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Proceedings of special session in Young Researchers' Seminars during the 18th International Conference on Reliability and Statistics in Transportation and Communication

alliance

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LIST OF ABBREVIATIONS

Abbreviation	Description
Fraunhofer IFF	Fraunhofer Institute for Factory Operation and Automation
GA	Grant Agreement
ICT	Information and Communications Technology
KFU	Kazan Federal University
RelStat'18	18th International Conference on Reliability and Statistics in Transportation and Communication
RTU	Riga Technical University
SUSU	South Ural State University
TTI	Transport and Telecommunication Institute
TTU	Tallinn University of Technology
UNI-WEIMAR	Bauhaus-Universität Weimar
UTH	University of Thessaly
VGTU	Vilnius Gediminas Technical University
WP	Work Package
YRS	Young Researchers Seminar

ABSTRACT

The deliverable presents the proceedings of the Young Researchers' Seminar – special session "Sustainable Transport Interchanges" in the framework of the 18th International Conference on Reliability and Statistics in Transportation and Communication (Riga, Latvia, 17-20 October 2018). During the Seminar, more than 37 particapants (both presenters and conference participants) took part in the ALLIANCE special session. This year it was decided to include presentations not only from ALLIANCE partners, but to extend the geography of the presenters in order to widen knowledge sharing. In frame of the special session, 7 presentations were provided by the TTI, UTH and other participants. Six additional abstracts were submitted to ALLIANCE special session, but the Organizing and Scientific Committees decided to include them to other thematically more specific sessions of RelStat'2018 conference, because of their topic relation and the necessity of more technical oriented knowledge for evaluation and discussion. Still the presentations were given in frame of ALLIANCE project with ALLIANCE spefications being used. As a result, in total 13 abstracts were included in the proceedings.

1 Introduction

1.1 Content of the deliverable

The current document is a deliverable in the framework of WP3. The objective of WP3 is to define and implement a knowledge-sharing strategy. The strategy clearly defines the activities and plans for activities execution, which can maximize the transfer of knowledge between partners of the project. Knowledge-sharing strategy targets on the following groups of users: researchers and academic staff of TTI; master and PhD students. Deliverable D3.8 is a compilation of the abstracts and presentations made in Young Researchers' Seminar “Sustainable Transport Interchanges” during the 18th International Conference on Reliability and Statistics in Transportation and Communication by the young researchers from TTI, UTH and Fraunhofer IFF.

Abstracts and papers were submitted from TTI, UTH, Fraunhofer IFF and other institutions to the 18th International Conference on Reliability and Statistics in Transportation and Communication (RelStat'18), which was held on 17-20 October 2018, in Riga, Latvia. Part of them was approved for presentation in Young Researchers' Seminar “Sustainable Transport Interchanges”.

RelStat'18 Conference was organized by the Transport and Telecommunication Institute. The purpose of the conference is to bring together academics and professionals from all over the world to discuss the following themes of the conference:

- Smart Solutions in Transportation Systems
- Networking and Telecommunications
- Reliability, Risk and Safety Applications
- Mathematics, Statistics, Modelling and its Applications
- Information Systems and Information Technologies
- Business and Economics Applications
- Mobile and Distance Education

Accepted abstracts of RelStat'18 were published in the book of abstracts, and selected papers will be published in Springer Lecture Notes in Networks and Systems http://www.springer.com/series/15179 (approximately 3 to 4 months after the Conference) published by Springer. The journal will be submitted for indexing in WoS and Scopus, the largest abstract and citation databases of peer-reviewed literature and other databases.

1.2 Project overview

ALLIANCE aims at developing advanced research and higher education institution in the field of smart interconnecting sustainable transport networks in Latvia, by linking the Transport and Telecommunication Institute – TTI with two internationally recognized research entities – University of Thessaly – UTH, Greece and Fraunhofer Institute for Factory Operation and Automation – Fraunhofer IFF, Germany. The close collaboration of TTI with UTH and Fraunhofer IFF will enable the achievement of the goals through the following activities:

- Organization of young researchers’ seminars.
- Organization of workshops.
- Organization of summer schools for trainers and young researchers.
- Development of an educational programme for graduate and post-graduate students.
- Development of training programme for trainers and practitioners.

- Provision of grants for participation as authors of peer reviewed publications in conferences.
- Facilitation of Short-Term Staff Exchanges (STSE's) with the aim of international collaboration, mainly publications.
- Establishment of a guidance strategy for preparing scientific publications.
- Creation of an educational forum as an on-line tool for distance learning and knowledge sharing.

The overall methodology of the project is built around the analysis of the needs of Latvia and the surrounding region of the Baltic sea (Lithuania, Estonia, Poland) on knowledge gain about intermodal transportation networks and the development of the tools to attain this knowledge, providing at the same time excellence and innovation capacity. The analysis to be conducted during the first stages of the project, steps on the overarching relations among policy makers, industry and education/research.

Structured around three main pillars, organizational/governance, operational/services and service quality/customer satisfaction, ALLIANCE will deliver a coherent educational/training program, addressed to enhancing the knowledge of current and future researchers and professionals offering their services in Latvia and the wider region.

The expected impacts on the overall research and innovation potential of TTI and Latvian research community will be of high importance and TTI will benefit from ALLIANCE by:

- Improving its knowledge in methodologies for preparing, writing and publishing scientific papers.
- Strengthening its research capacity.
- Establishing international research teams in specific areas of interest.
- Generating new innovative ideas for future research work through the project's activities.
- Setting up the fundamentals for the young generation of researchers.
- Being integrated into a number of existing international transportation research networks.
- Being incorporated in the European research system of transport and logistics.

In addition, the cooperation of TTI with UTH and Fraunhofer IFF will induce benefits into several domains of everyday life at regional, national and international scope. New bases will be established concerning knowledge transfer procedures, education and interdepartmental collaboration amongst research institutes. The innovative organizational framework, which will be structured for this purpose during the project, is expected to constitute a best practice application with tangible and well estimated progress results, which will be disseminated and communicated through social events to the research community and to the respective business sector as well.

Lastly, an important benefit will be the configuration of an integrated framework pertaining to the knowledge transfer techniques and the generic upgrading of the educational system with the use of networking, staff exchange, webinars and other knowledge transfer methods and techniques based on a well-structured and well-tried schedule.

2 ALLIANCE scientific contribution in RelStat'18

ALLIANCE team encourages young researchers to submit their relevant research in three thematic areas: governance and policy development, smart solutions, decision-making.

In total, 13 abstracts were prepared by the researchers (from TTI, UTH, and other institutions) and were reviewed by the reviewers of the Young Researchers Seminar (YRS), members of the ALLIANCE project consortium:

- Prof. Irina Yatskiv (TTI, Latvia)
- Prof. Igor Kabashkin (TTI, Latvia)
- Prof. Jury Tolujew (TTI, Latvia)
- As. Prof. Mihails Savrasovs (TTI, Latvia)
- Assist. Prof. Dmitry Pavlyuk (TTI, Latvia)
- Prof. Eftihia Nathanail (UTH, Greece)
- Dr. Giannis Adamos (UTH, Greece)

Thirteen abstracts were accepted, and the authors received the official notification from the moderators of ALLIANCE YRS and were invited to present their research work within the framework of the 18th International Conference on Reliability and Statistics in Transportation and Communication (RelStat'18), hosted by Transport and Telecommunication Institute in Riga, the capital of the Republic of Latvia, in October 17-20, 2018.

It is also noted that train-the-trainer event of ALLIANCE was organised as the special session of the RelStat'2018 entitled "Education and Training in Engineering". The session consisted of 7 presentations, and one of them was focused on the topic: "Supporting Lifelong Learning in Transportation Industry – Alliance E-Learning Approach", and was prepared by ALLIANCE team to explain their e-learning approach for supporting the suistanability of the ALLIANCE project results.

In total, 7 abstracts were chosen for presentation in special session "Sustainable Transport Interchanges" and 6 were recommended for presentation in other sessions of the 18th International Conference on Reliability and Statistics in Transportation and Communication. The YRS Special Session included papers presenting technical, experimental, methodological and/or applicative contributions in the scope of Sustainable Transport Interchanges. Also should be noted, that one day before YRS, the final conference of the ALLIANCE project was implemented. During final conference the poster session from research collaboration teams were provided. Also the poster session was continued during YRS 2018.

The title, authors, abstract and keywords for each of these chosen for YRS presentations are included in Tables 1-13. The Conference's program is given in Annex A, the data about the conference and content are provided in Annex C, and the presentations from special sessions are provided in Annex D. Additionally, the poster session from ALLIANCE final conference continued during YRS 2018 (see Annex B). The form was used to express the opinion about the presentations carried out. In the end of the sessions, feedback forms were collected and provided to the presenters.

Table 1: Presentation 1 – Conceptual Models for Better Interoperability Between Road and Rail Transport in Lithuania

Code:	**1**
Responsible or involved partner:	VGTU
Paper title:	Conceptual Models for Better Interoperability Between Road and Rail Transport in Lithuania
Author(s):	A. Vasilis Vasiliauskas, V. Vasilienė-Vasiliauskienė, J. Sabaitytė
Reference:	A. Vasilis Vasiliauskas, V. Vasilienė-Vasiliauskienė, J. Sabaitytė, 2018. "Conceptual Models for Better Interoperability Between Road and Rail Transport in Lithuania". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

One of the main strategic goals declared in the common European transport policy – development of efficient, environment-friendly, sustainable transport system (Rodrigue, 2015; Wagener, 2014; Comtois, 2013). The key prerequisites for the realization of this ambitious goal is development of national and international co-modal transport systems, that actually are based on the interoperability of different transport modes (Allsop, 2012; Beškovnik and Twrdy, 2012; Jaržemskienė, 2007). However, interoperability itself is also hard to implement without proper arrangement of legal framework, organizational measures and, last but not least, interconnected transport infrastructures of different transport modes (common multimodal transport network) (Reis *et al.,* 2013; Tsamboulas, 2008; Limbourg and Jourguin, 2009). Therefore, main object discussed in the given article – obstacles preventing efficient interoperability between the road and rail transport modes in Lithuania. It should be no surprise that despite huge financial investments made and construction works carried out during the last few decades, there is still a lack of proper infrastructure links and nodes assuring smooth interaction between road and rail transport in Lithuania (Jaržemskienė, 2007). As a logic outcome of that, the main goal of this article is to present the results of the study aimed at identification of key shortages of transport network in Lithuania, identification of factors that led to such situation and discussion of conceptual model that might be useful in changing current situation. In order to reach this goal, article starts with short theoretical introduction discussing concept of interoperability and multimodal transport networks which supports interoperability (Balint, 2012; Beškovnik, 2010; Hesse, 2010; Brien and Yuen, 2008; Bergqvist 2008). This is followed by presentation of results of the study depicting status of Lithuanian transport network problems and reasons behind them. The third part of the article is dedicated to presentation of conceptual model that could be applied to eliminate identified problems of interoperability between road and rail transport modes in Lithuania. Article ends with summarizing conclusions and recommendations.

Keywords:	Interoperability, Multimodality, Transport Network, Transport Infrastructure

Table 2: Presentation 2 – Techniques for Smart Logistics Solutions' Simulation: A Review

Code:	**2**
Responsible or involved partner:	UTH, TTI
Paper title:	Techniques for Smart Logistics Solutions' Simulation: A Review

Author(s):	I. Karakikes, E. Nathanail, M. Savrasovs
Reference:	I. Karakikes, E. Nathanail, M. Savrasovs, 2018. "Techniques for Smart Logistics Solutions' Simulation: A Review". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

Today, cities devise their own Sustainable Urban Logistics Plan (SULP) to improve the sustainability of their distribution system. Modern SULPs, following the development of the technology, consider smart measures and policies e.g. pick-ups and deliveries by electric vehicles, bicycles or drones, city lockers, ITS systems for planning/routing, crowdsourcing services and other, which aim at mitigating the negative effects of the freight transport in the urban area. The effectiveness of these measures, however, is not certain as it is proven that one solution does not fit all, whereas their performance relies on the city and measures' characteristics. To better understand and assess the impacts of a solution in a city context, ex-ante evaluation of the solutions through modelling is advised.

This study aims at identifying and analysing good practices implemented in case studies and deepen into the international trends, which apply in techniques for urban distribution systems' simulation, through modelling. Specifically, this paper extends the review of current state of practice in modelling smart logistics solutions, performed by Karakikes and Nathanail (2017), by interrelating transport, financial and demographic data of the urban area with the simulation technique, stakeholder category and solutions' characteristics, identifying similarities and differences and explaining the implications and specific requirements in each combination. Based on the review results, clusters of simulation techniques associated to solutions are formed to serve as guidance to interested stakeholders regarding impact assessment of innovative and smart distribution systems.

Keywords:	City logistics; Last mile distribution; Stakeholders; Evaluation

Table 3: Presentation 3 – Possible Consequences of the Implementation of Transport Integration in the Riga Planning Region

Code:	**3**
Responsible or involved partner:	UNI-WEIMAR
Paper title:	Possible Consequences of the Implementation of Transport Integration in the Riga Planning Region
Author(s):	J. Uhlmann
Reference:	J. Uhlmann, 2018. "Possible Consequences of the Implementation of Transport Integration in the Riga Planning Region". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

The Latvian capital Riga and surrounding area together form the economic and political centre of the Republic of Latvia and the biggest urban agglomeration in the Baltic states. It faces some distinct challenges in terms of public transport (PT).

The years after Latvia regained its independence in 1991 were characterized by a modernization of the country and an integration into the European Union. While the PT fleet has gradually modernized, and modern means of fare collections have been introduced with some operators in recent years, the PT services still lag behind most Western European cities in terms of transport integration (intermodal

journeys with a unified ticket, coordinated timetables, etc.). The road infrastructure is congested during peak hours, especially the bridges crossing the river Daugava, while PT passenger numbers are declining (Rīgas satiksme, 2017). The City of Riga and the municipalities in the surrounding area also lack common planning and coordination in the transportation field, which reflects the current trends of suburbanization in the area (OECD, 2017). A possible solution is transport integration, aiming to make public transport more convenient to use and therefore more attractive for passengers. This paper answers the questions: How could the public transportation system be improved by measures that promote transport integration? What consequences would the implementation have? To answer these questions, this paper analyses the current situation, reviews literature on concepts of transport integration and its consequences and develops two conceptional designs with different approaches on the implementation of transport integration which are then evaluated for their consequences on passengers, transport volume, costs and revenue, and environment. Two conceptual scenarios for the are developed: Scenario A features the implementation of a system of ticket integration for Riga and the surrounding area using a unified smart card, while ticket prices, discounts, and planning authority stay with the current authorities responsible for them. Scenario B covers implementation of a Public Transit Authority that acts as governing body regulating the ticketing and pricing system for all modes of PT in Riga and the surrounding area as well as being responsible for marketing, timetable coordination, and financial compensations. Operations still are carried out by individual PT companies. The consequences of Scenario A will be relatively minor. Convenience for passengers for multimodal journeys will increase, which might lead to a small increase in passenger numbers and especially interchanges. As ticket prices, except for small discounts, will stay the same, the revenue loss is expected to be minimal. The implementation of the unified e-ticket system will account for costs of around €19 million, while some savings will be achieved through the centralization of the fare collection and distribution. Measurable environmental effects are not expected. Scenario B will lead to a substantial increase in the attractiveness of multimodal journeys and a decrease in ticket prices for those journeys. The overall transport volumes are expected to rise by 2%–5%, depending also on the accompanying measures. The number of journeys including an interchange is expected to rise. Aside from the costs of the equipment of the new ticketing system of around €19 million, losses of revenue due to the new tariff system are expected to occur. Centralization of business planning and operation is expected to reduce the costs in the range of €3.4 million. Measurable environmental effects will not unfold in a short period.
Keywords: Public Transport, Transport Integration, Public Transport Authority

Table 4: Presentation 4 – Environmentally Friendly Transport Interchanges: Active Travel Accessibility and Policy

Code:	4
Responsible or involved partner:	UTH, TTI
Paper title:	Environmentally Friendly Transport Interchanges: Active Travel Accessibility and Policy
Author(s):	V. Magginas, E. Nathanail, G. Adamos, M. Tsami, I. Yatskiv (Jackiva), E. Budilovich (Budiloviča)
Reference:	V. Magginas, E. Nathanail, G. Adamos, M. Tsami, I. Yatskiv (Jackiva), E. Budilovich (Budiloviča), 2018. “Environmentally Friendly Transport Interchanges: Active Travel Accessibility and Policy”. 18th International

	Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

Environmental pollution is one of the greatest problems of contemporary society. Its effects can be experienced in every aspect of every-day life. Its causes can be traced in a multitude of human activities, including transport. The need for transport has grown as technology has advanced, as is the ease with which it can be facilitated. This has led to a rise in a lot of different types of pollution, like air and noise pollution. The effects can be mediated by reducing the need for transport by private vehicles (Garling *et al*., 2009). This is more easily achieved in large scale transport through facilities like transport interchanges. But, it is a lot more difficult to achieve in respect to the access to these facilities. This requires a targeted approach and specialized infrastructure and measures to encourage active travel (i.e. walking and cycling) accessibility to the interchanges (Tsami *et al*., 2013). These measures can be of either hard or soft nature. Hard policy is a more aggressive kind of policy, taking steps towards reducing motorized vehicle usage, mainly by increasing its operational cost and through infrastructure changes. On the other hand, soft policy consists of actions aiming to give the traveller incentives towards using an alternative mode.

This research focuses on active travel accessibility and the required actions to achieve a satisfying level of non-motorized access to urban interchanges. To this end, a systematic literature review was conducted, related to active travel policy measures and actions, as well as to measures aiming at the promotion of walking and cycling and the improvement of access to public transport terminals. This process was necessary in order to identify good practices and successful interventions implemented in Europe, but also to indicate potential legal, operational and infrastructure gaps and bottlenecks.

Based on the above, the public transport system of Riga, Latvia was investigated in terms of legislation, infrastructure, safety and space availability, addressing active travel accessibility to and from the main urban interchanges: Riga International Coach Terminal, Riga Central Railway Station and Riga Passenger Port Terminal.

The critical assessment of the literature review findings, and the analysis of the Riga transport system, facilitated the drafting of recommendations for stakeholders and decision makers, who wish to put together action plans geared towards tackling the issue of active travel accessibility at urban interchanges.

Keywords:	Soft transport modes; Interchange accessibility; Strategic plans; Good practices

Table 5: Presentation 5 – A Cross-Case Analysis of Riga Interchanges' Information Services and Technologies

Code:	**5**
Responsible or involved partner:	TTI, UTH
Paper title:	A Cross-Case Analysis of Riga Interchanges' Information Services and Technologies
Author(s):	I. Yatskiv (Jackiva), E. Budilovich (Budiloviča), I. Blodniece, E. Nathanail, G. Adamos
Reference:	I. Yatskiv (Jackiva), E. Budilovich (Budiloviča), I. Blodniece, E. Nathanail, G. Adamos, 2018. "A Cross-Case Analysis of Riga Interchanges' Information Services and Technologies". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

The European Commission in 2001 built a path towards upgrading urban interchanges in order to increase public transport usage (EC, 2001). The design of an optimal interchange depends on local framework and individual circumstances. Various issues in quality are important for good interchange management and operation and priorities may significantly differ among different interchanges.

The integration of information systems and ticketing as well as the application of other Intelligent Transport Systems (ITS) and services for users are crucial for the improvement of the travel experience and the appeal of the public transport terminals. Accurate, valid and timely information enhances the level of users' convenience and improves the efficient operation of the transport system (Grotenhuis *et al.*, 2007).

The movement of goods by enlarged cargo units, in containers, facilitates the integration processes of transport systems and facilitates the interaction of automobile and railway transport, thereby speeding up and reducing the cost of transportation.

The creation of an intermodal transport chain leads to a number of issues of strategic, tactical and operational level of planning and operations management (Caris *et al.*, 2008; Tsamboulas *et al.*, 2007). One of the reserves to reduce costs in the field of container transportation is the optimization of the interaction of automobile and railway transport at transport hubs (Marinov, 2009; Bontekoning *et al.*, 2004). A lot of studies have been devoted to the issues concerning tactical and operative planning of operations at land container terminals. Most studies on the maintenance of terminal capacities consider minimizing the costs of container processing and an efficient use of storage facilities.

The solutions are, as a rule, reduced to a minimum of the total mileage, total waiting time or general equipment delays. Let us also note the work of Sadovskaya (1984), in which sound recommendations were proposed to improve the operational planning and management of loading and unloading facilities for the processing of large-capacity containers at the container site, which allow reducing idle hours of automobile transport during the processing of containers.

Thus, in accordance with the conducted analysis of studies on the problem of the efficiency of the use of technical means at container terminals, it was established that practically all the studies in the field of cost optimization were performed without taking into account the weight characteristics of the containers.

As a result of the analysis of research on the problem of effective use of technical means at container terminals, it was established that in the offered methods on optimization of costs weight characteristics of containers are not taken into account.

The developed methodology allows developing management decisions aimed at increasing the efficiency of container terminals, as well as reducing investments in their technical development.

The main economic entities of the automobile-railway communication are distinguished, including the owner of the railway infrastructure, the operator of the railway rolling stock, the container terminal and a road carrier.

The developed model of interaction between participants in the transportation process will be able to reduce losses associated with excessive increase in the standards of the working fleet and the empty run ratio, as well as to shorten the delivery time.

Keywords:	Public transport; Terminals; Information Services; Comparison Analysis

Table 6: Presentation 6 – Optimization of Interaction of Automobile and Railway Transport at Container Terminals

Code:	**6**
Responsible or involved partner:	SUSU, KFU
Paper title:	Optimization of Interaction of Automobile and Railway Transport at Container Terminals
Author(s):	V. Shepelev, L. Zverev, Z. Almetova, K. Shubenkova, E. Shepeleva
Reference:	V. Shepelev, L. Zverev, Z. Almetova, K. Shubenkova, E. Shepeleva, 2018. "Optimization of Interaction of Automobile and Railway Transport at Container Terminals". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

The movement of goods by enlarged cargo units, in containers, facilitates the integration processes of transport systems and facilitates the interaction of automobile and railway transport, thereby speeding up and reducing the cost of transportation.

The creation of an intermodal transport chain leads to a number of issues of strategic, tactical and operational level of planning and operations management (Caris *et al.*, 2008; Tsamboulas *et al.*, 2007). One of the reserves to reduce costs in the field of container transportation is the optimization of the interaction of automobile and railway transport at transport hubs (Marinov, 2009; Bontekoning *et al.*, 2004). A lot of studies have been devoted to the issues concerning tactical and operative planning of operations at land container terminals. Most studies on the maintenance of terminal capacities consider minimizing the costs of container processing and an efficient use of storage facilities.

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The main economic entities of the automobile-railway communication are distinguished, including the owner of the railway infrastructure, the operator of the railway rolling stock, the container terminal and

a road carrier. The developed model of interaction between participants in the transportation process will be able to reduce losses associated with excessive increase in the standards of the working fleet and the empty run ratio, as well as to shorten the delivery time.

Keywords:	Container Transportation, Loading and Unloading Mechanisms, Railway Transport Operators Container Terminal Parameters

Table 7: Presentation 7 – Unsupervised Learning-Based Stock Keeping Units Segmentation

Code:	**7**
Responsible or involved partner:	TTI
Paper title:	Unsupervised Learning-Based Stock Keeping Units Segmentation
Author(s):	I. Jackson, A. Avdeikins, J. Tolujevs
Reference:	I. Jackson, A. Avdeikins, J. Tolujevs, 2018. "Unsupervised Learning-Based Stock Keeping Units Segmentation". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

An average inventory system contains immense number of stock keeping units (SKUs). In general case, it is computationally impossible to consider each item individually and manage it under individual inventory policy. As far back as late 80's, an essentially important question has arisen: "how to aggregate stock units into groups so that the resulting inventory policies are sufficiently close to those policies that would have been generated if every unit was treated individually?" (Ernst and Cohen, 1990). Nowadays the development of the efficient methodology for defining SKU's groups is still relevant. Thus, it becomes an extremely tempting opportunity to take advantage on the state-of-the-art unsupervised machine learning approaches in order to finally solve this long-standing problem.

This study discusses the application of various algorithms for clustering analysis to solve the SKU-aggregation problem. Namely, such algorithms as K-means, mean-shift and DBSCAN are compared based on the internal and external evaluation. The research utilizes dataset provided by the "Trialto Latvia SIA". The dataset under consideration contains 9240 SKUs with 14 features. Since SKU's groups should take into account all attributes with a sufficient impact on the certain inventory operation, considered features include information beyond the inventory cost and volume that are used in classical ABC analysis. Besides, the work pays special attention to comparing various validation and feature-scaling approaches.

Keywords:	Stock Keeping Units Aggregation, Unsupervised Machine Learning, Clustering, Inventory Grouping, DBSCAN

Table 8: Presentation 8 – Evaluation of The Impact of The Number of Picking Locations on the Total Cost of Warehouse

Code:	**8**
Responsible or involved partner:	TTI

Paper title:	Evaluation of The Impact of The Number of Picking Locations on the Total Cost of Warehouse
Author(s):	R. Apsalons, G. Gromov
Reference:	R. Apsalons, G. Gromov, 2018. "Evaluation of The Impact of The Number of Picking Locations on the Total Cost of Warehouse". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

Use of the smart systems becomes very popular in logistics. It is also very important to develop smart picking system for warehouses of the logistics centres. In Latvia most of logistical centres is using primitive picking technologies: the paper picking, RFID picking or more developed picking technologies such as: visual picking, picking by voice. Generally, it depends on velocity of order lines picked per paid man hour. In this paper it is discussed picking area (PA) which is located into storing area (SA). The one row rack storing system available in the definite warehouse. Picking process will be realized by picking handling units and customer units. The ground level and first level of pallet racks are used as PA. The one picking location of each stock keeping unit (SKU) 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 SKU's from SA to PA to avoid out of stocks in picking time interval. If picking location reaches critical stock level for single stock keeping unit, replenishment starts by the signal in warehouse management system. This approach is called as the Red Card principle (Apsalons, 2012).

The picking cost is optimising criterion for evaluation of the variants of organizing orders' picking process. The two approaches of the layout of SKUs in PA is analysed in this article: single picking location for each single SKU – the replenishment is realised in picking process and various picking locations for each single SKU –the replenishment is realised just only before picking process or after it. The main purpose of paper is to evaluate impact of the layout of PA on the total picking cost of the warehouse referring to approaches of the layout of stock keeping units in PA. The definition of the scientific problem is to obtain mathematic algorithms of evaluation of picking cost for these two approaches of the layout of SKU's in PA. The object of the research is storing and picking areas. The subject of the research concerns the total handling cost interconnection of replenishment process with the picking process.

The logical algorithms to evaluation of the impact of the number of picking locations on the total cost of warehouse have been developed by authors. However, a choice of appropriate approach of the layout of SKUs in PA is unequivocally. Generally, it depends on the speed of the turnover of each SKU. For single picking location for each single SKU the replenishment is realised in picking process. If picking quantity of any single SKU in replenishment time interval exceeds available picking quantity at picking location, then out of stock occur.

Keywords:	Picking Locations; Picking Process; Replenishment of Stock Keeping Units, Picking Route

Table 9: Presentation 9 – Exploring the Potential of Social Media Content for Detecting Transport-Related Activities

Code:	**9**
Responsible or involved partner:	TTI, UTH
Abstract title:	Exploring the Potential of Social Media Content for Detecting Transport-Related Activities

Author(s):	D. Pavlyuk, M. Karatsoli, E. Nathanail
Reference:	D. Pavlyuk, M. Karatsoli, E. Nathanail, 2018. "Exploring the Potential of Social Media Content for Detecting Transport-Related Activities". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

The explosive growth of social media use and the amount of the publicly shared information has resulted in huge volumes of available and active data. The wide spread of social media encourages the users to share more often their activities as well as their location, leading to an exponential increase of the data volume day by day. This user-generated content on social media platforms rendering them powerful tools, suitable for transport related data collection. In this paper data from Twitter are used to explore their potential for transport purposes.

Social media is acknowledged as a valuable source of information in recent literature (Kuflik *et al*., 2017; Steiger *et al*., 2016), but utility of obtained information is highly dependent on intensity of social media activities in the specified area. The main objective is to investigate the reliability of the transport related content retrieved from tweets and the transferability of findings to smaller cities and other languages.

The research data set includes thousands of tweets collected for three cities: Minneapolis-Saint Paul twin cities (USA), Riga (Latvia), and Volos (Greece) in May-June 2018. Selection of the research areas are related to substantially different environments in terms of population, language and transport infrastructure.

We use an extended information about each tweet – text, user account details, datetime, number of retweets/addition to favourite lists, and geo-reference (if available) – for its classification.

The main methodological steps of the research are:

- Pre-processing of collected data – sample clean-up (exclusion of automated notifications and empty tweets) and normalisation of tweet texts (word stemming, removal of punctuation and meaningless words).
- Identification of most frequent domain classes of messages: traffic-related, public transport-related, activity-related, etc.
- Preparation of a training sample for classification, which include tweets labelled by experts as related to one of identified classes.
- Training the classifier algorithm (naïve Bayes) and its application to the complete research sample.
- Exploring the results of classification in terms of classification precision and specific attributes of discovered classes (class size, availability of geo-reference information, etc.).

Based on the obtained results, we made conclusions about efficiency of Twitter as a social media source of transport-related information in different urban environments.

Keywords:	Text Mining; Twitter; Big Data; Classification Models; Location-Based Data

Table 10: Presentation 10 – Decision-Making Process for Choosing Technology of Diesel Bus Conversion into Electric Bus

Code:	**10**
Responsible or involved partner:	TTI, RTU
Abstract title:	Decision-Making Process for Choosing Technology of Diesel Bus Conversion into Electric Bus

Author(s):	K. Malnaca, M. Gorobetz and I.Yatskiv (Jackiva)
Reference:	K. Malnaca, M. Gorobetz and I.Yatskiv (Jackiva), 2018. "Decision-Making Process for Choosing Technology of Diesel Bus Conversion into Electric Bus". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

Following the European Commission's 2016 Strategy for Low Emission Mobility (European Strategy for Low-Emission Mobility, 2016) many local public transport authorities and operators are in need of replacing ageing bus fleet with cleaner and more sustainable vehicles in order to meet standards, increase efficiency and reduce transport related emissions. There is a wide choice of cleaner fuel and engine technologies for urban bus operators in the market including electric buses but at the same time new vehicles beyond lower emission Euro VI diesel buses are still a challenge for public transport operators due to high acquisition costs of a new vehicle and lack of charging infrastructure. The alternative proposed is to convert used diesel city bus into electric bus which would significantly reduce the harmful impact of the used diesel bus on the environment and improve performance of the vehicle.

Decision-making process for choosing technology of the bus conversion requires thorough assessment of possible solutions from technical, operational, logistical and economical point of view under the given conditions and constraints.

Within the framework of this research, mathematical models are developed for assessing the efficiency of an electric vehicle on the basis of various criteria which affect life cycle costs as well. The models include the definition of functional dependencies and dynamic performance equations of a diesel bus and a converted electric bus. The models are implemented in the specially developed simulation environment. Motion of the diesel and electric bus has been simulated for different routes, road profiles, loads with the goal to forecast and to evaluate energy consumption equivalent to daily service based on bus operating profiles in mid-size city in Latvia. The results of these models help to choose the most suitable parameters of the traction motor's torque and power under the given conditions and determine the most suitable battery type and capacity for the selected bus route. Total Cost of Ownership (TCO) model is utilized in the decision-making process to determine economic viability of technological solution to convert a diesel bus conversion into an electric bus. In addition, the assessment of charging options and availability of grid connection is also considered.

Keywords:	Low-emission: Electric Bus: Converted Diesel Bus: Economic Analysis: Total Cost of Ownership: Energy consumption

Table 11: Presentation 11 – Blockchain Application for Supply Chain Management

Code:	**11**
Responsible or involved partner:	TTI, TTU
Abstract title:	Blockchain Application for Supply Chain Management
Author(s):	G. Gromovs, E. Shevtshenko, A. Norta, M. Lammi
Reference:	G. Gromovs, E. Shevtshenko, A. Norta, M. Lammi, 2018. "Blockchain Application for Supply Chain Management". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

The increased dynamics of digital supply chain integrations forcing companies to investigate the possibilities of emerging technologies, which enables to increase the interoperability and decrease the dependability on intermediate companies for mapping and integrating company specific data (Korpela *et al*., 2017). Existing solutions typically caused high integration costs, and target of current research is to offer an alternative solution for supply chain integration, based on block chain technology (Blasetti, 2016). Blockchains are a specific type of a distributed ledger and a way of ordering and verifying transactions into blocks with various protections against tampering and revision (Gromov and Lammi, 2017). If a blockchain is well-implemented, the resulting advantages include speed, privacy, reliability, and much lower costs (Kabashkin, 2017). To simplify the integration with existing Supply Chain authors have developed the novel Blockchain API, designed accordingly to the needs of predefined transport corridor. Authors research the impact of the new API to transport times with target to prove that the technology developed has made the significant effect on transit times. Authors have applied Value Added Chain (VAC) and Event Process Control (EPC) notations for supply chain modelling and simulation to validate the advantages of suggested solution during the Pilot1 project, which is a miniature example model of the approach applied to transport corridors. To measure the efficiency of new solution authors identified the measuring points and generated metrics framework based on SCOR standard based Key Performance Indicators. Qualitative analysis is used to measure: process efficiency, labour cost, time. Quantitative analysis of operational and waiting time's measurement using valid statistical base. Authors have tested the impact of the novel Blockchain API developed under the frame of SMART Log project, to transport and transit times. It is obvious, that whatever transport time reduction we will deliver, the ones benefitting from it are not the transport companies, but their customers, who are in manufacturing and retail. The target of current research project is to reduce the cycle time by 3% at least (full cycle: empty from depot - full export to terminal in a 20km long loop) when compared the situation before the developed methodology was used and after, and the testing methodology and comparison method will be described in the article.
Keywords: Supply Chain Modelling; Blockchain; API; SCOR

Table 12: Presentation 12 – Spatiotemporal Feature Selection for Urban Traffic Flow Forecasting

Code:	**12**
Responsible or involved partner:	TTI
Abstract title:	Spatiotemporal Feature Selection for Urban Traffic Flow Forecasting
Author(s):	D. Pavlyuk, E. Mertens
Reference:	D. Pavlyuk, E. Mertens, 2018. "Spatiotemporal Feature Selection for Urban Traffic Flow Forecasting". 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

Abstract:

Short-term traffic forecasting is an emerging problem in transportation engineering that attracts significant academic attention over past decades. Recently a methodological focus of researches shifted to spatiotemporal models that utilise both spatial and temporal relationships (Ermagun and Levinson, 2018). Given a large number of available urban traffic data sources, an appropriate variable selection becomes an integral part of modern forecasting methodologies. In this study we present an empirical

analysis of different approaches to spatiotemporal variable selection for support vector regression and their stability in case of large urban networks.

We employ the classical soft-margin support vector regression model (Drucker et al., 1997). The support vector regression was selected as a predictor due to its good balance of the resulting model transparency (inherited from statistical models) and flexibility (inherited from neural networks).

The problem of variable selection is of great importance in specifying support vector regression models, because the potential number of explanatory variables is generally large, especially when simultaneously taking into account temporal and spatial information of a city-wide road network, and naturally lead to problems of high dimensionality and overfitting. Several recent studies (Chen et al., 2017; Xu et al., 2016; Zheng et al., 2018) mentioned this problem as a potentially important research direction.

In this study we consider different approaches to selection of explanatory variables x_i, such as predefined road network-based predictors (exogenous filter approach) and evolutionary identified predictors (wrapper approach). The main focus of this research is a stability (in terms of overfitting prevention) of selected approaches given an expanding size of analysed road network segment.

Keywords:	Spatiotemporal Models, Feature Selection, Support Vector Regression, Urban Traffic Modelling

Table 13: Presentation 13 – Impact of Joining the European Union on the Development of Transport Policy in the Republic of Latvia

Code:	**13**
Responsible or involved partner:	TTI
Abstract title:	Impact of Joining the European Union on The Development of Transport Policy in the Republic of Latvia
Author(s):	J. Kanels
Reference:	J. Kanels, 2018. “Impact of Joining the European Union on The Development of Transport Policy in the Republic of Latvia”. 18th International Conference on Reliability and Statistics in Transportation and Communication, Riga Latvia, 17-20 October 2018.

***Abstract*:**

Over the past 25 years Latvia has rapidly evolved into a modern European state. Dramatic changes in the political and economic system of Latvia also were accompanied by the reforms in the field of public administration. Public administration reforms started at the beginning of 1990-s and the current planning period (2014 - 2020) is already the fourth stage in the development of public administration policy. However, in the author's opinion, the greatest influence on the development of the state administration system was left to the process of preparation for Latvia's accession to the European Union and becoming a member of the EU.

Transport is one of the central elements of the process of European integration, which helps to create an internal market conducive to employment and economic growth. Transport policy is one of the common policies of the European Union that has existed since the beginnings of the EU (European Commission, 2011), as it was considered essential to guarantee three of the four freedoms of common market set out in the Treaty of Rome in 1957: the freedom of movement of people, services and goods.

In Latvia, as elsewhere in Europe and in the world, transport plays an important role in the economy and in providing access. Transport share in Latvia's GDP has been around 10% in recent years, with

around 9% of the population employed in the sector. Overall evaluating there is no doubt that Latvia's transport sector has evolved as a member of the European Union. The implementation of the EU legislation and technical, social and environmental standards has taken place; very significant investments have been made for infrastructure development.

At the same time, it is difficult to find out any comprehensive research on the particular impact on the Latvian transport sector of accession to the EU and the consequences of this accession. Therefore the aim of this paper is to try to answer following questions:

• How process of joining of the European Union contributed to the development of the Latvian transport sector, and how has the transport policy changed in the period after accession?

• What are the economic, social and environmental consequences of Latvia's accession to the European Union in the transport sector?

In order to answer these research questions, it is necessary to determine, by means of ex-post impact assessment method, what are immediate or long-term political, economic, social, technical, environmental etc. consequences of Latvia's accession to the EU (Project ASSIST, 2012), of the acquisition of its legislative package acquis communautaire in the transport sector and of the attraction of EU funds to infrastructure projects in this sector. Paper also looks at the essence of the impact assessment system (Renda, 2006).

Keywords: Public Administration; Integration in the EU; Impact Assessment; Transport Policy

3 Analysis

In total, seven presentations were given during the special session “Sustainable Transport Interchanges”. Two of them were provided by TTI representatives from Latvia, 1 by UTH (Greece) and the rest by other representatives (see Figure 1).

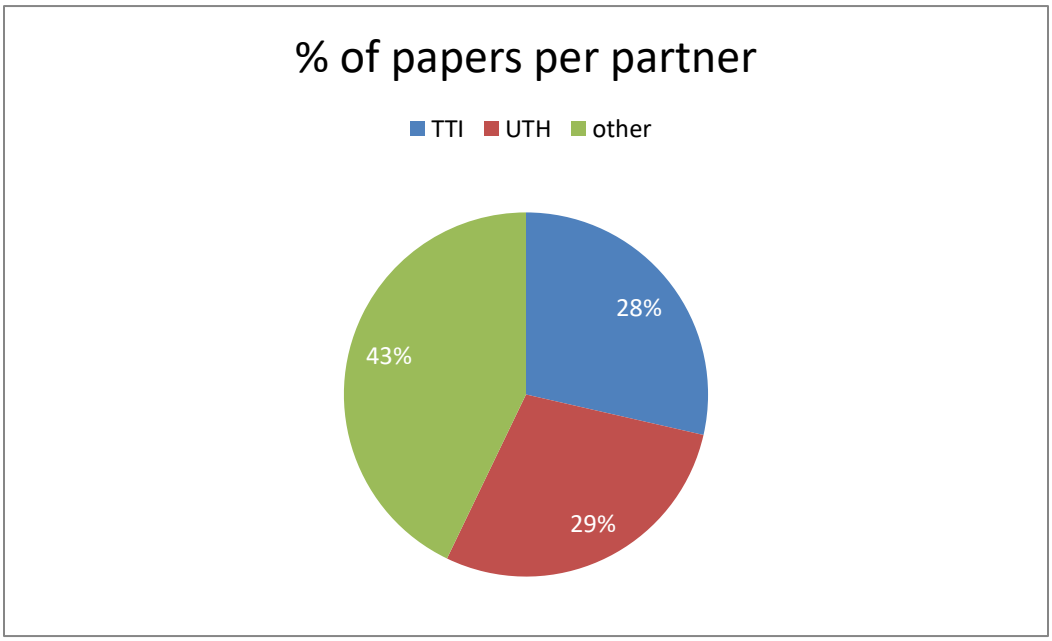

Figure 1: Percentage distribution of contributions per partner

In total, there are 24 authors and co-authors of the presentations. Figure 2 shows the percentage distribution of authors and co-authors by ALLIANCE partners and other universities and research institutes.

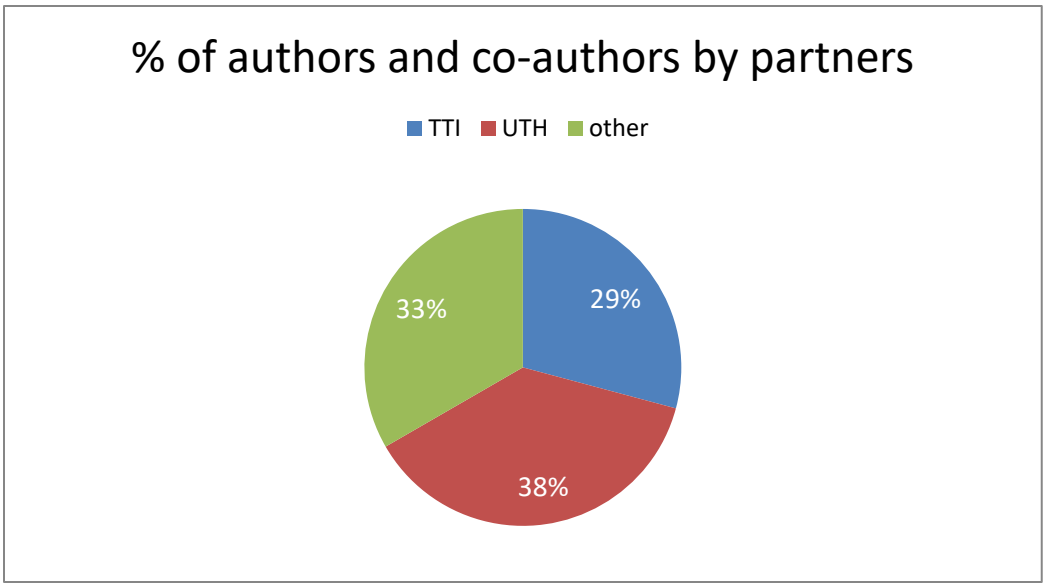

Figure 2: Percentage distribution of authors and co-authors by partners

In addition, 46% of the authors or co-authors of the presentations were female, and the rest 54% were male, which shows an acceptable gender balance (Figure 3).

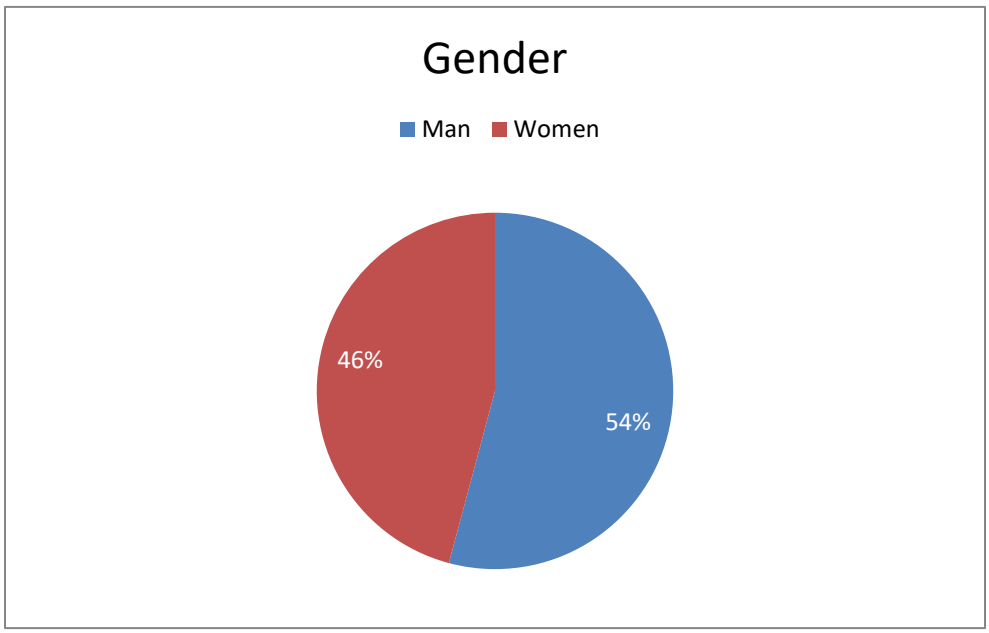

Figure 3: Gender distribution

Lastly, 54% of the authors or co-authors were young researchers and the rest 46% were senior researchers, addressing the scope of ALLIANCE for the active involvement of students and young researchers in its activities (Figure 4).

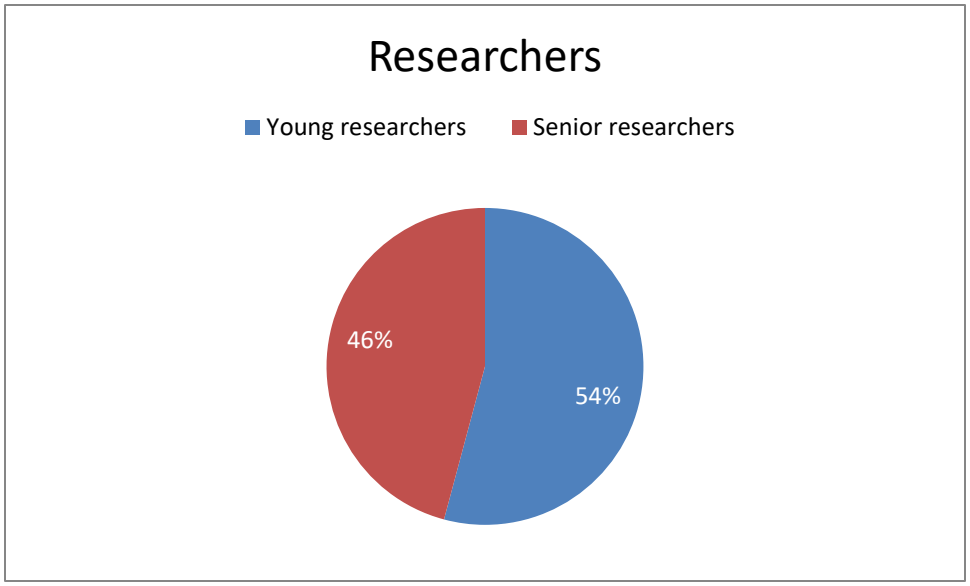

Figure 4: Percentage of young & senior researchers

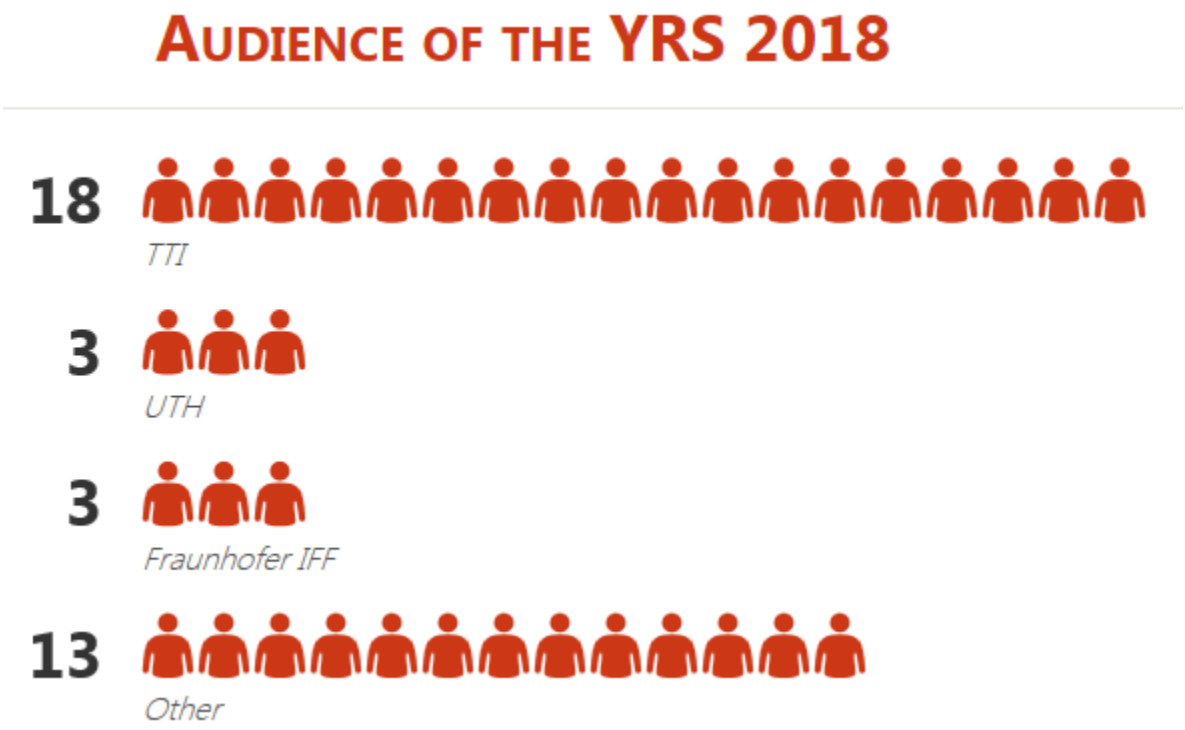

Figure 5: Audience of the YRS (based on attendance list)

4 Synopsis

This deliverable is the compendium of the ALLIANCE contribution to the 18th International Conference on Reliability and Statistics in Transportation and Communication (RelStat'18), which was held on 17-20 October 2018 in Riga, Latvia.

Thirteen abstracts were accepted, and the authors received an official notification from the moderators of ALLIANCE YRS and were invited to present their research work.

Seven abstracts were chosen for presentation in the special session "Sustainable Transport Interchanges" and 6 abstracts were recommended for presentation in other sessions of the 18th International Conference on Reliability and Statistics in Transportation and Communication (see Annex C).

Table 14: Overview of the activity

No	Type of activity	Main Leader	Title	Date/period	Place	Type of audience	Size of audience	Countries addressed
1	18th International Conference	TTI	Reliability and Statistics in Transportation and Communication	17-20 October 2018	Riga, Latvia	Research & academics communities, Local & regional authorities, Transport & terminal operators, Transport policy makers & influencers, Enterprises /Businesses, General public	120 participants	7 abstracts in Special Session and 6 - in other

Table 15: Overview of contribution to YRS

No.	Title	Authors	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Contribution	Permanent identifiers (e.g.. link, if available)	Is/Will open access provided to this publication?
1	Conceptual Models for Better Interoperability Between Road and Rail Transport in Lithuania	A. Vasilis Vasiliauskas, V. Vasilienė-Vasiliauskienė, J. Sabaitytė	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
2	Techniques for Smart Logistics Solutions' Simulation: A Review	I. Karakikes, E. Nathanail, M. Savrasovs	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
3	Possible Consequences of the Implementation of Transport Integration in the Riga Planning Region	J. Uhlmann	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
4	Environmentally Friendly Transport Interchanges: Active Travel Accessibility and Policy	V. Magginas, E. Nathanail, G. Adamos, M. Tsami, I. Yatskiv (Jackiva), E. Budilovich (Budiloviča)	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
5	A Cross-Case Analysis of Riga Interchanges' Information	I. Yatskiv (Jackiva), E. Budilovich (Budiloviča), I. Blodniece, E. Nathanail, G. Adamos	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

No.	Title	Authors	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Contribution	Permanent identifiers (e.g.. link, if available)	Is/Will open access provided to this publication?
	Services and Technologies									
6	Optimization of Interaction of Automobile and Railway Transport at Container Terminals	V. Shepelev, L. Zverev, Z. Almetova, K. Shubenkova, E. Shepeleva	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
7	Unsupervised Learning-Based Stock Keeping Units Segmentation	I. Jackson, A. Avdeikins, J. Tolujevs	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
8	Evaluation of The Impact of The Number of Picking Locations on the Total Cost of Warehouse	R. Apsalons, G. Gromov	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
9	Exploring the Potential of Social Media Content for Detecting Transport-Related Activities	D. Pavlyuk, M. Karatsoli, E. Nathanail	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
10	Decision-Making Process for Choosing Technology of Diesel Bus Conversion into Electric Bus	K. Malnaca, M. Gorobetz and I.Yatskiv (Jackiva)	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

No.	Title	Authors	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Contribution	Permanent identifiers (e.g.. link, if available)	Is/Will open access provided to this publication?
11	Blockchain Application for Supply Chain Management	G. Gromovs, E. Shevtshenko, A. Norta, M. Lammi	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
12	Spatiotemporal Feature Selection for Urban Traffic Flow Forecasting	D. Pavlyuk, E. Mertens	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
13	Impact of Joining the European Union on The Development of Transport Policy in the Republic of Latvia	J. Kanels	Compendium of abstracts presented at the 18th International Conference on Reliability and Statistics in Transportation and Communication	October 2018	ALLIANCE Project	Riga, Latvia	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

ANNEX A: Agenda of YRS "Sustainable Transport Interchanges"

Enhancing excellence and innovation capacity in sustainable transport interchanges
ALLIANCE
(Grant agreement no.: 692426)

Young Researcher Seminar "Sustainable Transport Interchanges"
Agenda

Location: Transport and Telecommunication Institute, Lomonosov street 1, Aud. 130
18-19 October 2018, Riga, Latvia

18 October 2018		
Time	**Topic**	
09:15 – 10:00	Registration and Welcome Coffee (Aud. 130)	
10:00 – 12:30	**Opening Session and Plenary Session** (Hall#1 – Aud. 130). Moderator: TTI Vice-Rector, Prof. Irina Yatskiv (Latvia) • ***Prof. Enrique Onieva (Spain)*** Artificial Intelligence and Data Analysis Applications in Intelligent Transportation Systems • ***Prof. Itzhak Benenson (Israel)*** SMART-PT: Adaptive Public Transport for a Smart City • ***Prof. Gunnar Prause (Estonia)*** The Socio-Economic Impact of Green Shipping: A Holistic View from the Baltic Sea Region	
12:30 – 13:30	Lunch	
13:30 – 15:30	Parallel Sessions of RelStat'18	
15:30 – 16:00	Coffee Break	
16:00 – 18:00	Parallel Sessions of RelStat'18	Education and Training in Engineering (Project ALLIANCE)
19 October 2017		
Time	**Topic**	
Special session **Sustainable Transport Interchanges** Moderators: *Prof. Irina Yatskiv (TTI, Latvia)* *Dr. Giannis Adamos (UTH, Greece)*		
10:00 – 10:20	Conceptual Models for Better Interoperability between Road and Rail Transport in Lithuania ***Aidas Vasilis Vasiliauskas, Virgilija Vasilienė-Vasiliauskienė, Jolanta Sabaitytė (Lithuania)***	
10:20 – 10:40	Techniques for Smart Logistics Solutions' Simulation: A Review ***Ioannis Karakikes, Eftihia Nathanail, Mihails Savrasovs (Greece, Latvia)***	
10:40 – 11:00	Possible Consequences of the Implementation of Transport Integration in the Riga Planning Region ***Julius Uhlmann (Germany)***	

11:00 – 11:20	Environmentally Friendly Transport Interchanges: Active Travel Accessibility and Policy ***Vissarion Magginas, Eftihia Nathanail, Giannis Adamos, Maria Tsami, Irina Yatskiv, Evelina Budilovich (Greece, Latvia)***
11:20 – 11:40	A Cross-Case Analysis of Riga Interchanges' Information Services and Technologies ***Irina Yatskiv, Evelina Budilovich, Iveta Blodniece, Eftihia Nathanail, Giannis Adamos (Greece, Latvia)***
11:40 – 12:00	Optimization of Interaction of Automobile and Railway Transport at Container Terminals ***V.D. Shepelev, L.A. Zverev, Z.V. Almetova, K.A. Shubenkova (Russia)***
12:00 – 12:20	Unsupervised Learning-Based Stock Keeping Units Segmentation ***Ilya Jackson, Aleksandrs Avdeikins, Jurijs Tolujevs (Latvia)***
12:20 – 12:30	Summary and certification of participants
12:30 – 13:30	Lunch
Time	**Topic**
13:30 – 15:30	Parallel Sessions of RelStat'18
15:30 – 16:00	Coffee Break
16:00 – 16:30	Closing Session (Hall#1 – Aud.130)

ANNEX B: Posters session

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Assessing performance of a passenger transport interchange: Railway accessibility for disabled people inside the Riga Central Station

Ineta Ielīte, Irada Heidarova, Theonymfi Xydianou, Atrjoms Ušakovs
Transport and Telecommunication Institute
Lomonosova iela 1, Rīga, LV 1019, Latvija
ielite.l@tsi.lv artjoms.usakovs.tsi@gmail.com

Abstract

Analysis of accessibility for people with disability inside Riga Central Station by using various data collection methods and statistical analysis, has presented that the transport interchange is in compliance with EU and national legislation, the station infrastructure, ticketing system, rolling stock and aprons provide access to people with various types of disability allowing ever larger numbers of passengers with disability use the services. However, both, the infrastructure owners and stakeholders are looking for more improved solutions that are present in EU interchanges.

Goals of research

Collect data about demand, transport modes, services for disabled persons

Define: terminal location in the city, surrounding area features, distances between different modes

Assess: way-finding, legibility (layout, lighting, surfaces, finishes), permeability (easy movements), inclusivity (design of lifts and escalators, personnel assistance, information), facilities (service areas, waiting areas/platforms, amenities, comfort)

Indicate involved stakeholders: interchange's stakeholders, local government, developers and businesses, associations, users

Methodology

Literature review, data collection: observation on-site, face to face interview with stakeholders, quantitate data derived from the web

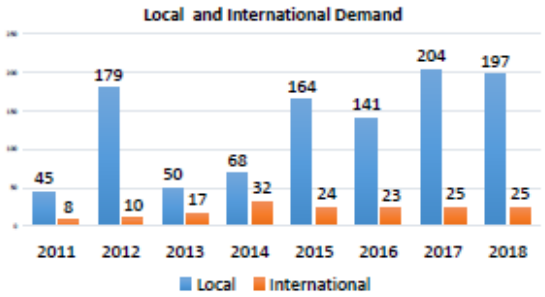





Analysis of the interchange's components

- Station infrastructure: parking, main entrances, movement inside the building, information desks, apron access
- Ticketing system: ticket desks, other ticketing options
- Rolling-stock and aprons: apron equipment, wagons access, train wagons

Statistical analysis



Conclusions

Priority infrastructure adjustments for improved accessibility are:

Parking:
- Reduced number of doors, automated doors and wide elevator

Main entrances:
- Step-free access from all sides; at least one automated door per entrance, rubber mud collectors changed

Movement inside the building
- Metal ramps changed with travolators
- Marked access for people with visual impairment*

Information desks:
- Connected and integrated network for voice information stands
- To provide more pictograms, in different colors for easy understanding*

Apron access
- Support call buttons should across the interchange to request assistance
- More assistants, in special recognizable uniforms

Ticketing system. Ticket desks. Other ticketing options
- Ticket machines inside the building
- Specially designed ticket office where only disabled travelers could be served

Rolling-stock and aprons. Apron equipment
- Safety barriers to avoid free fall onto rails

Rolling-stock and aprons. Wagons access
- Automated lifts on each platform

Rolling-stock and aprons. Train wagons
- Each train with wagon fully equipped for people with disabilities, equipped with automated doors for easy access inside the wagon

* Also on aprons

This poster was supported by ALLIANCE project (http://alliance-project.eu/)

TSI Transport and Telecommunication Institute
TTLg Traffic, Transportation and Logistics Laboratory
Fraunhofer IFF

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 692426

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Exploring the Potential of Social Media Content for Detecting Transport-Related Activities

Dmitry Pavlyuk[1], Maria Karatsoli[2], Eftihia Nathanail[3]
[1] Transport and Telecommunication Institute, Latvia
[2,3] University of Thessaly, Greece
Corresponding author: Dmitry Pavlyuk, Dmitry.Pavlyuk@tsi.lv

Introduction

The wide spread of social media encourages users to share more information about their activities, opinions and locations. Due to high availability and low cost of obtaining data, social media platforms become a valuable data source of transport-related information. In recent years several studies have analyzed the use of social media for transport related purposes. Such studies open up a potential of social media for various applications including incident detection, transport planning and decision making, human mobility and travel behavior analysis (Steiger et al., Transp.Res.C, 2016).

Aim of the research

The main objective of this study is investigation of reliability of social media content (Twitter) as a source of transport-related information in different geographical environments (with different population sizes, Twitter penetration rates, and spoken languages).

Methodology

Main methodological stages of the research presented on Fig. 1:

Fig. 1. Main research stages

Data collection is implemented via standard Twitter API and scripts, developed by the authors; collected tweets were preliminary graded on the base of predefined keyword lists (developed scripts and lists of transport-related keywords in English, Latvian, Russian, and Greek are available by request).

Tweets in the training sample were manually labelled with one of the following classes: general and real-time transport-related information, complain, advice/question, and transport-unrelated tweets.

Collected data is pre-processed by language-specific stemming, stop words' removal, and tf-idf approach to feature construction. Further we estimated classification accuracy (via cross-validation) of three popular techniques:

- Naive Bayes classifier (unigram)
- Decision tree (recursive partitioning)
- Artificial neural network (feed-forward network)

Results

Twitter data was collected for three geographical areas: Minneapolis-Saint Paul twin cities, USA (tweets in English only), Riga, Latvia (Latvian, Russian, and English), and Volos, Greece (Greek and English).

Table 1. Summary of data collection, keyword-based grading, and manual labelling (stages 1-3)

Corpus	Number of tweets	Grade per document	Labelled documents				
			Complain	General information	Real-time information	Unrelated	Total
MSP (en)	330082	0.995	87	379	60	474	1000
Riga (en)	9846	1.096	9	255	4	232	500
Riga (lv)	12814	0.615	31	167	0	382	580
Riga (ru)	6963	0.341	16	37	3	444	500
Volos (el)	6000	0.460	5	89	2	404	500
Volos (en)	306	0.605	0	2	0	304	306

Automated classification of tweets was performed using text analytics techniques and three selected classifiers (Table 2).

Table 2. Accuracy of classification for different corpuses and classifiers (stage 5)

Corpus	Naïve Bayes		Decision tree		Artificial Neural Network	
	Accuracy	Kappa	Accuracy	Kappa	Accuracy	Kappa
MSP (en)	0.626	0.265	0.609	0.238	0.658	0.320
Riga (en)	0.750	0.523	0.780	0.576	0.806	0.624
Riga (lv)	0.698	0.158	0.736	0.308	0.723	0.316
Riga (ru)	0.888	0.000	0.884	0.031	0.890	0.184
Volos (el)	0.812	0.000	0.802	0.137	0.800	0.137

Conclusions

- **Overall intensity of transport-related tweets is low**; most useful tweets are shared by official bodies (e.g. Total Traffic & Weather network) or automated volunteered sources (Waze)
- **Good quality of keyword-based grading**. This approach is recommended as the first option for extracting transport-related information from social media
- **Higher average grades per document for English tweets**, so we observe a higher potential of tweets in English as a source of transport-related information
- **Relatively weak (but significant) classification accuracy** for all corpuses, concluding that the potential of Twitter as a source of transport-related information is very limited in specified areas.

Acknowledgements

Dmitry Pavlyuk was financially supported by the post-doctoral research aid programme of the Republic of Latvia (1.1.1.2/VIAA/1/16/112, ERDF)
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This poster was supported by ALLIANCE project (http://alliance-project.eu/)

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alliance

Modelling and Simulation of the Riga International Airport to reduce turnaround times of curcial clearance processes

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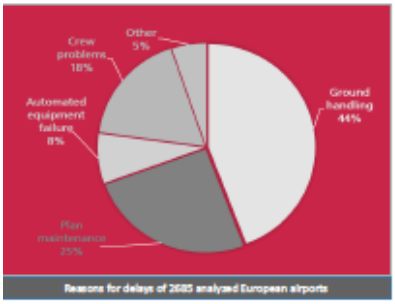
Introduction

The number of passengers as well as the number of flights have risen in the last few years at Riga International airport (RIX). Furthermore the main reason for delay of aircrafts seems to be ground handling (see below), meaning the management of the processes happening on the ground of an airport. In order to cope with the rising number of flights, new approaches are needed for ground handling are needed. In this project, a second road system for prioritized ground vehicles is introduced. Through a simulations study the effectiveness of this approached will be verified.



Reasons for delays of 2685 analyzed European airports

Problem statement

The regarded System is Apron 3 of RIX. Road systems exist for airplanes, prioritized ground vehicles and normal ground vehicles. The hierarchy in the right of way is given in the previous order list.

In order to measure the enhancement, but also delay, several performance indicators have been defined:

- Non-operation-period or handling time of an airplane
- Estimated and the measured time of travel for ground vehicles
- Distance the ground vehicles have to drive
- Resource utilization, in this case relating to the ground vehicles.

In order to control the system, several control factors were defined:

- parking positions of airplanes (location of stand on Apron 3)
- criteria for prioritization of ground vehicles (e.g. type of vehicle / stand of served airplane, ...)
- criteria for the selection of the next task (shortest / fastest / most ecological route)

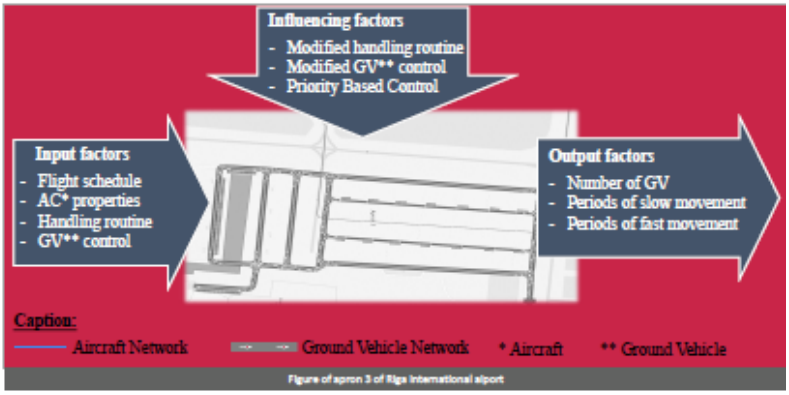


Figure of apron 3 of Riga International airport

Conceptual and simulation model

For the data preparation, the schedule of departure and arrival times were taken from RIX. There are more than 458 data sets in the summer schedule of 2017, without any repetitions. The details (volume, tonnage, fuel level, number of flight seats) to the various types of aircraft were researched from the manufacturers. The amount of luggage carried per passenger depends on the airline. Values for the process times were researched as well. This is supposed to ensure realistic results.
Based on the data preparation and its results, a rough calculation as a formal model was calculated. Each flight received an individual flight-ID. The flight number, the used airplane, the airline executing the flight, the start airport, the end destination and the days at which the flight is flown were taken. The data were supplemented by the individual technical features of the aircraft, such as number of seats for each plane, fuel capacity and the delay in minutes. All influences on ground handling could be identified and modeled. For the simulation model, a general purpose simulation software named AnyLogic was chosen, because a new non-standard movement management algorithms of ground vehicles GV should be investigated.

Experiments

During the experiments, a specific experimental setup, in which the number of available ground vehicles varied. This setup showed a saturation effect at about 70 ground vehicles in use. This means than more than 70 ground vehicles has no positive effect on the system, due to traffic congestions.
With a growing number of moving ground vehicles the need of decelerating rises. The reasons are diverse, ranging from priorities to other vehicles parking maneuvers at the terminals and the stands.

Results

It can be stated that the following positive effects were achieved by the prioritized route guidance:

- Empty runs of ground vehicles shortened
- Intersection control adapted and improved
- Flight times of the aircraft accelerated
- Efficient design of the number of ground vehicles

Methodical Conclusion

The first step was to plan the research by planning and developing a conceptual model, which included all necessary details, for example all airplanes parameters were taken form aircraft manuals and all connections from the summer flight plan of 2017 were taken as a basis for the used flight plan.
Afterwards the model was programmed into the software. The model was tested to ensure validation and verification of the model. Afterwards numerical experiments were performed, followed by a semantic interpretation of the results.

This poster was supported by ALLIANCE project (http://alliance-project.eu/)

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 692426

Assessing performance of a passenger transport interchange: Service integration at Riga International Coach Terminal (RICT)

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Sustainability in transport systems

Sustainability plays a cardinal role in transport systems especially in interchanges. An interchange is a transport–transfer hub created to gather and distribute passengers as efficiently as possible by linking outward-bound urban passenger transport facilities.

For this reason, Riga International Coach Terminal in Latvia was investigated for its service integration to point out potential problems in its operating system.

- **Crucial factors: design and layout of access and egress modes, transfer time**
- **Define: terminal location in the city, local area facilities, entrance/exit, distances between different modes, connectivity of the transport system**

To achieve this goal were set the following tasks:

- **Collect data about: demand (users/day), transport modes, services for transfer**
- **Assess: way-finding, legibility (layout, lighting, surfaces, finishes), permeability (easy transfer), facilities (service areas, waiting areas/platforms, amenities, comfort), information**

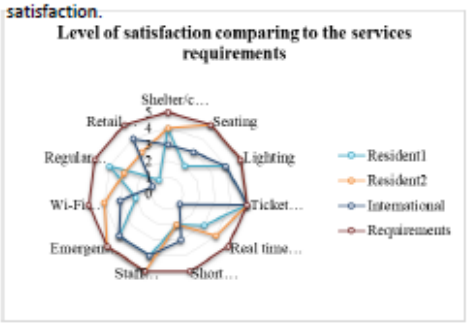
Methodology

- ✓ Face-to-face interview with the chairwoman of the RICT board. The aim was to gather information about future plans, current data and general information to create a broader picture of the current conditions.
- ✓ Customer satisfaction survey: Questionnaire according to the framework of the European Commission Research Project "City-HUB" was filled out using the "mystery shopping" approach from residents and international passengers using the marking scale from 1 to 5.

Through the satisfaction survey many aspects were tested for instance the overall cleanliness of the terminal, ticketing system, WiFi signal, number of seats and more, which were included in 8 general categories of questions. Its category for example Access had 3 to 4 indicators to be evaluated and so a mean value was derived for its one.

Service requirements

According to City-HUB's requirements the RICT was examined comparing to the level of customers' satisfaction.



Conclusions

- It is not convenient for foreigners to use the RICT due to the fact that most information are in Latvian language.
- A shelter has to be constructed for the outside waiting area for the buses.
- Improve the accessibility to the terminal especially for the pedestrians.
- Renovate the terminal inside and outside in order to be more attractive.
- Implement a two route ticket with which you can use the bus and the train.

It is worthwhile to conduct a survey among more foreign and local passengers, and also as a recommendation - to conduct a benchmarking analysis.

This poster was supported by ALLIANCE project (http://alliance-project.eu/)

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Mechanism for Investment in the Transport Infrastructure Development

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Abstract

Well-developed and efficient infrastructure is crucial for ensuring the effective functioning of the economy. A considerable lack of industry financing certainly affects the assessment of the quality of the overall infrastructure in a global context; according to the report by the World Economic Forum, Latvia languished in 51st position in its global league table for overall quality of the transport infrastructure provision. In countries with a high rating on the quality of the overall infrastructure (Germany and Great Britain), appropriate investment mechanisms have been developed. In general, the results of the study can be useful in developing financial mechanism for investing in the development of transport infrastructure in Latvia as an integral part of the investment policy for the industry development.

Goal of Research

To develop a conceptual approach to the creation of an investment mechanism for Latvia as a means to make an effective investment decision, based on the experience of Germany and other countries having a high rating of the quality of the overall infrastructure.

The research focuses on studying the following issues:

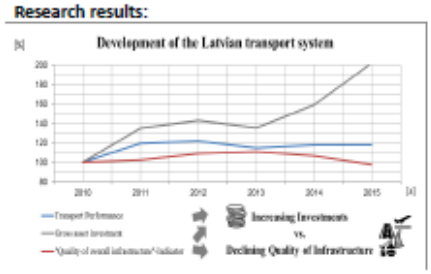
✓Transportation infrastructure investment performance in Latvia and Germany.
✓How are the investments financed? How to bridge infrastructure financing gap?
✓Mechanism for improving the management process of investment decision making in transport infrastructure.

Research Methods

✓analytical and logical-structural approaches
✓statistical and graphical methods of data processing and presentation
✓the method of comparative economic analysis.

Information sources: official data published by the state institutions of the Republic of Latvia and the Federal Republic of Germany, official publications of the World Forum and the Organization for Economic Cooperation and Development, OECD. To evaluate the results of the development of transport infrastructure in the international aspect, the calculation methodologies of Global Competitiveness Index (GCI) has been implemented.

Research results:



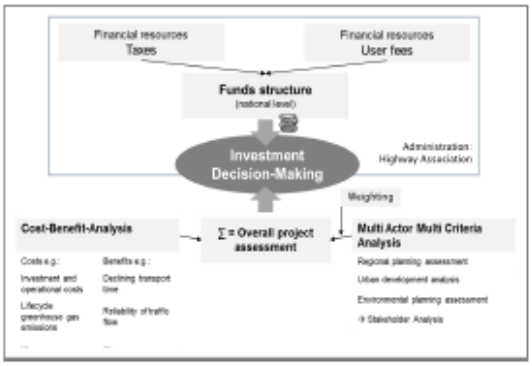
The transport and storage sector is one of the most promising sectors in the Latvian economy, and today it contributes 9.5% of GDP. The OECD data shows that in 2015 total investment in infrastructure development increased more than 12.5 times comparing with 2010. The main source of financing the transport sector in Latvia is EU funds.
Despite the positive dynamics of investments, the indicator "Quality of overall infrastructure" in 2015 was only 4.4. This is the lowest index for the last 6 years.

Investment Decision Making Mechanism

Conceptual approach to building investment decision-making mechanism (developed by the authors based on PwC model and 'Green Book')

Application of the ROAMEF cycle approach at each level establishes the relationship between the objectives of the investment policy and resources, on the one hand, and the indicators of project implementation and reporting, on the other.

Investment Decision-Making Concept
(developed by the authors based on commission's fund structure and COSIMA model



Conclusions:

✓The role of the state in funding the transport sector remains the leading one, but PPP are seen as an efficient way of financing the transport infrastructure.
✓The lack of an orderly investment mechanism was called by the European Commission among the most serious problems of implementing the investment policy in the development and maintenance of the transport industry.
✓Investments in transport infrastructure may be attractive for private investors, but only if the investment project developed on the basis of the adopted business model is attractive itself. The essence of the investment mechanism is to help find the most profitable investment solution and the most efficient way of financing an investment project.
✓ The authors have refined their proposed conceptual approaches for developing investment decision-making mechanism into recommendations aimed at policy-makers, professionals, academics.

This poster was supported by ALLIANCE project (http://alliance-project.eu/)

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Passenger transport accessibility at interchanges

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Supervisors: Dr. Giannis Adamos[2], Prof. Irina Yatskiv (Jackiva)[1], Prof. Eftihia Nathanail[2]
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Abstract

Transportation plays a vital role in the socio-economic development of a country and is explicitly important in developing countries, where inadequate levels of transport services often jeopardise high-quality mobility and accessibility.

Intermodality, defined by the European Commission as the policy under which different transportation modes are being combined in a trip to achieve a seamless journey, promotes short and long-distance integration.

Case study: Riga International Coach Terminal (RICT)

more 2 million of passengers

Evaluation of RICT accessibility level

Criteria	Indicators	Average rating (M)	Standard deviation (SD)
Wayfinding information	Signposting to different facilities and services	3.62	1.05
	Signposting to transfer between transport modes	3.31	1.12
	Information and assistance provided by staff	3.59	1.08
Time and movement	Distances between different transport operators or transport services	3.77	0.97
	Coordination between different transport operators or transport services	3.43	1.03
	Use of time at the interchange	3.52	1.06
	Distance between the facilities and services	3.93	1.0
	Ease of movement due to number of people inside the interchange	3.64	1.06
Access	Ease of access to the interchange	3.97	0.94
	Ease of access from the interchange	4.02	0.93
Overall satisfaction	Level of services provided by the interchange	3.50	0.79

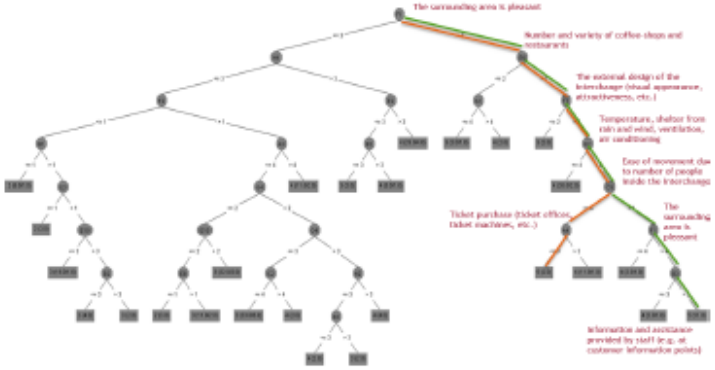
Collaboration team research is discussed

- *International Logistics Doctoral Students Workshop IFF, Magdeburg, Germany, June 2017*
- *1st and 2nd ALLIANCE Summer Schools, Riga, Latvia*
- *International Conference ReiStat, Riga, Latvia: 2017, 2018*
- *4th Conference on Sustainable Urban Mobility (CSUM2018), Skiathos Island, Greece, May 2018*
- *The 46th European Transport Conference, 10-12 October 2018: Dublin Castle, Dublin, Ireland*
- *Journal Transport and Telecommunication, Vol. 19 (3), 2018*
- *ALLIANCE Final Conference, Riga, Latvia, October 2018*

Travelers versus stakeholders

Service factors	Travelers		Stakeholders	
	Average rating	Standard deviation	Average rating	Standard deviation
Overall satisfaction	3.5	0.79	3.8	1.39
Information	3.8	0.77	4.1	0.56
Time and movement	3.7	0.77	3.9	0.59
Access	4.0	0.89	3.2	1.64
Comfort and convenience	3.4	0.83	3.8	0.76

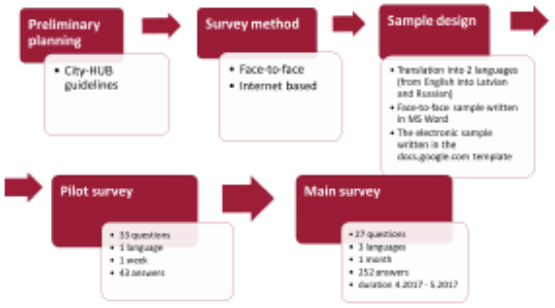
Assessment of RICT design and operation through a decision tree approach



Methodological approach

- Systematic state-of-the-art review
- Problem definition: transport accessibility
- Traveler satisfaction survey
- Stakeholder survey
- Innovative techniques for data analysis

Traveler satisfaction survey



Comparative analysis with European interchanges

Interchange	Overall satisfaction	Access	Satisfaction with signposting & station's staff
Moncloa Madrid	3.92	4.19	3.81
Kamppi Helsinki	3.94	4.29	3.70
Ilford Railway Station London	3.16	3.33	3.26
New Railway Station Thessaloniki	3.13	3.73	3.26
Kobanya-Kispest Station Budapest	3.61	4.31	3.70
RICT	3.50	3.81	3.50

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Assessing performance of a passenger transport interchange: Information provision at Riga International Airport

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Abstract

Riga International airport is the pivotal infrastructure facility in the Baltic States. The current and forecasted figures prove that the passenger traffic is expected to increase in the nearest future. Moreover, within the framework of the Rail Baltica project, a railway is supposed to link Riga International Airport with the railroad system, which may transform Riga international airport to a multimodal node and increase the passengers' turnover even more. In order to cope with such a forecasted growth, it is important to have an efficient information provision. The airport shows the stable growth and is expected to grow even more in the forecasted future, namely, with the number of passengers increasing by 16.3%, Riga Airport was ranked fifth in TOP 5 fastest growing airports of Europe this April, showing a steady increase in traffic. However, currently the board of the airport has no clear vision or understanding on what type of information is important for each traveller group. In this regard, it is important to link information with traveller groups and identify the suitable delivery channel. The survey covered respondents among experts and non-experts in the field of transport and logistics.

The passenger traffic growth

Research goals

The key goal of this study is the assessment of the current information provision at Riga international airport and suggestion of possible improvements.

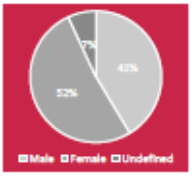
In order to conduct this research, we designed a survey to verify several hypotheses concerning the insufficient information provision.

Current issues

- Check-in zone may become a bottleneck in the future;
- Lack of personalized information provision;
- No dynamic map;
- Some pictograms and abbreviations are not enough readable;
- Secondary sign-posts are not enough clear and visible;
- The urgent need to Integrate the FLIO application into the information provision.

Results of survey

The survey covered 29 respondents among experts and non-experts in the field of transport and logistics.



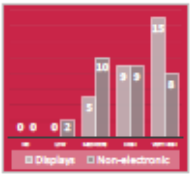
Gender distribution of respondents

Share of experts in transport and logistics

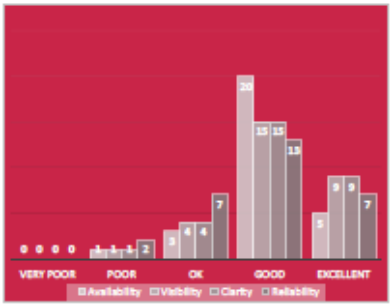
Despite the fact of relatively good information provision in general, there is a quite significant share of 28% of respondents, who are not satisfied with the current level of information provision at Riga international airport.

The most valuable conclusion to make based on this fact is that this relatively smaller share of dissatisfied visitors is the most important for further improvement of information provision at Riga international airport. Especially, taking into account the fact that the vast majority of respondents pay lots of attention to both displays and non-electronic signposts.

Satisfaction by current information provision at the airport



Aattention paid on displays and non-electronic signposts

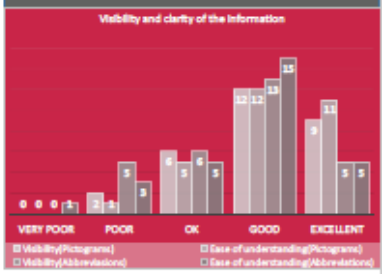


The current information provision by displays

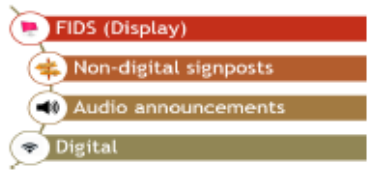
The provision was assessed by the following criteria:

- Availability;
- Visibility;
- Clarity;
- Reliability.

Among the non-electronic means of information provision, pictograms and abbreviations were considered to be the weakest point by the representative of the airport. However, the same result on average was shown, namely, the provision was assessed on such criteria as visibility and clarity.



Visibility and clarity of abbreviations and pictograms



Information by source

Conclusion

Riga international airport is growing and will inevitably face new challenges. According to the survey conducted within the framework of this study, current information provision is not fully sufficient. Moreover, the Rail Baltica project may transform Riga international airport to a multimodal node and increase the passengers' turnover even more. This fact threatens to make current information provision poor in conditions of rapidly growing traffic.

The conducted survey also unveils the fact that despite the fact that the share of dissatisfied visitors is relatively small, their presence is important by itself and the management of the airport should pay attention on it for further improvement of information provision. Since personalized information may increase both the quality of service and non-flight related revenues, information interchange is crucially important. Furthermore, both travellers and information must be grouped and linked in such a way to maximize the efficiency of information provision. The individualization of content or purpose-specialization of the information can improve both general information provision and advertising capacity for non-flights revenues.

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Integrating logistics and transportation simulation tools for evaluating smart urban freight solutions

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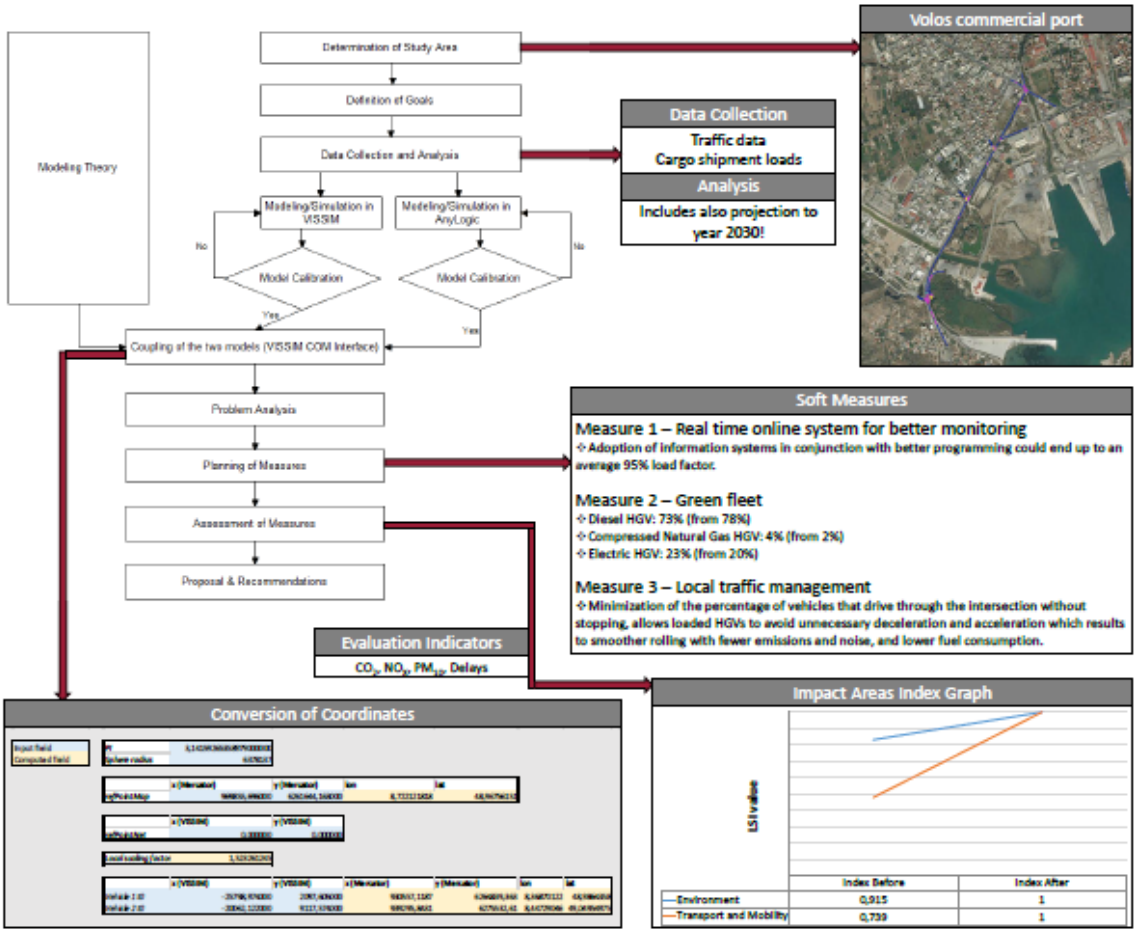
Abstract: The complexity that underlies in transport systems and logistics necessitate the integration of different models that are capable of overcoming potential limitations when considering tools individually. This paper focuses on the evaluation of traffic and logistics measures by integrating two simulation software (PTV VISSIM and AnyLogic). The simplicity of integrating the two software make the resulting model a suitable tool for evaluating measures both at urban and regional level.



Conclusions: The two well-known software can be integrated effectively!
This hybrid approach can be applied in all types of freight terminals or city freight terminals, since it connects a facility's intra-processes with the nearby transport network.

This poster was supported by ALLIANCE project (http://alliance-project.eu/)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 692426

ANNEX C: RelStat'18 Abstracts proceeding

TRANSPORT AND TELECOMMUNICATION INSTITUTE

The 18th International Multi-Conference

RELIABILITY and STATISTICS in TRANSPORTATION and COMMUNICATION (RelStat'18)

17-20 October 2018. 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 - 2018

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http://RelStat.tsi.lv

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Contents

Session 11. Education and Training in Engineering (Train-forTrainers. Project ALLIANCE)

ANNEX D: Presentations of special session "Sustainable Transport Interchanges"

Conceptual Models for Better Interoperability between Road and Rail Transport in Lithuania

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Virgilija Vasilienė-Vasiliauskienė,
Jolanta Sabaitytė,
Dovydas Baltrūnas
General Jonas Žemaitis Military Academy of Lithuania
Vilnius Gediminas technical university

Objectives

- The main strategic goal of the common European transport policy is development of efficient, environment-friendly, and sustainable transport system. The key prerequisite for this is efficient interoperability between different transport modes.

- **The goal of this presentation is to discuss the results of study aimed at identification of key shortages of transport network in Lithuania, and presentation of conceptual model that might serve as a starting point in increasing interoperability between road and rail transport.**

Outline

- Globalization and increasing role of transportation;
- Importance of multimodality and interoperability;
- Problems of Lithuanian transport infrastructure;
- Conceptual model to increase interoperability;
- Conclusions.

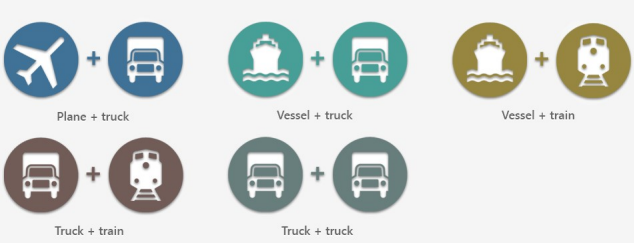
Globalization and increasing role of transportation

- The last decades of the 20th and beginning of the 21st century are associated with the accelerating pace of globalization;
- Globalization gave a chance for every country to compete in world-wide markets and set a challenge to secure their competitive position in these markets;
- One of the most important measures that assure competitiveness of country‘s economy is **provision of high quality services**.

- In the process of globalization, rates of international trade are growing and requirement for faster delivery of products increase;
- Transportation became one of the most important industry as it determines current and future conditions of countries economy and quality of inhabitant's life;
- Services provided by road freight transport in most cases seems to be the only real option that meets producer or consumer needs, however, scarcity of energetic resources, growing concern about safety and environment, as well as geographical barriers in international trade, calls for alternative modes of transportation. **The concept of multimodality in such circumstances emerged as a potential solution.**

Importance of multimodality and interoperability

- Multimodal services are of great importance since they have crucial affect on the economy of given country, and assure it's sustainable development;
- **The main prerequisite for successful implementation of "intermodality in the reality" is adequate level of interoperability between different transport modes.**



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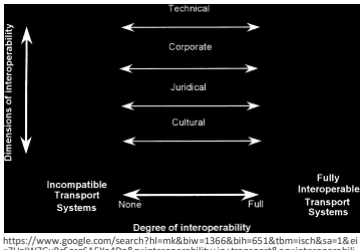
Levels of Interoperability

- Interoperability is defined as the ability of two, or more, transport systems to operate effectively and efficiently together;

- **Technical interoperability requires the various systems of physical infrastructure in different transport modes to interface effectively and efficiently.**



https://www.google.com/search?hl=mk&biw=1366&bih=651&tbm=isch&sa=1&ei=ZUzJW7GyBcSorgSA5Yn4Dg&q=interoperability+in+transport&oq=interoperability+in+transport&gs_l=img.3...10450.14592.0.15219.0.0.0.0.0.0.0.0...0.0....0...1c.1.64.img..0.0.0....0.-porrbsWkC8#imgrc=6mXbckZSS8o9jM:

- **Main infrastructure features, that show it's capability:**

✓*Density of road transport network;*

✓*Density of rail lines network;*

✓*Density of multimodal terminals network;*

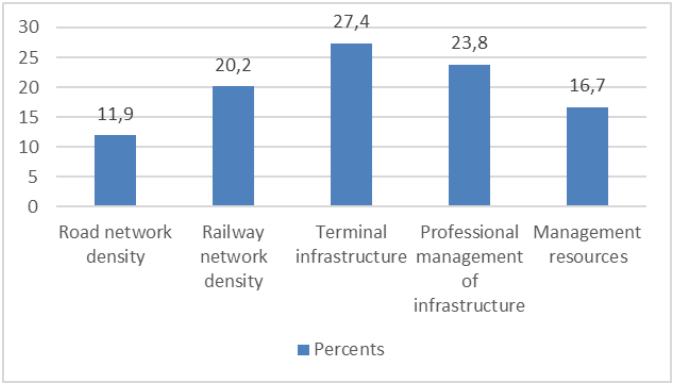
✓*Capabilities of multimodal terminals.*

- **These characteristics serve as core parameters that form background for evaluation of transport network elements of selected country.**

Problems of Lithuanian transport infrastructure

- To understand present situation of transport infrastructure elements necessary to assure development of multimodal transport services in Lithuania, research covering this topic was carried out.

- Questionnaire based on the conducted literature analysis was created and distributed among the respondents working in the positions of directors and vice-directors of state enterprises responsible for the development of rail-road terminals and multimodal services.



- Respondents agreed that **Lithuania needs further development of multimodal transport services (and, therefore, supporting infrastructure).**
- Respondents recognized that **present condition of infrastructure elements is not acceptable to assure necessary level of interoperability.**
- As the main problems, respondents identified **lack of terminal infrastructure and lack of professional management of transport infrastructure.**

Reasons that conditioned main identified problems

Reasons	Problems	
	Lack of terminal infrastructure	**Lack of professional management of infrastructure**
1.	Ignoring needs of users	Lack of strategy
2.	Complicated access	Wrong allocation of funds
3.	Lack of space	Lack of responsibility
4.	Too complicated collaboration condition	Lack of competence
5.	Wrong selection of geographical territories	Wrong selection of partnering institutions

Conceptual model to increase interoperability

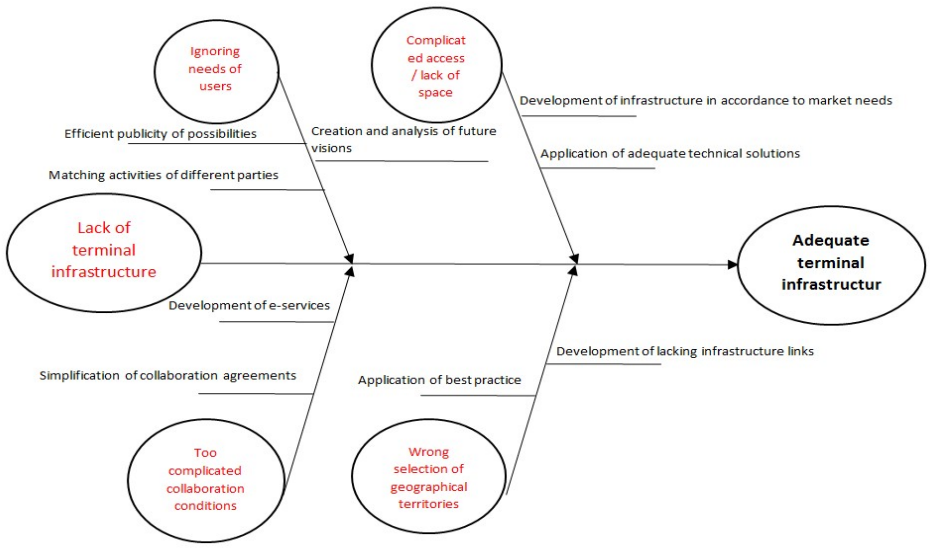
Development of model is based on the idea of elimination of causes that led to emergence of identified problems.

Problem 1 / Reasons	Suggested solutions	Problem 2 / Reason	Suggested solutions
Lack of terminal infrastructure		**Lack of professional management of infrastructure**	
Ignoring needs of users	**Match the activities of different parties**	Lack of strategy	**Regulation of relationships through the improvement of services and quality**
Complicated access	**Application of adequate technical solutions**	Wrong allocation of funds	**Increase of investments**
Lack of space	**Development of infrastructure in accordance to market requirements**	Lack of responsibility	**Increase of competences of responsible persons**
Too complicated collaboration condition	**Simplification of collaboration agreements**	Lack of competence	**More careful selection of staff, evaluation of staff's competence**
Wrong selection of geographical territories	**Development of lacking infrastructure links**	Wrong selection of partnering institutions	**Application of stricter criterions for partner selection**

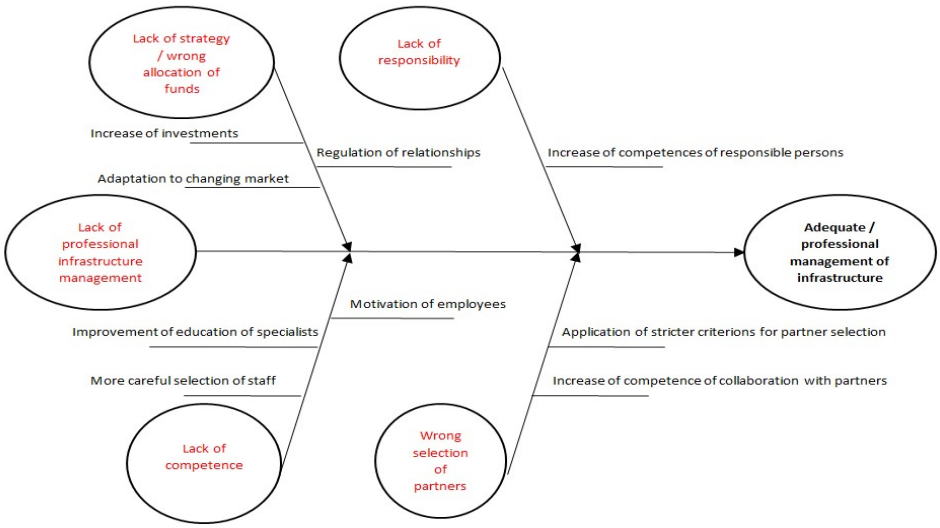
5 top-level experts conducted approbation of mentioned solutions, and this led to following two findings:

- ✓ *experts agreed that **solutions suggested to eliminate separate causes are correct, and may be incorporated into conceptual model** dedicated to increase road-rail transport interoperability in Lithuania;*
- ✓ *experts **suggested several supplementary solutions** that could be worth taking into account and could increase the quality of conceptual model.*

Conceptual model for solving problem of lack of terminal infrastructure



Conceptual model for solving problem of lack of professional management of infrastructure



Conclusions

- Development of national multimodal transport network is the main prerequisite for sustainable economic growth, and it starts from the integration of the main transport links through the network of intermodal terminals.
- Despite huge financial investments, current condition of transport infrastructure in Lithuania is not acceptable to assure necessary level of interoperability. The main problems are the lack of terminal infrastructure and lack of professional management of transport infrastructure.
- Solutions that are helpful in elimination of identified causal reasons are put on “fish-bone” diagram, and form conceptual model dedicated to solve problems of interoperability.

Thank you for your attention!

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Techniques for smart urban logistics solutions' simulation: A systematic review

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Young Researchers' Seminar: Sustainable Transport Interchanges
19 October 2018, Riga, Latvia

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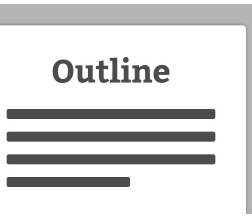
Aim

RQ: What are the most prevalent simulation techniques regarding the evaluation of innovative urban freight solutions?

Outline

1) Introduction
2) Search strategy
3) Paper inclusion criteria
4) Results
5) Discussion



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Introduction

- Systems dynamics (SD)
- Agent-based simulation (ABS)
- Traffic simulation (time discrete or continuous)
- Discrete-event simulation (DES)
- Hybrid techniques
- Miscellaneous (Custom made)

26 Solutions

Urban freight solutions	
(1) Multimodality for urban freight	(13) Access by load factor
(2) Urban consolidation centres	(14) Multi-users lanes
(3) Trans-shipment facilities	(15) Enforcement and ITS adoption for control and traffic management
(4) ITS for freight monitoring and planning/routing	(16) Businesses recognition scheme
(5) Home deliveries system	(17) Public transport indirect promotion for shopping
(6) E-commerce system for small shops	(18) Urban planning measures
(7) Cargo bikes for B2B and B2C	(19) Harmonization and simplification of city logistics rules
(8) Electric vehicles diffusion in businesses (zero-emission transport)	(20) Off peak deliveries
(9) Reverse logistics integration into supply chain	(21) Public transport for freight
(10) City lockers	(22) Freight travel plans
(11) Loading/Unloading areas and parking	(23) Crowdsourcing
(12) Access: time windows, emission zones	(24) Autonomous vehicles
	(25) Drone deliveries
	(26) 3D-printing

(NOVELOG, 2016)

Techniques for smart urban logistics solutions' simulation: A systematic review

- Search 3 databases
- Papers' screening following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.

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Search Strategy

- Databases: Web of Science Core Collection, SCOPUS and JSTOR
  - Core journals and conference proceedings related to urban freight transport
- Years: 2003 – 2018
  - Innovative solutions
- Keywords:
  - "city logistics simulation"
  - "urban freight simulation"
  - "last mile simulation"

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Paper inclusion criteria

- Address the research question
- Employment of at least one simulation technique
- Evaluation of at least one urban logistics measure
- English language
- Type of the document:
  - 1) Journal
  - 2) Conference Proceedings, and
  - 3) Book chapter

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Search Queries

Database	Query
Scopus	TITLE-ABS-KEY (urban AND freight AND simulation) OR TITLE-ABS-KEY (city AND logistics AND simulation) OR TITLE-ABS-KEY (last AND mile AND simulation) AND (LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016) OR LIMIT-TO (PUBYEAR , 2015) OR LIMIT-TO (PUBYEAR , 2014) OR LIMIT-TO (PUBYEAR , 2013) OR LIMIT-TO (PUBYEAR , 2012) OR LIMIT-TO (PUBYEAR , 2011) OR LIMIT-TO (PUBYEAR , 2010) OR LIMIT-TO (PUBYEAR , 2009) OR LIMIT-TO (PUBYEAR , 2008) OR LIMIT-TO (PUBYEAR , 2007) OR LIMIT-TO (PUBYEAR , 2006) OR LIMIT-TO (PUBYEAR , 2005) OR LIMIT-TO (PUBYEAR , 2004) OR LIMIT-TO (PUBYEAR , 2003)) AND (LIMIT-TO (LANGUAGE , "English ")) AND (EXCLUDE (SUBJAREA , "PHYS") OR EXCLUDE (SUBJAREA , "MATE") OR EXCLUDE (SUBJAREA , "MEDI") OR EXCLUDE (SUBJAREA , "EART") OR EXCLUDE (SUBJAREA , "AGRI") OR EXCLUDE (SUBJAREA , "BIOC") OR EXCLUDE (SUBJAREA , "ARTS") OR EXCLUDE (SUBJAREA , "ECON") OR EXCLUDE (SUBJAREA , "PSYC") OR EXCLUDE (SUBJAREA , "CHEM") OR EXCLUDE (SUBJAREA , "CENG") OR EXCLUDE (SUBJAREA , "NEUR") OR EXCLUDE (SUBJAREA , "PHAR") OR EXCLUDE (SUBJAREA , "NURS") OR EXCLUDE (SUBJAREA , "IMMU")) AND (EXCLUDE (DOCTYPE , "cr") OR EXCLUDE (DOCTYPE , "re")) AND (EXCLUDE (SUBJAREA , "MATH")) AND (LIMIT-TO (LANGUAGE , "English")) AND (EXCLUDE (LANGUAGE , "Spanish") OR EXCLUDE (LANGUAGE , "Polish"))
Web of Science	TITLE: (urban freight simulation) OR TITLE: (city logistics simulation) OR TITLE: (last mile simulation) AND YEAR PUBLISHED: (2003-2018) AND LANGUAGE: (English) AND DOCUMENT TYPES: (Article OR Book Chapter OR Proceedings Paper) Timespan: 2003-2018. Indexes: SCI-EXPANDED, SSCI, A&HCI, ESCI.
JSTOR	ti:("urban freight simulation" OR "city logistics simulation" OR "last mile simulation") AND y:(2003-2018)

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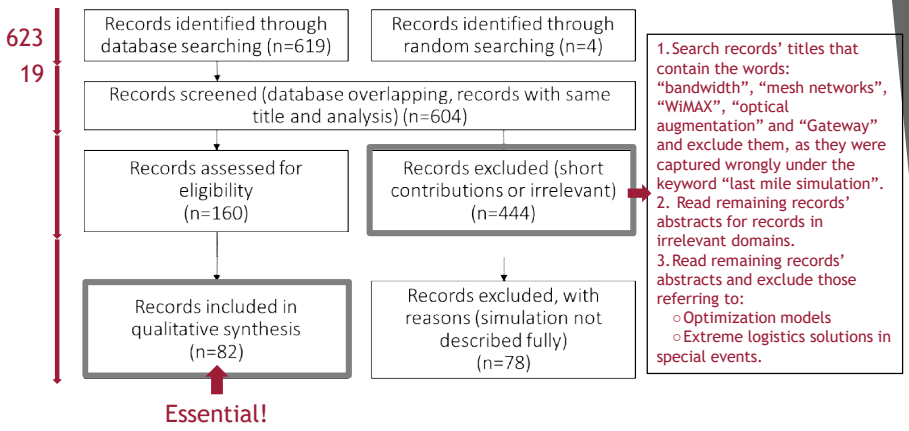
Results



1. Search records' titles that contain the words: "bandwidth", "mesh networks", "WiMAX", "optical augmentation" and "Gateway" and exclude them, as they were captured wrongly under the keyword "last mile simulation".
2. Read remaining records' abstracts for records in irrelevant domains.
3. Read remaining records' abstracts and exclude those referring to:
   - Optimization models
   - Extreme logistics solutions in special events.

Note: All identified records (n=623) can be found here: http://alliance-project.eu/wp-content/uploads/2018/09/Simulation-Techniques-Repository.xlsx

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Catalogue of essential records

Technique	Solution (Solution No.): Times that this solution is met in such studies	Reference
Systems Dynamics (SD)	(6): 1, (12): 1, (13): 1, (15): 1, (16): 1	[3], [4]
Agent-based Simulation (ABS)	(1): 1, (2): 1, (4): 3, (7): 1, (8): 1, (11): 3, (12): 2, (16): 1, (23): 1	[5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15], [16]
Traffic simulation (time discrete or continuous)	(2): 5, (3): 1, (4):1, (7): 2, (8): 3, (10): 1, (11): 4, (12): 2, (15): 1, (19): 1, (24): 1	[17], [18], [19], [20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30], [31], [32], [33], [34]
Discrete-Event Simulation (DES)	(1): 1, (2): 1, (4): 5, (8): 1	[35], [36], [37], [38], [39]
Hybrid modeling	(4): 4, (8): 1, (9): 1, (11): 1, (12): 1, (13): 1, (20): 1	[40], [41], [42], [43], [44], [45]
Misc. (custom-made)	(1): 7, (2): 4, (3): 1, (4): 10, (5): 2, (6): 1, (7): 1, (8): 2, (10): 1, (11): 5, (12): 2, (14): 1, (15): 2, (18): 1, (20): 1, (23): 1, (24): 1	[46], [47], [48], [49], [50], [51], [52], [53], [54], [55], [56], [57], [58], [59], [60], [61], [62], [63], [64], [65], [66], [67], [68], [69], [70], [71], [72], [73], [74], [75], [76], [77], [78], [79], [80], [81], [82], [83], [84]

Note: Some logistics solutions have been adjusted to achieve a common nomenclature.

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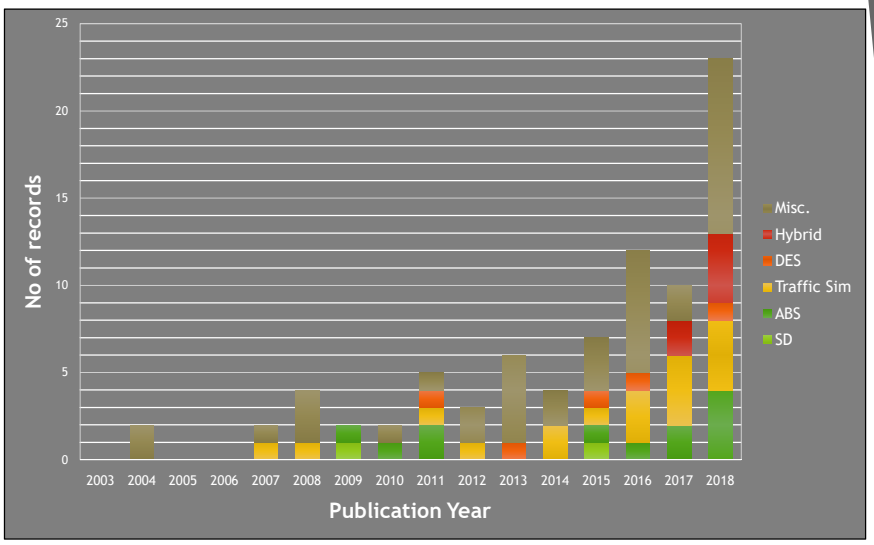
Results



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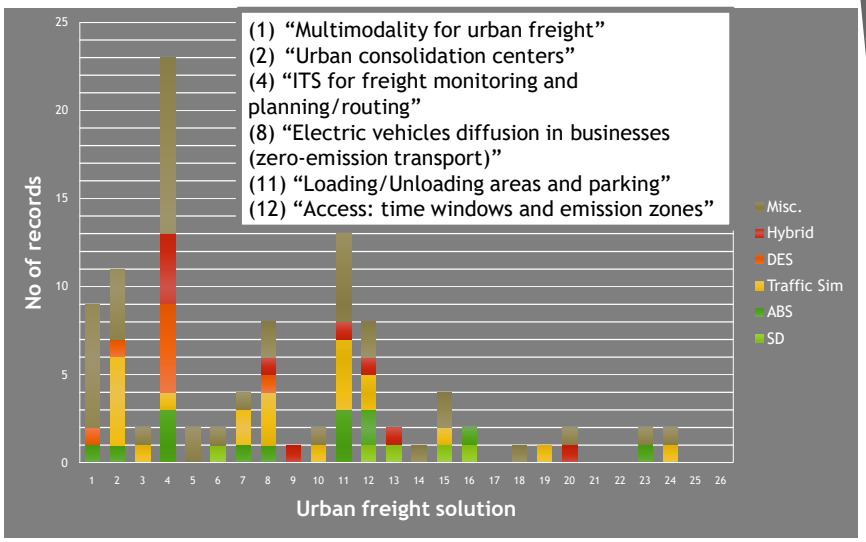
Results

(1) "Multimodality for urban freight"
(2) "Urban consolidation centers"
(4) "ITS for freight monitoring and planning/routing"
(8) "Electric vehicles diffusion in businesses (zero-emission transport)"
(11) "Loading/Unloading areas and parking"
(12) "Access: time windows and emission zones"



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Discussion

Limitations

1. The keywords were formulated by the authors in order to capture all relevant studies.
2. The examined years 2003-2018 may leave out some significant contributions.
3. The exclusion of abstracts, posters and other document types (long reviews) may also leave out significant contributions.

General conclusions

1. The evaluation of urban freight solutions through modeling is gaining year by year more attention.
2. ITS and cooperative oriented solutions are clearly in the top preferences of city logistics studies.

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Thank you for your attention!

Possible Consequences of the Implementation of Transport Integration in the Riga Planning Region

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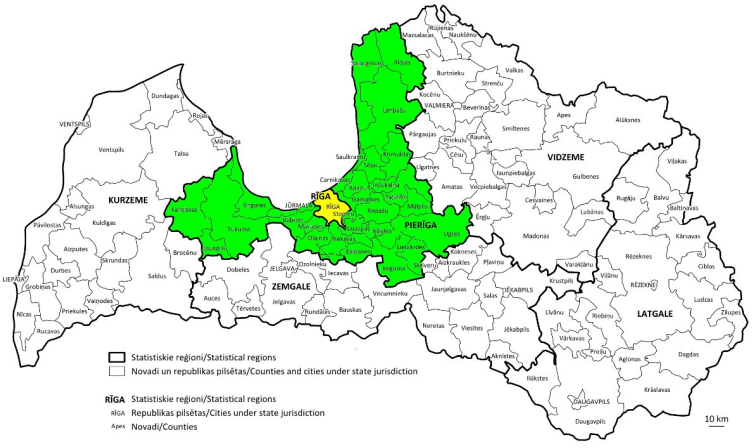
Objectives

- How could measures of transport integration benefit the public transport system in the Latvian capital Riga and its surrounding area?

Outline

1. Analysis of status quo in research area
2. Literature review on transport integration and its effects
3. Conceptual design of transport integration measures
4. Estimation of effects

Research Area

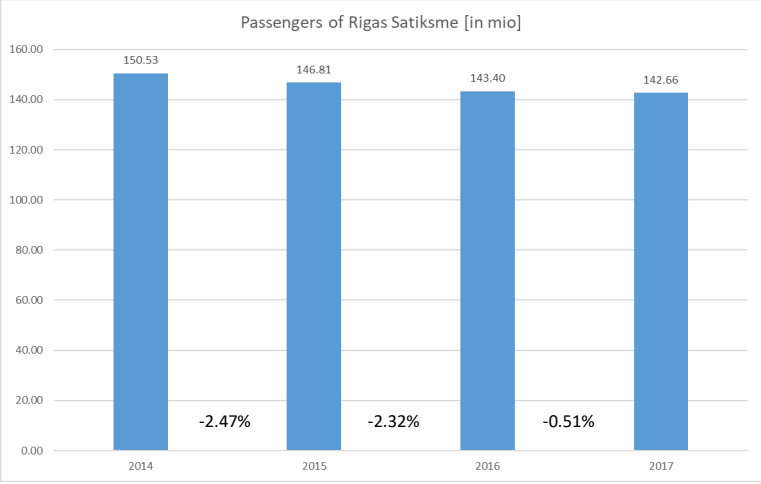


Source of base map:
Centrālā statistikas pārvalde

Current Situation

- 6 Modes of public transportation
- Multitude of operators
- No common ticket or tariff system
- Lack of coordination

Current Situation



Fields of Transport Integration

- Information integration
- Ticket integration
- Tariff integration
- Network integration
- Wider integration

Effects of Transport Integration

- Transport volumes:
  - Increase after transport integration
  - Wide range of increases
- Modal choice:
  - 15-20% increased likelihood of modal choice
- Passenger satisfaction:
  - 13% more citizen satisfied in cities with integrated PT

Effects of Transport Integration

- Environment:
  - 9% lower levels of particulate matter in cities with an integrated transport system

Conceptual Design

- Scenario A
  - Ticket integration
  - Unified smartcard
  - Small discounts for intermodal trips
- Scenario B:
  - Information, Ticket, tariff, and network integration
  - Unified smartcard and unified zonal tariff
  - Implementation of a Public Transport Authority as governing body

Expected Consequences

Consequences for:	Scenario A	Scenario B
Transport Volumes	Only minor changes	2-5% increase
Costs	Cost for new ticketing system (~€ 20 million) Same cost of operation Same cost of organization	Cost for new ticketing system (~€ 20 million) Higher cost of operation Lower cost of organization
Revenues	Only minor changes	Losses due to new tariffing system Increases due to increased transport volumes
Environment	No short-term effects	No short-term effects

Conclusions

- Transport integration would improve the PT system in the Riga Planning Region
- Only small increases in transport volumes are expected, while costs will arise
- No short term environmental effects expected

Conclusions

- Motivation for the implementation of transport integration should rather be the aim to create an attractive PT system to improve the traffic situation in the RPR than commercial interests.

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Thank your for your attention!

Paldies par uzmanību!

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ENVIRONMENTALLY FRIENDLY TRANSPORT INTERCHANGES: ACTIVE TRAVEL ACCESSIBILITY AND POLICY

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Outline

- Active travel and accessibility
- Active community and interchanges (public transportation)
- Soft and hard measures
- EU policy
- The case of Riga city
- Recommendations

Objectives

- Review the literature regarding active travel accessibility at transport interchanges
- Go through the Riga public transport system in regards with active travel accessibility
- Provide suggestions and recommendations to stakeholders and local authorities

Active travel

- Active travel refers to the act of commuting by non-motorized means
- The main reasons for the promotion and support of active travel are the reduction of environmental pollution and the improvement of the commuters' health

Active commuting and public transportation

- Active commuting provides routine-based regular physical activity, which reduces the risk of chronic diseases
- The use of public transportation requires some walking or cycling to a transit stop, transfers and a walk to the end location
- Users of public transportation seem to accumulate more moderate physical activity than non-users

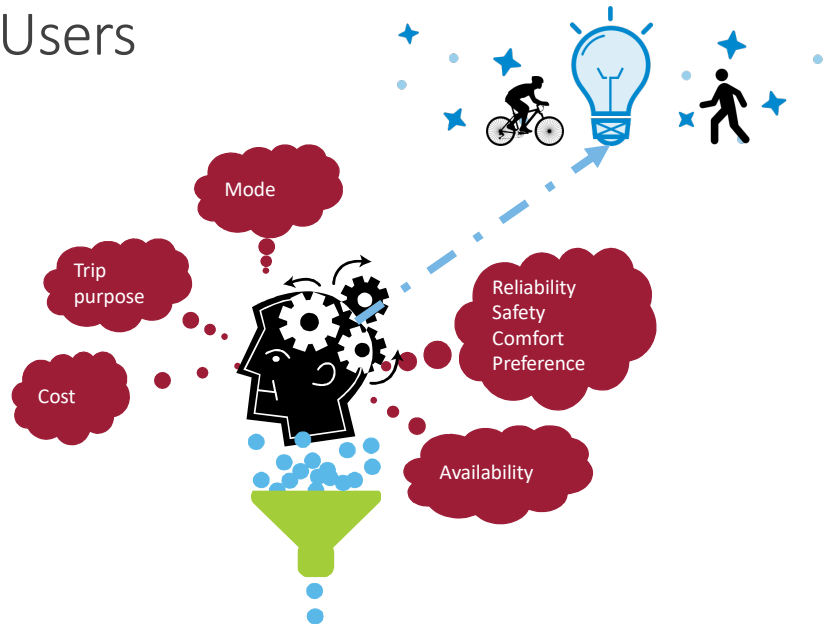
Active commuting and access to public transportation

- Proximity and density of transit stops
- Service frequency
- Number of routes at nearest stop
- (Nearby facilities)

Active accessibility

- How easily can people reach their destinations or activity sites?
- How efficient is public transportation network to bring people to destinations often within a time frame?
- Do neighborhood characteristics affect travel behavior and access to public transportation?
- Which built environment factors affect active accessibility?

Users



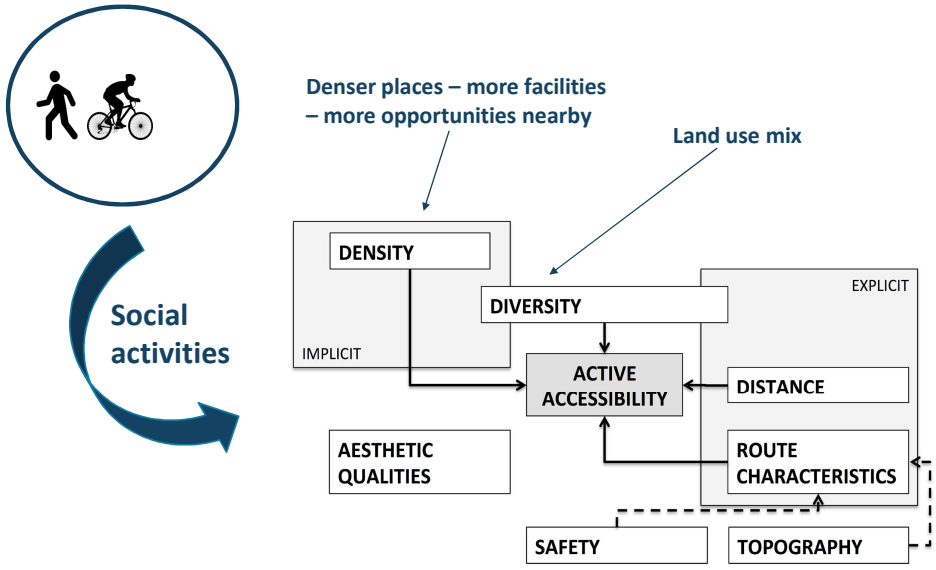


Figure 1. Relationship between built environment factors and active accessibility (Source: Vale et al., 2016)

Do residents of walkable neighbourhoods undertake more active travel?

How far people walk or cycle to access facilities?

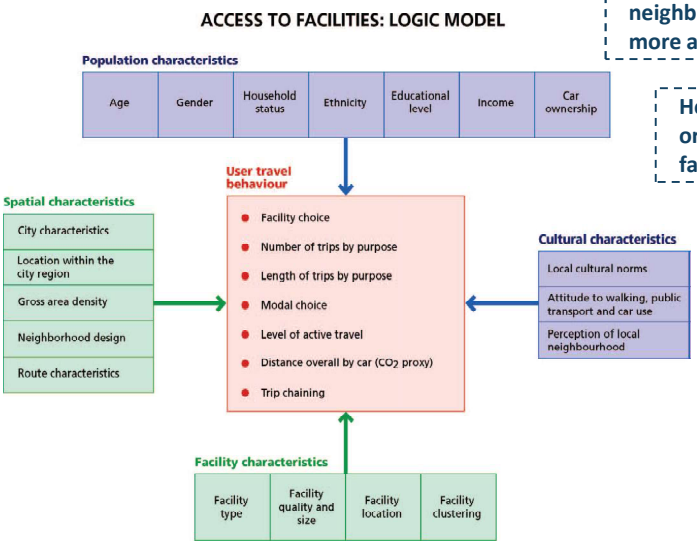


Figure 2. Access to local facilities (Source: Barton et al., 2012)

Determinants of active travel

- **Infrastructure**: Good quality, appropriately designed with meaningful network connectivity
- **Gender**: on average, males and females tend to walk about the same distance each day, although males cycle about 2.75 times further than females
- **Age**: those aged 10-34 years tend to walk about 1.4 times the average, while persons aged 65+ years tend to walk significantly less (0.4 of the average). Persons aged 15-34 years who cycle about 1.5 times the average, while those aged 60+ years tend to cycle about 0.25 times the average.
- **Land use**: land uses having higher incidence of walk trips: outdoor recreation facilities, indoor sports facilities, schools, public transport interchanges and hotels
- **Climate**

Active travel hard policy

- Cycling infrastructure construction
- Walking infrastructure construction
- Infrastructure improvements

Active travel soft policy

- Mainly focused on influencing traveller behaviour
- Use of individualized marketing
- Use of personalized travel plans
- Extensive use alternative transport schemes (e.g. bike hiring services implementation and promotion, cycle training)

EU policy

- Initially greater focus on hard measures (COM(1998) 431)
- More open to the implementation of soft policy (COM(2007) 551)
- Combination of soft and hard policy (COM(2009) 279 and COM(2009) 490)
- More support towards soft policy schemes through the use of ITS (COM(2013) 527)

Policy implementation – review

- Case studies from across Europe
- Good practices mainly coming from EU funded initiatives
- Relative balance between hard and soft policy instruments
- Results generally positive (increase in cycling and walking, infrastructure improvement, reduction in car use)

Intervention type	Intervention approach	Scale	Modes	Stakeholders	Time horizon	Costs	Impacts	Area	Paper
Development of cycling and walking friendly spaces, weakest user protection, right of way to pedestrians, reduction of speed limit, redesign and extension of cycle lanes, extension of low speed limit areas, improvement of cycling parking facilities, removal of barriers for bicycles on trains and metros, better cycling track maintenance, cleaning and signange, information campaigns	Soft/hard	Local	Cycling/walking	Travelers, academia, local governments	About 10 years	82,5 million Euros (Copenhagen)	Varying (depending on specific measure)	EU cities	EU, 2007. Sustainable Urban Transport Plans Preparatory Document in relation to the follow-up of the Thematic Strategy on the Urban Environment.
Cycle parking construction, park and ride service, construction of bicycle bridge, increased bike and ride capacity	Hard	Local	Cycling	Travelers, local governments, system provider, market analyst, urban planners and financial advisors	1-2 years	Varying (from 6 million to 1500 Euros)	-	Sweden, Hungary, Spain, The Netherlands	Monigl et al., 2010. Guidelines for Implementers of Innovative Cycling Facilities for Interchanges.
Signposting improvement, construction of direct pedestrian and cycling routes, information provision, traffic control measures, cycle parking construction	Hard/soft	International	Cycling/walking	Travelers, local authorities	2 years	-	Varying (depending on specific measure)	Preston, La Rochelle, Ploiesti	Galloway et al., 2009. Innovative Soft Measures Deliverable 11 of the Success Project.
New cycle and walking lanes and support facilities, construction of cycle parkings, pedestrianization, personalised travel plans, cycle training, reduction of car parking spaces,cycling and walking promotion	Hard/soft	Local	Cycling/walking	Travelers, local authorities	3 years	5 million pounds (London)	50% increase of cycle trips	London, Abu Dhabi	Price & Leather, 2011. Transport Mobility Management: Small Changes - Big Impacts Understanding TMM in the Urban Context.

Intervention type	Intervention approach	Scale	Modes	Stakeholders	Time horizon	Costs	Impacts	Area	Paper
Promotional activities, school travel awareness plans, cycle training, travel plans, bicycle and pedestrian facilities construction	Hard/soft	Local	Cycling/ walking	Travelers, local authorities	2 years	-	Varying (depending on city)	European cities	Midas, 2009. Soft measures for Sustainable Mobility Lessons from Case Studies in Aalborg, Bologna, Clermont-Ferrand, Cork, Liverpool and Suceava.
Separate cycling lanes, traffic calming measures, extension of cycling network, connection of cycle lanes with bus rapid transit system, pedestrian corridors, promotional activities, bike rental services	Hard/soft	Local	Cycling/ walking	Travelers, local authorities	Varying (Depending on city)	Varying (Depending on city)	Varying (Depending on city)	Various cities	Santos et al., 2010. Policy Instruments for Sustainable Road Transport.
Individualised marketing	Soft	Local	Cycling/ walking	Vasttrafik, Traffic and Public Transport Authority	1 year	2700000 SEK	Car use reduction and soft modes use increase of 6%, 45% relative increase to cycling, 4% increase in walking, expected reduction of 2150 CO2 tons/year	Goteborg	Almgren, 2003. Effects on mode choice with individualised marketing (IndiMark) in Göteborg.
Extensions of walking and cycling lanes, creation of more cycle parking spaces,cycling promotion, free bicycle service, bike sharing	Hard/soft	Local	Cycling	Travelers, academia, local authorities	Varying (Depending on city)	Varying (Depending on city)	Varying (Depending on city)	EU cities	Boschetti, et al., 2014. Innovative Urban Transport Solutions CIVITAS makes the difference.

The case of Riga city

- Small percentage of active travellers
- 52.1% of Latvian population is cycling periodically, but only 9.9% on a regular basis
- Cyclists must use the driveways (and not sidewalks) (Road Traffic Regulations, 2006)
- Main gap: bad connectivity between soft modes and public transport (and also between different transportation modes)
- Land uses concerns
- Recent attempts to improve the situation

Counting cycling “volumes”

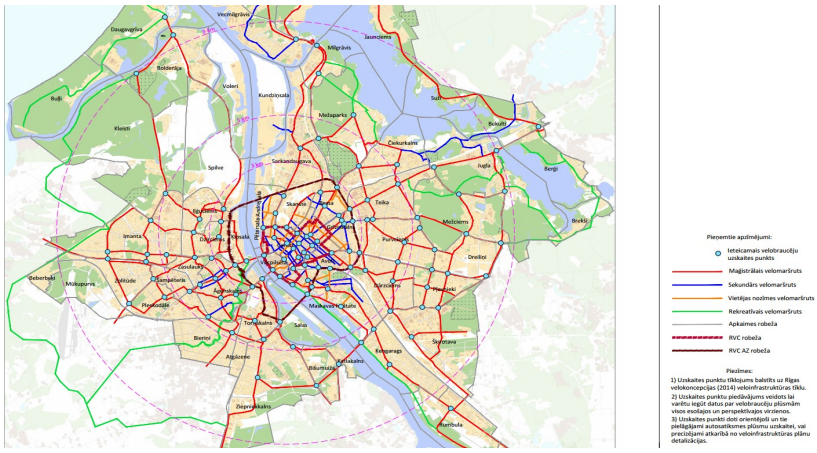


Figure 3. Traffic volumes counting (Riga Municipality Development Department, 2016)

Carrying and parking bicycles

- Cyclists are allowed to carry their bicycles in public transportation modes free of charge
- Parking at interchanges
  - Riga International Coach Terminal: at the main entrance of the terminal and at car parking (free of charge)
  - Riga International Airport: at the airport area and car parking
  - Riga Central Railway Station: at the entrance and the car parking space of two shopping malls next to the station
  - Riga Passenger Port Terminal: no bicycle parking area

Recommendations

- Proper legal framework
- Promotion actions and awareness campaigns and initiatives
- Infrastructure improvement and maintenance

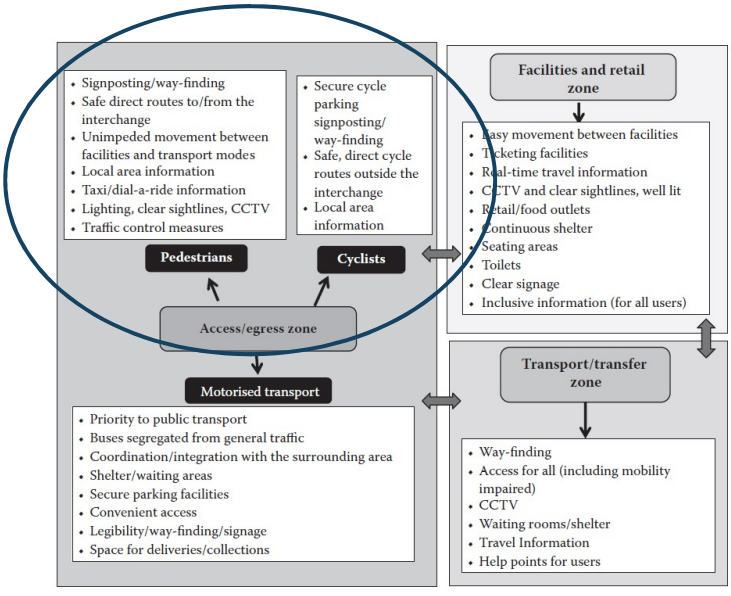


Figure 4: Interchange zones (Source: Monzon, A. & Di Ciommo, F., 2015)

Transport services features

Users/mode	Essential features	Desirable features
Pedestrians	Safe direct routes to/from the interchange	Street furniture, landscaping
	Unimpeded movement between facilities and transport modes	Segregation from traffic
	Signposting/way-finding	Easy access/egress to and from the interchanges
	Local area information and maps	
	Lighting, clear sight lines, CCTV	
	Taxi/dial-a-ride information alongside telephone access	
	Traffic control measures (pedestrian crossings)	
Cyclists	Secure cycle parking	Street furniture, landscaping
	Safe, direct cycle routes to/from the interchange	Segregation from traffic
	Signposting/way-finding	Easy access/egress to and from the interchange
	Local area information and maps	

Bike parking

Segregated bike lane within road corridor

Restrictions in active travel

- Lack of appropriate infrastructure and facilities
- Inadequate connectivity between paths, public transport interchanges and appropriate land uses
- Absence of infrastructure covering physical safety needs or concerns of people with disabilities or the elderly
- Lack of security as people may feel unsafe without CCTV or lighting along the path

Conclusions

- Individual public transportation accessibility is associated with commuters profiles and travel preferences
- Higher public transportation accessibility enhances active travel
- When it comes to modal choice, interchanges (and facilities) should be in walkable distance
- Public awareness on the benefits of active travel is required together with the establishment of the proper infrastructure

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Thank you for your attention!

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TSI TRANSPORT AND TELECOMMUNICATION INSTITUTE

Traffic, Transportation and Logistics Laboratory

A CROSS-CASE ANALYSIS of Riga interchanges' information services and technologies

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Enhancing Excellence and Innovation Capacity in Sustainable Transport Interchanges ALLIANCE
(Grant agreement no.: 692426)

Outline

- **Introduction**
- **State of the art**
- **Methodology**
- **Results analysis**
- **Conclusions and next steps**

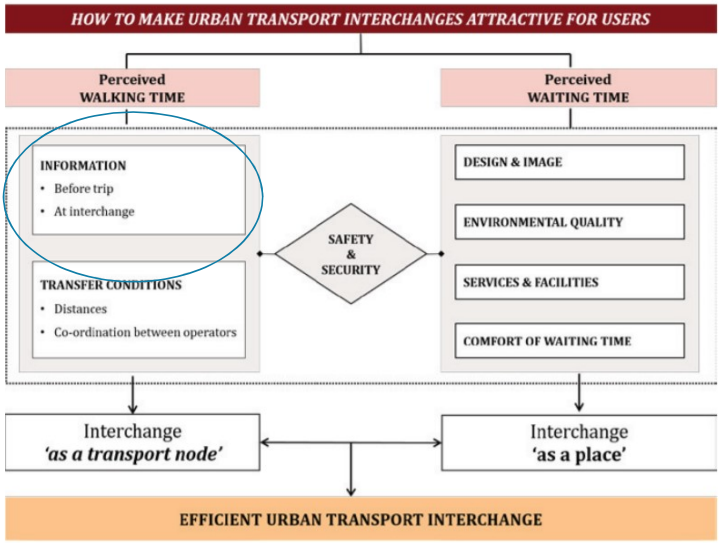
Introduction

Intermodality, defined by the European Commission as the policy under which different transportation modes are being combined in a trip to achieve a seamless journey, promotes short and long-distance integration (European Commission, 2007)

interchange – a place where you can transfer for one transport mode to another one with certain conditions of accessibility, safety, information, transfer and quality

Non-published materials: Javier Aldecoa: 2nd Summer school: Sustainable Transport Interchanges Program- Public Transport Systems: From research to decision making. ALLIACE project. Riga.Latvia, July 2018

Key factors identified to make urban transport interchanges attractive for users



Source: Hernandez and Monzon, 2015

Quality matrix

Components of PTS quality	Characteristics of PTS quality components
1. Availability	Network, Timetable
2. Accessibility	External interface, Internal interface, Ticketing
3. Information	General information, Travel information – normal conditions, Travel information – abnormal conditions
4. Time	Journey time, Punctuality and reliability
5. Customer care	Commitment, Customer interface, Staff, Physical assistance, Ticketing options
6. Comfort	Ambient conditions, Facilities, Ergonomics, Ride comfort
7. Security	Safety from crime, Safety from accident, Perception of security
8. Environment	Pollution, Natural resources, Infrastructure

Source: EN13816, 2002; EN15140, 2006

Provision of information

- Information must be (perceived to be) accurate and travelers must be to act on this information
- Multilingual information must be available both outside and inside vehicles and interchanges. Clear orientation within interchanges essential
- Information may not be limited to individual modes or operators. Real-time information systems are recommended to help in journey planning and improving connections at interchange points
- Information systems are required which combine static and dynamic data on public and private modes (trip planning system)

Source: https://trimis.ec.europa.eu/sites/default/files/project/documents/20130205_124551_90945_D13_-_Catalogue_of_Best-practice_Implementation_Examples.pdf

Inclusive information

- Reliable and real-time information should be provided to all users
- Audio loops and near-field technologies should be applied for providing information to visually impaired users
- Assistance help points/desks should be established
- The design of the typeface should be large enough to be read by users with different visual abilities
- Accessible information should be available for users that my have language learning difficulties or may not speak the language
- Real time displays need to be linked to audio systems, and real time information screens should be set up at eye level
- At least one ticket machine should be available a information at appropriate reach ranges for people with disabilities

Source: City-Hub, 2013

ITS in interchange design

Christchurch Bus Exchange, New Zealand, showing dynamic stop allocation and passenger transport information in a central passenger waiting lounge

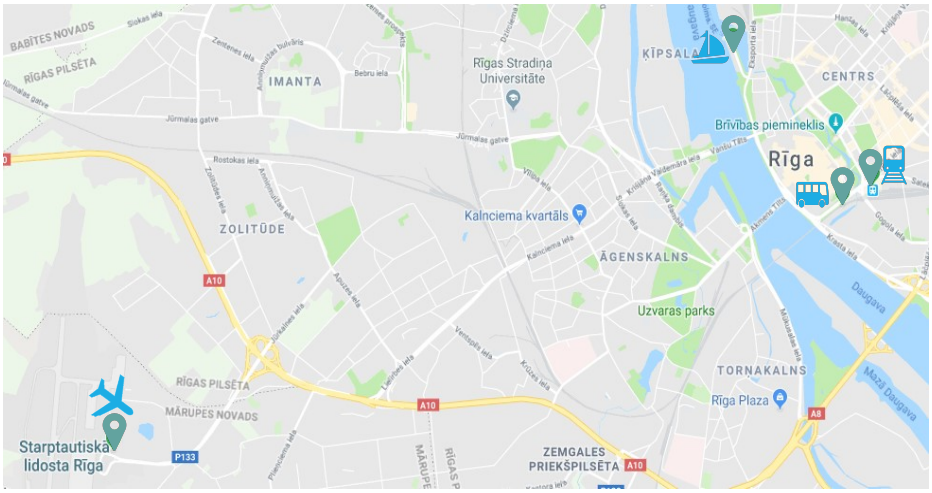
Well-designed and positioned information panels at the railway station of Sint-Niklaas, Belgium. Photo: TTB

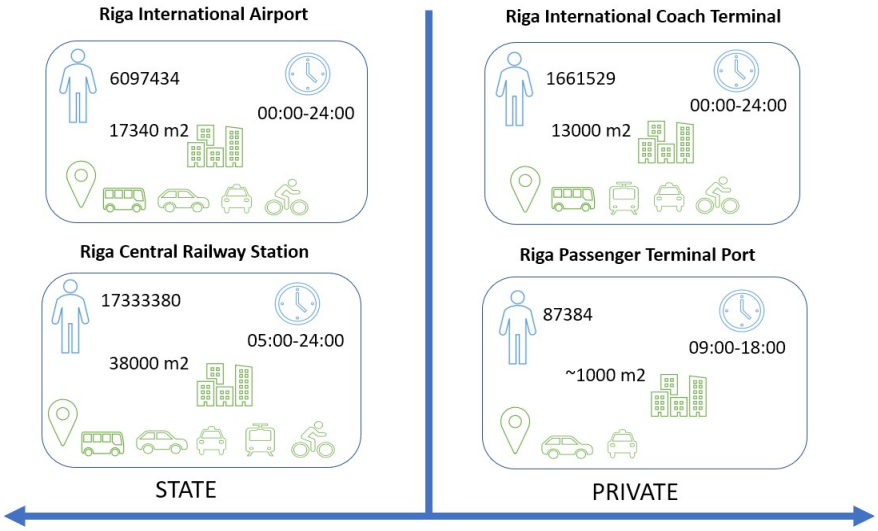
Paddington one stop shop. Intermodal transport interchange for London, Best practice guidelines January 2001 Issue 1

Waiting room, Birkenhead bus station, Merseyside, UK. Photo: Alan Murray Rust

Non-published materials: G.Adamos: 2nd Summer school: Sustainable Transport Interchanges Program- Public Transport Systems: From research to decision making. ALLIACE project. Riga.Latvia, July 2018

Interchange location





Methodology

- City hub project questionnaire adopted for local conditions
- Define the respondents from stakeholders
- Face-to-face survey: body of the 4 interchanges, carried out between August 2018 and September 2018
- Cross-case analysis

Survey purpose:

- Requirements for the provision of information to travellers throughout the total journey, in the trip planning phase and during the trip especially at the interchange points, through previous research and case study analysis.
- Online integrated information given at the interchange points including incident information.
- Dialogue between information systems of various operators. For the traveller integrated information should appear on the screens in the vehicles and terminals as well as available through mobile equipment.
- Integrated ticketing is not actually a question of interchange points but is a key issue for the use of public transport and acceptance of inter-modality i.e. changes during the trip. Integrated ticketing thus leads to the overall increase of the use of interchange points which makes the services and quality of the terminals and other interchange points extremely important.
- Ticket purchasing systems, especially mobile solutions.
- Emergency information given at the interchange points should be separated from the daily incident and breakdown information as it concerns all stakeholders involved demanding immediate action of the terminal management as main responsible body, all operators and guidance and management of the passengers and other customers.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 692426

alliance

Name of the interchange (and location):

Information needs

Integration of information systems, ticketing and other ITS services

Information Provision

1. **Are there regulations or guidelines on the requirements for provision of information to travellers? If so, what is required and where (particularly for interchanges)?**
2. **How is information about interruptions and incidents (e.g. breakdowns) provided to travellers?**
3. **How is information about emergencies provided to travellers?**
4. **Can the same information displays be used for different purposes depending on situation?**

Yes	No	Purpose
		Timetables
		Departure / Arrival time
		Interruption information
		Emergency information
		Advertisement

5. **Do retailers or restaurants at or near the interchange provide transport information to their customers? What and how? (e.g. departure time displays)**
6. **How and what information is provided to travellers with disabilities? (e.g. impaired vision or mobility)**
7. **Do different operators share the same displays? (e.g. combined timetable info) If not, are different operators' information displays uniform in style?**
8. **What kinds of information services are there which integrate information from different operators? (e.g. mobile services with timetable data from multiple operators)**
9. **What kinds of ticket purchasing options are available?**
10. **Are tickets valid for multiple modes and operators? Are there plans for shared ticketing systems?**
11. **Are you satisfied with the information and intelligent systems in the interchange?**

If not, how would you improve the quality, content or provided systems and services?

Please tick a) the ones **currently in use** and b) what you think would be **essential to implement**, and c) what systems are **considered unimportant** (e.g. system has been tried and found not necessary or worth costs).

In use	Needed	Not needed	Intelligent System or Service in the Interchange Area
			Journey planner for local public transport for pre-trip planning
			Journey planner for long-distance public transport for pre-trip planning
			Information for interchange facilities and layout available on the internet (or via call centre) for pre-trip planning (important especially for the disabled)
			Smart ticketing (speeds up transfer)
			Electronic departure time displays based on *timetables* (for multiple stops)
			Electronic departure time displays based on *timetables* (at stops)
			Electronic departure time displays based on *real-time information* (for multiple stops, incl. fleet monitoring systems)
			Electronic departure time displays based on *real-time information* (at stops)
			Departure times via audio calls
			Real-time disturbance information provided via *displays*
			Real-time disturbance information provided via *audio calls*
			Multi-language information
			Public access information kiosk / internet kiosk restricted for Public Transport information (not for open internet surfing)
			Information centre with personal service
			Audio services for the visually impaired (e.g. a special dedicated information area with a push button)
			Guidance and warning surfaces for the visually impaired
			Tactile maps of the interchange for the visually impaired
			Information with hearing aids (e.g. "T-coil")
			Matrix bar codes (e.g. QR-codes) for additional information with mobile phones (e.g. for departure times for a specific stop or platform)
			Intelligent Indoor-Navigation System
			Intelligent security systems (e.g. CCTV)
			Area or terminal fleet management with the aid of cameras, in-vehicle systems, Variable Message Signs etc. for guiding buses, taxis, park & ride etc.
			Intelligent automated passenger or people counting (infrared, video, thermal etc.)

Survey Ticketing

RICT	PORT	RIX	Railway station
• Mobile applications (Bezrindas.lv, Mobilly.lv) • Internet • Home page • By phone • Ticket offices • Ticket machines • No NFC Payment	• Internet • Ticket offices • Ticket machines • No NFC Payment	• Mobile applications (Air Baltic Air tickets, Skyscanner) • Internet • Home page • Ticket offices • Ticket machines • Airport operator • Tourism companies • No NFC Payment	• Mobile applications (Pasazieru vilciens, Mobilly.lv) • Internet • Home page • Ticket offices • Ticket machines • No NFC Payment

Survey Disability

RICT	PORT	RIX	Railway station
• Request help 36h before trip • By phone or email • Informative video about assistance available • Has tactical guidelines for visual impaired • 3 specialized summon boards	• Request help 48h before trip • By phone or email	• Request help 48h before scheduled flight • By phone or email, website, travel agency or at airline's representative office • Has tactical guidelines for visual impaired outside terminal	• Request help 48h before trip • By phone or email • Has tactical guidelines for visual impaired • Boarding the departing train and disembarking from the arriving train using mobile platforms

Survey: indoor-outdoor service

Services	RICT	PORT	RIX	Railway station
Indoor	-Electronic departure time displays and disturbance information -Multi-language information -Information centre with personal service -Guidance and warning surfaces for the visually impaired -Tactile maps of the interchange for the visually impaired -Intelligent automated passenger or people counting (infrared, video, thermal etc.) -Intelligent security systems (e.g. CCTV)	-Electronic departure time displays and disturbance information -Multi-language information -Intelligent security systems (e.g. CCTV)	-Smart ticketing -Electronic departure time displays and disturbance information -Multi-language information -Information centre with personal service -Intelligent automated passenger or people counting (infrared, video, thermal etc.) -Intelligent security systems (e.g. CCTV)	-Electronic departure time displays and disturbance information -Multi-language information -Information centre with personal service -Intelligent automated passenger or people counting (infrared, video, thermal etc.) -Intelligent security systems (e.g. CCTV) -Guidance and warning surfaces for the visually impaired
Outdoor	-Journey planner for long-distance public transport for pre-trip planning -Facilities and layout available on internet -Matrix bar codes (e.g. QR-codes)	-Facilities and layout available on internet	-Facilities and layout available on internet -Guidance and warning surfaces for the visually impaired	-Journey planner for local public transport for pre-trip planning -Facilities and layout available on internet
Indoor/ outdoor	Area or terminal fleet management with the aid of cameras -Tactile maps of the interchange for the visually impaired	Area or terminal fleet management with the aid of cameras	Area or terminal fleet management with the aid of cameras -Tactile maps of the interchange for the visually impaired	Area or terminal fleet management with the aid of cameras -Tactile maps of the interchange for the visually impaired

Results analysis

- 12 questions in use all interchanges
- 1 question in needed all interchanges (Intelligent Indoor-Navigation System)
- 1 question in Not needed all interchanges (Information with hearing aids (e.g. “T-coil”))

Results analysis

	RIX	RICT	PORT	Railway station
Infrastructure	RIX	RICT	PORT	Latvijas Dzelzcels (LDZ)
Passenger	Air Baltic, Turkish Airlines	Ecolines, Lux Express, and others	Tallink	Pasazieru vilciens

RIX

Strenght	Weaknesses
• Fast way to travel, only ones who has smart ticketing • Technological advancement and investment in information technology • Infrastructural development • PRM Service (passenger with reduced mobility) • Mobile solutions for ticket purchasing • Location and access to public transport	• No journey planner services • Tickets are not valid for multiple modes and operators • No warning surfaces for visually impaired inside airport

RICT

Strenght	Weaknesses
• Inegrated information (15 + operators) • Mobile solutions for ticket purchasing • Journey planner for long-distance public transport • Central location to downtown and access to public transport • Terminal adjusted for passengers with disabilities	• Infrastructural development • Tickets are not valid for multiple modes and operators • No smart ticketing

Riga Central Railway Station

Strenght	Weaknesses
• Infrastructural contains several systems that allow avoiding unpleasant incidents • The most punctual trains in Europe • Mobile solutions for ticket purchasing • Central location to downtown and access to public transport • LDz Call Centre available 24/7 • Mobile platforms for passangers with disabilities	• No journey planner services • Tickets are not valid for multiple modes and operators • One main operator Pasažieru vilciens

Riga Passenger Terminal Port

Strenght	Weaknesses
• Infrastructural development • Central location to downtown	• Terminal need upgrade • One main operator Tallink • No journey planner services • No mobile solutions for ticket purchasing • Tickets are not valid for multiple modes and operators • Less accessible by public transport • Working hours

Thank you for attention!

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alliance

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Optimization of Interaction of Automobile and Railway Transport at Container Terminals

K.A. Shubenkova

V.D. Shepelev, L.A. Zverev, Z.V. Almetova

Objectives

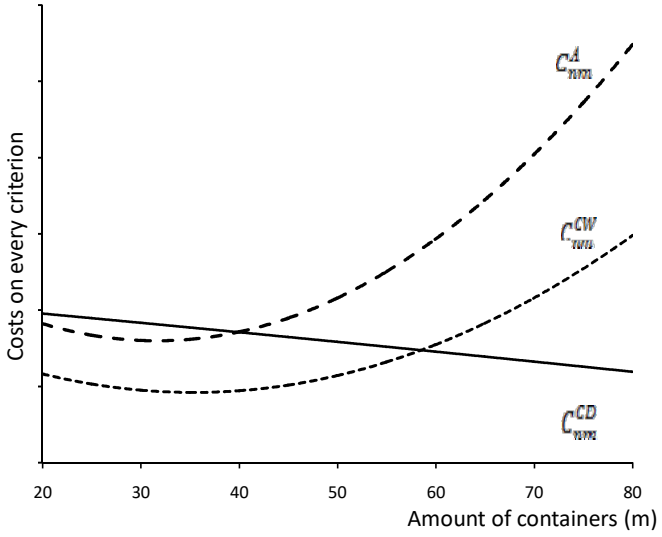
- To organize effectively the operation of the transit terminals, a lot of different tasks should be solved. One of them is to determine the amount and productivity of loading and unloading complexes.
- There is the need to find the balance between losses due to the downtime of loading / unloading facilities and losses due to the downtime of road and rail vehicles.
- When justifying the optimal amount of loading and unloading mechanisms, the processing capacity of different types of containers should be taken into account.

Calculation of the optimal amount of loading and unloading facilities (n), under which it is possible to provide the minimum aggregate operating costs and unproductive idle hours of loading and unloading complexes, as well as road carriers' losses due to idle rolling stock under the appropriate operations (Cnm) is:

- $C_{nm} = C_{nm}^{A} + C_{nm}^{RW} + C_{nm}^{CD} + C_{nm}^{CW} \rightarrow min$

where C_{nm}^{A} is costs for over-normative idle hours of automobile vehicles for loading (unloading) over the planned time of work, roubles; C_{nm}^{RW} is costs due to idle time of the railway rolling stock on public roads in anticipation of loading (unloading) operations, roubles; C_{nm}^{CW} is the cost of operating one loading and unloading mechanism for the entire period of work, rubles; C_{nm}^{CD} is costs due to the forced idle hours of each loading and unloading mechanism in the absence of transport vehicles for the whole period of idle time, roubles.

Graph of changes in costs at *n*, the amount of loading and unloading mechanisms – 2



Conclusions

- The existing methods to determine the amount and productivity of loading and unloading complexes do not fully take into account the volumetric and weight characteristics of containers, the time spent on cargo deconsolidation and the cost of the involved infrastructure.
- The proposed model allows us to reduce the losses associated with the limit-exceeding idle hours of railway and motor transport and loading and unloading facilities, and shorten the delivery time, taking into account the probabilistic nature of the containers' arrival and the reassessment of the transport capacity of the automobile transport.
- the application of the methodology will make it possible to effectively use the available capacities of the railway network and to plan their development taking into account the minimum investments.

Acknowledgements

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Thank you for your attention!

Unsupervised Learning-Based Stock Keeping Units Segmentation

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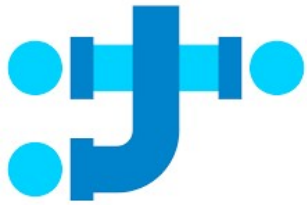
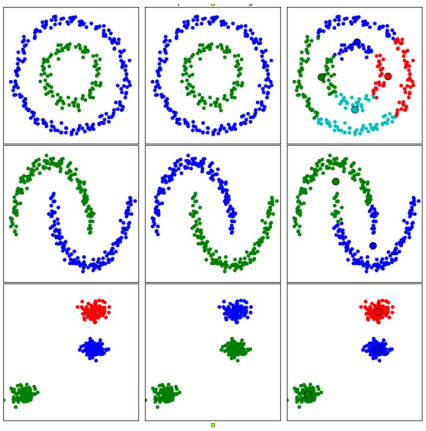
Research question

"How to aggregate stock units into groups so that the resulting inventory policies are sufficiently close to those policies that would have been generated if every unit was treated individually?" (Ernst and Cohen, 1989)

Objectives

- To compare several clustering algorithms based on real-world data
- To develop an efficient data pipeline





Previous work

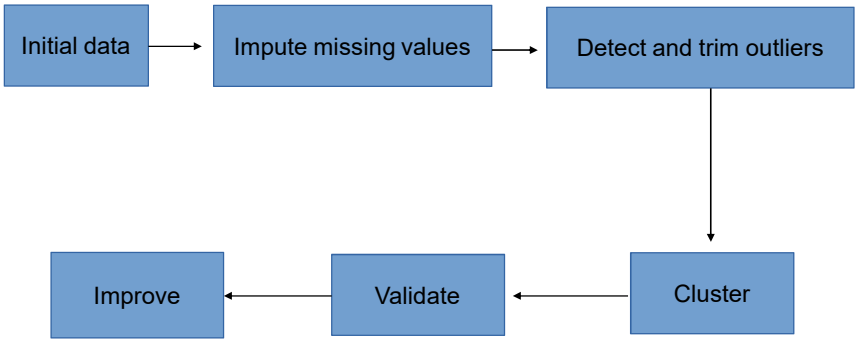
Authors	Year	Applied methods
Srinivasan and Moon	1999	Agglomerative hierarchical clustering
Desai	2007	K-means
Egas and Masel	2010	K-means, Principal Component Analysis
Yang and Nguyen	2016	Constrained Minkowski Weighted K-Means

Dataset description

ID	Unit price (EUR)	Expire date (days)	Total outbound (units)	№ of outbound orders	Pallet weight (kg)	Pallet height (cm)	Units per pallet
1	0.058	547	2441	9	105.6	1.56	1920
2	0.954	547	0	0	207.68	1.00	384
3	2.385	547	23	12	165.78	1.02	108

- 2279 observations
- 7 features (numerical only)
- Missing values
- No ground-truth
- Provided by “Trialto Latvia” Ltd

Approach



Missing values imputation

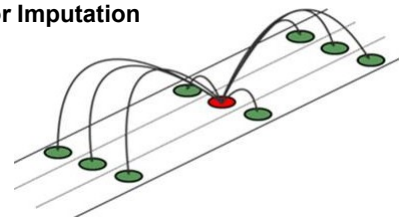
- 47% of observations include at list one missing feature
- all four features are missing in 9.1%
- Data was imputed using **Nearest Neighbor Imputation**

$$d(a,b) = \sqrt{\sum_{i \in D}(x_{ai} - x_{bi})^2}$$

d(a, b) is the Euclidean distance between observations

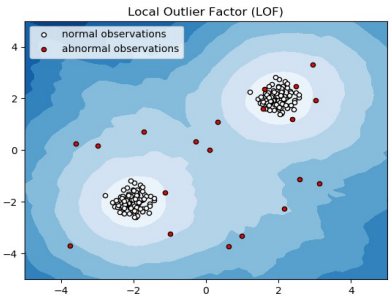
x_{ai} and x_{bi} are the values of a feature *i* of observation *a* and *b* respectively

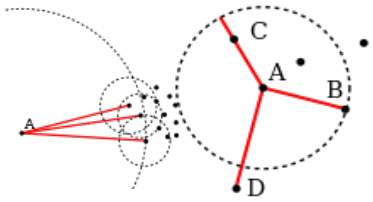
D is a set of features with nonmissing values



Anomaly detection

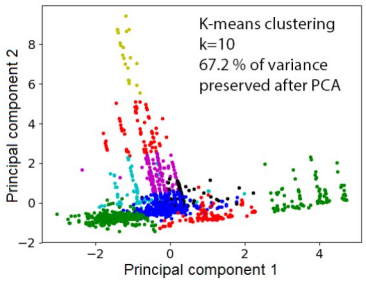
- **The local outlier factor** compares the local density of an object to the local densities of its neighbors. Algorithm identifies regions of similar density and spots observations that have a significantly lower density than their neighbors.
- 114 anomalies (5.1%) have been detected!

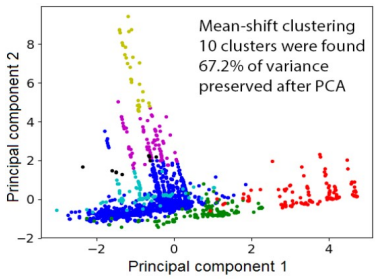


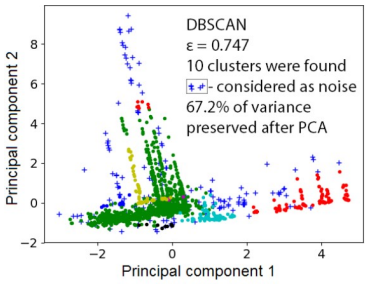


Cluster analysis

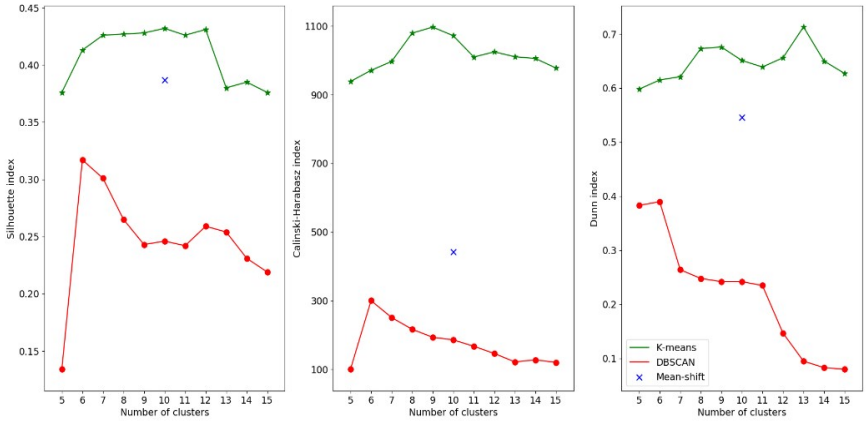
- Clusters are convex with large differences in densities, thus **DBSCAN** was quite inefficient
- "Clots" discovered by **mean-shift** correspond to nearly-optimal value of *k*







Validation



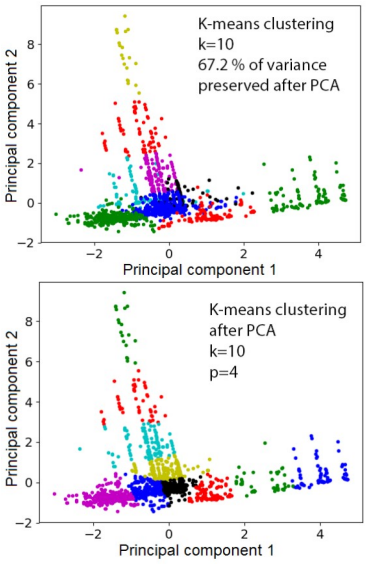
Further improvement via PCA

	Expire date	Total outbound	№ of outbound orders	Pallet weight	Pallet height	Units per pallet
Unit price	-0.08	-0.07	-0.09	-0.09	-0.09	-0.04
Expire date	1.00	0.08	0.07	-0.35*	-0.36*	0.04
Total outbound	-	1.00	0.86**	0.04	-0.04	-0.03
Number of orders	-	-	1.00	-0.04	0.01	0.00
Pallet weight	-	-	-	1.00	0.28*	0.06
Pallet height	-	-	-	-	1.00	-0,04

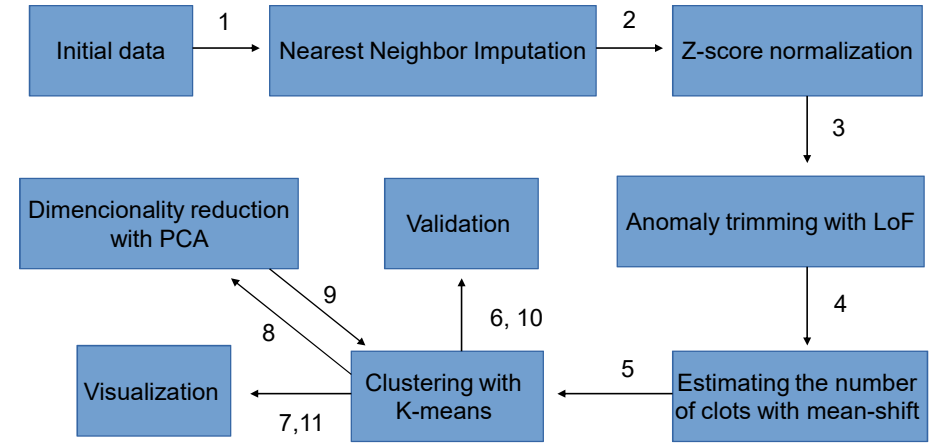
Further improvement via PCA

- Noise reduction
- Eradicate multicolliniarity

№ of components	Silhou-ette	CH	DI	Variance preserved
Prior to PCA	0.432	1072.0	0.639	100%
6	0.441	1120.1	0.662	99.10%
5	0.452	1163.5	0.667	97.82%
4	**0.475**	**1368.3**	**0.750**	**95.11%**
3	0.456	2173.1	0.746	82.09%
2	0.454	3641.7	0.581	67.21%



Data pipeline



https://github.com/Jackil1993/pumpy

Findings and conclusion

- 114 anomalies (5.1%) have been detected
- Dataset comprises quite convex clusters with large differences in densities, thus DBSCAN was quite inefficient
- Mean-shift may be potentially used to predict nearly-optimal value of *k* for k-means
- PCA has gradually improved the initial result on 11% according to silhouette validity index preserving more than 95% of variance

Acknowledgments

This research has been supported by the ALLIANCE project (http://alliance-project.eu/) and has been funded within the European Commission's H2020 Programme under con-tract number 692426.

Thank you for attention!