

References

2. The CLARIN Virtual Language Observatory, see https://vlo.clarin.eu/
Invited Session 12

Sustainable Transport Interchange

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 692426
ASSESSING THE DESIGN AND OPERATION OF RIGA’S INTERNATIONAL COACH TERMINAL

Maria Tsami¹, Evelina Budilovich², Vissarion Magginas¹, Giannis Adamos¹, Irina Yatskiv (Jackiva)²

¹Traffic, Transportation and Logistics Laboratory (TTLog)  
Department of Civil Engineering, University of Thessaly  
Pedion Aresos, GR-38334, Volos, Greece  
²Transport and Telecommunication Institute  
Lomonosova 1, Riga, LV-1019, Latvia

Keywords: Urban transport; decision tree; interchanges; city hubs; public transportation systems

The present paper aims at identifying the Riga’s International Coach Terminal performance, by assessing its design and operation. Towards this direction and based on an extended state of the art review of best practices, a list of selected indicators, grouped under eight clusters, were used and assessed by station users. These clusters deal with mobility provision, way-finding information, time and movement issues in the station, accessibility, comfort, station image and attractiveness, safety and security, and handling of emergency situations.

The objectives of the research are to:
• point out the level of users’ satisfaction from the current station operation, infrastructure and services,
• correlate the above attributes with the overall station assessment, users’ profiles, special characteristics and needs and users’ decision making in regards to travel behaviour and mode choice.

For the data collection, an extended face-to-face and internet-based questionnaire survey was conducted, with station users stating their perceptions and level of satisfaction, related to the terminal infrastructure, operation and services, as classified in the aforementioned eight clusters of indicators. The survey was designed within the framework of the European Project City-HUB (1), and was adopted for this particular case.

A decision tree approach was used to indicate the key performance indicators in users’ assessment formulation for the case study. Research findings, define the most significant parameters that need to be modified in order to increase users’ satisfaction, which will gradually also increase the overall image and attractiveness of the station and the usage of its services. In addition, this approach will provide significant input into proper design and operation of urban transport interchanges, efficient usage and guidance on methods to increase users’ satisfaction.

References
MECHANISMS FOR INVESTMENT IN THE TRANSPORT INFRASTRUCTURE DEVELOPMENT IN LATVIA

Irina Kuzmina-Merlino¹, Oksana Skorobogatova², Niels Schmidtke³, Fabian Behrendt⁴

¹,² Transport and Telecommunication Institute
Lomonosova street 1, Riga, LV-1019, Latvia
¹ +371-67109389, Kuzmina.I@tsi.lv, ² Skorobogatova.O@tsi.lv
³,⁴ Fraunhofer Institute IFF
Sandtorstraße 22, 39106 Magdeburg, Germany
³ niels.schmidtke@iff.fraunhofer.de, ⁴ fabian.behrendt@iff.fraunhofer.de

Keywords: transport infrastructure, investing mechanism, ranking, effectiveness

Well-developed and efficient infrastructure is crucial for ensuring the effective functioning of the economy. The transport and storage sector is one of the most promising sectors in the Latvian economy, and today it contributes 9.5% of GDP (LIAA, 2017). However, despite the successes in the development of the industry, one of the most problematic factors for doing business is inadequate supply of infrastructure. In Latvia, due to the limited state funding, the country's ability to create a new infrastructure and maintain the existing is reduced significantly. A considerable lack of industry financing certainly affects the assessment of the quality of the overall infrastructure in a global context; in 2015, according to an assessment made by the World Economic Forum, Latvia is ranked 51st among 138 countries (World Economic Forum, 2016). In countries that have a high rating on the quality of the overall infrastructure, for example, Germany, appropriate investment mechanisms have been developed. They set benchmarks for decision-making and evaluation of investment efficiency. In these countries, investments in transport infrastructure allow linking the main development goals of the country with the available resources.

The article focuses on studying the following issues:
1) What mechanisms of investment in transport infrastructure are used in countries that have a high rating of the quality of overall infrastructure?
2) What underlies the evaluation of the effectiveness of the invested funds?
3) How the investment mechanism influences the choice of the priority of the project and the evaluation of the project's effectiveness.

The results of the study show which analytical tools and processes can be used to prioritize transport infrastructure needs and evaluate projects that can meet these needs. In general, the results of the study can be useful in developing mechanisms for investing in the development of transport infrastructure in Latvia as an integral part of the investment policy for the industry development.

References
SMART SOLUTION FOR 3PL OPERATORS: STATE-OF-THE-ART

Aleksandrs Avdeikins¹, Mihails Savrasovs²

¹² Transport and Telecommunication Institute
Riga, Latvia, Lomonosov street 1
¹ +371 67100584, avdey@avdey.lv
² +371 67100590, Savrasovs.m@tsi.lv

Keywords: 3PL, Smart Solution, TRL

Logistics is the most fast changing and rapid businesses in the world. It plays significant role in most of the business processes. Every company producing goods or services needs to setup supply chain management procedure to be competitive in the market and cost effective. Sometimes such task is very complicated and it is better to outsource it to professionals or 3PL (Third Party Logistics) operators.

According to Logistics Focus 3PL is the activity of outsourcing activities related to Logistics and Distribution. The 3PL industry includes Logistics Solution Providers (LSPs) and the shippers whose business processes they support. Eyefortransport Ltd., who is the global business intelligence provider for supply chains and transportation, stands, that 3PL supply logistics related operations between traders by an independent organization

As seen from definitions 3PL operator always plays role in the middle. Such role force 3PL operators to implement and use smart solutions and informational processes. As 3PL normally serves more than one client its technologies should be as much flexible as possible to support client own processes, such as:

- Receiving and issuing of goods;
  - Planning inbound receipt procedures.
  - Outbound delivery procedures
- Quality control or verification;
- Storage of goods
  - Location management
  - Inventory control
  - Occupational health and safety
  - Information flow

Smart solutions allow to implement all operations in the more effective way, but the intensive development of modern technologies rise the question about applicability, security, effectiveness and scalability of the such technologies use in practice. There are many scientific articles and books referencing to this issue, but most of them are targeted only on one technology. Some examples could be found in (Uckelmann, 2012).

That is why the goal of this paper is to make wide-scale analysis of the existing technologies, like IoT, AI, Drones, EDI Communication, PDA/Tablets, RFID, Barcodes/optical recognition, BigData etc, which could be applied for 3PL and evaluate technology readiness level, as well to map technologies to the standard business processes of the 3PL companies.

References
ANALYSIS OF RIGA INTERNATIONAL AIRPORT FLIGHT DELAYS

Iyad Alomar¹, Jurijs Tolujevs², Aleksandrs Medvedevs³

¹,²,³ Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
¹ +371-67100623, alomar.i@tsi.lv
² +371-67100623, Juri.Tolujew@iff.fraunhofer.de
³ +371-67100527, medvedevs.a@tsi.lv

Keywords: ground handling; flight delay; on-time operation; statistical analysis

Flight delays have negative consequences on airlines, airports and passengers. On-time operation of the airports and airlines schedules are the target of all airports and airlines stockholders in order to fulfill with passengers and customer requirements as well as getting more new customers.

Flight schedules are subject to inconsistency due to various reasons. Flight delays could be seasonal or due to current conditions of operations, lack of equipment, bad management, etc. One of the main parts of airport and airlines expenses and losses is that losses are coming from flight delays. Delays of the aircrafts by reasons are tightly related to the ground handling services are quite often observed. Analysing of delays and their reasons will be helpful to improve the prediction of future delays and reduces them as well as reduces of the waiting and downtime of the aircraft on the ground.

During future article, we plan to perform statistical analysis of airport flight delays, and then in future link and use the results of the analysis in our research.
BIG DATA IN TRANSPORT – DATA SOURCES AND DATA SETS USED IN LITERATURE

Maria Karatsoli¹, Eftihia Nathanail²

¹,² University of Thessaly, Department of Civil Engineering
Pedion Areos, 38334, Volos, Greece
¹ +30 2421074176, makarats@uth.gr
² +30 2421074164, enath@uth.gr

Keywords: data collection, Intelligent Transport Systems, Information and Communications Technology, big data classification, traffic information, real-time data

The development of Information and Communications Technology (ICT) and the Internet provide Intelligent Transport Systems (ITS) with a huge amount of real-time data. These data are the so-called “Big Data” which can be collected, interpreted, managed and analyzed in a proper way in order to improve the knowledge around the transport system. The term “Big Data” refers to all those data whose scale, diversity and complexity require new analysis techniques and algorithms (Chandrasekar, 2015). The use of these technologies has greatly enhanced the efficiency and user friendliness of ITS, providing significant economic and social impacts, contributing positively to the management of sustainable mobility.

In this paper, different sources of big data that have been used in ITS are presented, while their advantages and limitations are further discussed. Analytically, big data sources that have been used within the last 15 years are identified and classified based on different criteria, i.e. the accessibility of the source, the type of the data recorded. Then, a review of current applications is done and based on a statistical analysis the most used and proper data source per case, is indicated.

Aim of the present study is to improve the knowledge around the usage of Big Data in transport planning and to contribute to the better support of ITS, by providing a roadmap to decision makers for big data collection methods.

References
EVALUATING SMART URBAN FREIGHT SOLUTIONS USING MICROSIMULATION

Ioannis Karakikes\textsuperscript{1}, Lambros Mitropoulos\textsuperscript{2}, Mihails Savrasovs\textsuperscript{3}

\textsuperscript{1,2}University of Thessaly, Department of Civil Engineering
Pedion Areos, 38334, Volos, Greece
\textsuperscript{1}+30 2421074191, iokaraki@uth.gr
\textsuperscript{2}+30 2421074176, lmit@civ.uth.gr

\textsuperscript{3}Transport and Telecommunication Institute
Lomonosova street 1, Riga, LV-1019, Latvia
+371 67100654, Savrasovs.m@tsi.lv

Keywords: city logistics, evaluation, lifecycle analysis, microsimulation, logistics sustainability index

Last mile distribution remains a difficult-to-solve variable in urban congestion’s equation, especially in Europe due to increased population and economic growth and limited space. Over the last decades, several European projects have contributed significantly into that direction, by developing innovative concepts (e.g., electric solutions, ITS adoption, effective policy-based strategies). A great number of measures have been deployed and have been considered as possible solutions to the last mile distribution problem of European cities, however only few of them have actually been implemented and tested over a long period of time and their impacts have been quantified.

Focusing on an urban interchange -Volos Port-, different smart UFT solutions will be evaluated by using a microscopic traffic simulation tool to disclose which is the most effective in environmental and transportation terms. This study aims to compare different smart solutions and evaluate their performance by assessing different scenarios. The impacts will be measured by replicating traffic conditions in the transport network around the port. The number of vehicles that are used for pick-ups and deliveries as well as the traffic volumes of the surrounding area will be provided for a typical day. Having calibrated and validated the model, the number of deliveries and pick-ups as well as the traffic volumes will be projected to 2020 and 2030 in order to assess solutions’ effectiveness in the short as well in the long term. Results will show which of the evaluated solutions have the greatest impact towards alleviation of congestion in the city of Volos. The analysis will be completed by using a multi-criteria multi-stakeholder decision making tool to generate the Logistics Sustainability Index (LSI) for each measure to summarise results and provide a sustainability based rating to support local decision making.
DEVELOPMENT PROSPECTS OF ROAD TRANSPORT IN KAZAKHSTAN AS PART OF THE STRATEGY “NURLY ZHOL”

Gani Askarov\(^1\), Utegali Shedenov\(^1\), Juris Tolujevs\(^2\)

\(^1\) Al-Farabi Kazakh National University  
\textit{al-Farabi Ave. 71, Almaty, Republic of Kazakhstan}  
+7(775)1704444, askarovg@mail.ru  
\(^2\) Transport and Telecommunication Institute  
1 Lomonosova street, Riga, Latvia  
+491632631508, Tolujevs.J@tsi.lv

\textbf{Keywords}: transport and logistics infrastructure, hubs, transit traffic

The economy of Kazakhstan located in the centre of the Eurasian continent between the capacious and dynamically developing markets of Europe, East and South-East Asia, is highly dependent on the effective use of the transport capacity of the state. Therefore, in terms of area, the republic is one of the world's 10 largest countries, occupying about 2% of the world's surface, 6.1% Asia's territory (Shedenov and Askarov, 2015).

The transport system is a key component of Kazakhstan’s infrastructure and it has a major impact on the level of development of the country’s economy. The transport complex accounts for almost 20% of the productive assets value, over 35% of energy consumption, and about 10% of the working population. The share of transport represents approximately 8% of GDP (Bekmagambetov and Smirnova, 2012).

Transport complex of Kazakhstan contains all the main types of transport used in world practice. Each of them has a role in the national economy. Road transport is consistently leads in the total traffic and provides more than 80% of it, more than 30% of turnover and 95% of passenger turnover, serving virtually all sectors of the economy (Ministry of National economy, 2017).

In his Address to the people of Kazakhstan entitled ”Nurly Zhol - Way to the Future” (The Address of President, 2014), President Nazarbayev outlined the key points of the new deal, the new economic policy of Kazakhstan, in particular: "Development of transport infrastructure”.

The development and implementation of an integral strategy aimed at ensuring the sustainable competitiveness of the economy is the main direction of state policy for successful integration of Kazakhstan into the world economy.

In the present article, the features of road transport’s development in the Republic of Kazakhstan are considered, the transportation patterns in recent years are analyzed and strategies for the development of transit traffic are formulated. In addition, in this work, problems in the given branch are considered and recommendations for the decision of these problems are given.

\textbf{References}


MODELLING AND SIMULATION OF THE RIGA INTERNATIONAL AIRPORT TO REDUCE TURNAROUND TIMES OF CRUCIAL CLEARANCE PROCESSES

David Weigert\textsuperscript{1}, Alina Rettmann\textsuperscript{2}, Iyad Alomar\textsuperscript{3}, Juri Tolujew\textsuperscript{4}

\textsuperscript{1, 2, 4}Fraunhofer Institute for Factory Operation and Automation, Magdeburg, Germany, Sandtorstraße 22
\textsuperscript{3}Transport and Telecommunication Institute, Riga, Latvia Lomonosova Street 1

\textsuperscript{1} +49 3914090 726, david.weigert@iff.fraunhofer.de
\textsuperscript{2} +49 3914090 156, alina.rettmann@iff.fraunhofer.de
\textsuperscript{3} +371 26728 515, alomar.i@tsi.lv
\textsuperscript{4} +49 3914090 156, juri.tolujew@iff.fraunhofer.de

Keywords: ground vehicle movement, routing, aircraft processes

Due to the rise of low cost carriers within the airline industry and rising numbers of passengers, airlines and airports alike try to optimise their processes to maximise their revenue. Worldwide the number of air passengers will nearly double between 2016 and 2035 (Statista GmbH, 2017). This development can also be witnessed in the European union, as the amount of passengers in air transport industry grew in the EU28 by 4,72 percent between 2014 and 2015 (eurostat statistics explained, 2016).

As a matter of fact an airplane only creates sales revenue as long as it transports passengers and therefore airlines try to minimize their airplane’s ground time and optimise all processes on the ground. Generally, every airplane has to go through several processes. These include the parking, the way to and on the taxiway, take-off and departure, the climb at the beginning of the flight, the cruise, the descent, the approach towards the destination airport, landing at the airport and the drive to the gate or stand. As about 70\% of all delay happens due operations happening on the ground (European Commission, 2011), it seem to be a promising approach to optimise the time needed on the ground, in particular to optimise the routing of ground vehicles. Operation figures to measure an improvement are the non-operation period of an airplane, the (estimated) time of travel for ground vehicles and the distance the ground vehicles need to drive. Control factors are the parking position of the airplane and the routing algorithm of the ground vehicles.

The main course of action to tackle this problem is a simulation study. As a preparation for the simulation study, to create actual data and to determine the primary processes happening during the ground time of an airplane, a rough calculation and a conceptual model were developed. The Riga International Airport (RIX) was taken as a basic model.

The ground handling process, all operations happening while the airplane is parked and therefore non-operated, can be divided in terminal processes that happen within the terminal, for example baggage claim, check and handling, or airside processes which mostly happen on the airside of the airport and include ramp and on-ramp aircraft servicing (Ashford, et al., 1997-2015). As aircraft handling practices, equipment and resources differ among airlines (Casanova, Jesse, 2013; AIRBUS S.A.S Customer Service Technical Data Support and Services, 2005), it was decided to focus on general processes happening at an airport, to enable common conclusions. The following processes were considered: The airplane moves to its assigned stand, deplaning of all passengers and unloading all baggage from the airplane, cleaning and catering of the airplanes galley, fuelling of the airplane, the enplaning of all passengers and loading of baggage, the airplane leaves its stand and moves to the runway for take-off.
Difficulties during data preparation, the development process of the conceptual model, formalisation of the conceptual model and the results, which have been achieved until now as well as a forecast to future tasks, are discussed in this paper.

With the Riga International Airport as a basic model, a simulation study of chosen ground operations, including aircraft handling and ground vehicle movement in order to minimise the lead-time of aircraft handling, can be determined as future task. In this context, the development of scenarios and experiments as well as a change in ground vehicle movement traffic routing will be considered.

References