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alliance

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PANEPISTIMIO THESSALIAS – UTH	Greece
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Abbreviation	Description
3PL	Third-Party Logistics
AV	Autonomous Vehicle
B2B	Business-to-Business
B2C	Business-to-Consumer
CSUM	Conference on Sustainable Urban Mobility
CV	Connected Vehicle
D	Deliverable
DCL	Deep Convolutional Learning
EU	European Union
Fraunhofer	Fraunhofer Institute for Factory Operation and Automation
GA	Grant Agreement
GPS	Global Positioning System
ICT	Information and Communications Technology
IoD	Information on Delivery
ITS	Intelligent Transportation System
LSI	Logistics Sustainability Index
M	Month
MLP-NN	Multi-Layer Perception Neural Networks
P	Paper
PO	Project Officer
QR	Quick Response
SDR	Software-Defined Radio
SME	Small and Medium-sized Enterprises
SSAM	Surrogate Safety Assessment Model
STSE	Short-Term Staff Exchange
SVM	Support Vector Machines
TTI	Transport and Telecommunication Institute
UFT	Urban Freight Transport
UTH	University of Thessaly
WP	Work Package

ABSTRACT

The present deliverable constitutes the compendium of abstracts presented at the 4th Conference on Sustainable Urban Mobility (CSUM2018) by the ALLIANCE members within the project's special session and other sessions.

A statistical analysis was performed to reveal useful findings regarding the abstracts, presentations and the authors of the submitted papers. These data have been summarized in tables, i.e. table for recording dissemination activities and table for monitoring publications, according to the set templates.

1 Introduction

1.1 Contents of the deliverable

This document is the eight deliverable of WP3 that has been prepared till now, along with deliverable D3.1, which outlined the knowledge-sharing strategy, deliverables D3.2, D3.3 and D3.4 regarding the assessment of educational/training program implementation with updates by UTH, Fraunhofer IFF and TTI, respectively, deliverables D3.6 and D3.7 including the proceedings of special session in Young Researchers' Seminars during the 16th and 17th International Conferences in Reliability and Statistics in Transportation and Communication, respectively and deliverable D3.9, which included the proceedings of special session in the previous International Conference on Sustainable Urban Mobility (CSUM2016).

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 must maximize the transfer of knowledge among partners of the project. Knowledge-sharing strategy targets on the following groups of users: research and academic staff of TTI, master and PhD students. Deliverable D3.10 constitutes the compendium of abstracts presented at CSUM2018 by the ALLIANCE members.

Papers from TTI, UTH and Fraunhofer IFF were submitted to the 4th Conference on Sustainable Urban Mobility (CSUM2018) which was held on 24 - 25 May, 2018 in Skiathos Island, Greece. The International Conference was organized by the University of Thessaly, Department of Civil Engineering, Traffic, Transportation and Logistics Laboratory - TTLog, with the support of the European Commission's project "Enhancing Excellence and Innovation Capacity in Sustainable Transport Interchanges - ALLIANCE" and the European Commission's project "New Cooperative Business Models and Guidance for Sustainable City Logistics - NOVELOG". The theme of this year's Conference was "Data analytics: Paving the way to sustainable urban mobility" and its primary goal was to disseminate knowledge and exchange good practices among researchers and practitioners in the domain of urban transportation.

The Conference proceedings have been submitted for publication in the book series "Advances in Intelligent Systems and Computing (AISC)" by Springer, ISSN: 2194-5357. Proceedings will be submitted for indexation by: ISI Proceedings, EI-Compendex, DBLP, SCOPUS, Google Scholar and Springerlink. In addition, selected papers will be revised and extended versions will be considered for publication in the De Gruyter open access Transport and Telecommunication Journal (indexed in SCI and Scopus) of the Transport and Telecommunication Institute and in an indexed Special Issue entitled "Paving the way to sustainable urban mobility".

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, Germany. Close collaboration of TTI with UTH and Fraunhofer 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 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 a virtual platform for guiding young and professional researchers through the process of their research (ALLIANCE Virtual Research Compliance Office).

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 in 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 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 CSUM2018

In total, 19 papers were prepared by TTI, UTH and Fraunhofer IFF staff and students, and were submitted and presented at the 4th Conference on Sustainable Urban Mobility. Seven of the papers were included in the ALLIANCE special session focusing on transport interchanges, one of them in session "Public transport and demand responsive systems", five in "City logistics systems", three in "Applications of big data technologies in transport", one in "Data security and legal issues", and two in session "Social networks and traveller behavior".

The title, the authors, the abstract and keywords for each of these papers are presented in Tables 1-19. The Conference's program is given in Annex A, and the presentations are found in Annex B.

Table 1: Paper P1 – Integrating logistics and transportation simulation tools for long-term planning

Paper code:	**P1**
Responsible or involved partner:	UTH, Fraunhofer IFF, TTI
Paper title:	Integrating logistics and transportation simulation tools for long-term planning
Author(s):	Ioannis Karakikes, Wladimir Hofmann, Lambros Mitropoulos, Mihails Savrasovs
Reference:	Karakikes, I., Hofmann, W., Mitropoulos, L. & Savrasovs, M., 2018. "Integrating logistics and transportation simulation tools for long-term planning". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
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 at regional level. The result of the integration is a model that is able to simulate the traffic conditions on a transport network. The integrated model is tested in the wider area of Volos Port, Greece and port's intra-logistics processes. The model is used to evaluate the feasibility of the measures in the year 2030, by comparing it with the situation in the year 2030 without the implementation of any new measure. The evaluation of the model is performed by using a set of indicators that represent environmental and transport impacts. The analysis is completed by using a multi-criteria decision making tool to generate the Logistics Sustainability Index (LSI) to summarize the information that is provided by the indicators. The study indicates that the usage of simulation models has the potential to provide a holistic impact evaluation of complex decisions and support long term planning.	
Keywords:	City Logistics, Software integration, Evaluation, Simulation, Transport interchanges, Port.
Session:	ALLIANCE Special Session

Table 2: Paper P2 – Development and simulation of priority based control strategies of ground vehicles movements on the aerodrome

Paper code:	**P2**
Responsible or involved partner:	Fraunhofer IFF, TTI
Paper title:	Development and simulation of priority based control strategies of ground vehicles movements on the aerodrome
Author(s):	David Weigert, Alina Rettmann, Iyad Alomar, Juri Tolujew
Reference:	Weigert, D., Rettmann, A., Alomar, I. & Tolujew, J., 2018. “Development and simulation of priority based control strategies of ground vehicles movements on the aerodrome”. 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: Performance indicators to measure delay and delay improvement within the system are the non-operation period of an aircraft, the distance and time by ground vehicles needed to get to their assigned task. Due to the rising number of passengers within the next years, the effectiveness of these indicators needs to rise. A conceptual model was built with the help of Kuhn’s process chain model, which was used as a basis for the following rough calculation. The rough calculation contains time for necessary tasks at an airport as well as data about aircrafts, which departure and arrive at Riga International Airport. This paper focuses on the development and computer simulation of priority based control strategies for improving turnaround times of aircrafts at the apron of the Riga International Airport.	
Keywords:	Ground vehicle movement, Apron Simulation, Prioritization of vehicles.
Session:	ALLIANCE Special Session

Table 3: Paper P3 – Design and prototyping of IoD shared service for small and medium enterprise

Paper code:	**P3**
Responsible or involved partner:	TTI
Paper title:	Design and prototyping of IoD shared service for small and medium enterprise
Author(s):	Aleksandrs Avdekins, Mihails Savrasovs
Reference:	Avdekins, A. & Savrasovs, M., 2018. "Design and prototyping of IoD shared service for small and medium enterprise". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: The importance to have information on delivery accurate and on-time is considered quite high in B2B (business-to-business) and B2C (business-to-consumer) segments. It is also essential for managing supply chain and delivery networks. With the aim of being fast, safe, controllable and traceable, delivery and trucking companies have developed a quite different logistics networks and systems in their logistics processes. Usually implementing of such processes requires a lot of resources from finance and IT perspective, which is not very suitable for SME (small and medium-sized enterprises). This paper presents concept, design and prototyping of the solution, which can be used and shared between delivery companies, 3PL (third-party logistics) operators and consignees to get IoD (information on delivery) accurate and on-time without implementing high costs and complicated processes and IT systems. The proposed solution is primarily based on QR (quick response) code recognition and data sharing.	
Keywords:	Logistics, Tracking, Information on Delivery, QR Code.
Session:	ALLIANCE Special Session

Table 4: Paper P4 – Comparing the customer use and satisfaction in two Latvian transport interchanges

Paper code:	**P4**
Responsible or involved partner:	TTI
Paper title:	Comparing the customer use and satisfaction in two Latvian transport interchanges
Author(s):	Irina Yatskiv (Jackiva), Vaira Gromule
Reference:	Yatskiv (Jackiva), I. & Gromule, V., 2018. "Comparing the customer use and satisfaction in two Latvian transport interchanges". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.

Abstract:

Transport services usability refers to the conditions of the infrastructure: reliability, safety, comfort and ease of access to various modes, travel time, and affordability. However, the transport services market does not distribute equitably in urban and rural areas. The scope of research is to analyze equity in user satisfaction in two transport interchanges: Bus Stations in capital city Riga and in small town Jelgava. Data were collected through a questionnaire survey in August 2017. The questionnaire included the users' opinion about service usability and quality of services. The analysis of differences between provided services and quality level for interchange in the capital city and small town was conducted.

Keywords:	Transport Interchange, Quality of Services, Survey, User Satisfaction.
Session:	ALLIANCE Special Session

Table 5: Paper P5 – Investigating the accessibility level in Riga's International Coach Terminal: A comparative analysis with European interchanges

Paper code:	**P5**
Responsible or involved partner:	TTI, UTH
Paper title:	Investigating the accessibility level in Riga's International Coach Terminal: A comparative analysis with European interchanges
Author(s):	Evelina Budilovich (Budiloviča), Vissarion Magginas, Giannis Adamos, Irina Yatskiv (Jackiva), Maria Tsami
Reference:	Budilovich (Budiloviča), E., Magginas, V., Adamos, G., Yatskiv (Jackiva), I. & Tsami, M., 2018. "Investigating the accessibility level in Riga's International Coach Terminal: A comparative analysis with European interchanges". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: This paper investigates the accessibility level of the International Coach Terminal in Riga, Latvia, determining crucial parameters, such as needs, elements and policies that can reform existing transportation hubs into fully accessible ones for all citizens. In order to receive users' feedback on the existing conditions of the terminal and gather their expectations for future interventions, a questionnaire survey was conducted by the Transport and Telecommunication Institute in cooperation with the terminal administration. Achieving a response rate of 95%, 239 users provided useful information about their travel habits, preferences and level of satisfaction, by rating thirty indicators. The results of this survey were also compared, through a meta-analysis approach, with relevant findings of similar surveys realized in five European transport interchanges.	
Keywords:	Interchange, Accessibility, Intermodality, Transport Hub, Meta-analysis.
Session:	ALLIANCE Special Session

Table 6: Paper P6 – Impact of critical variables on economic viability of converted diesel city bus into electric bus

Paper code:	**P6**
Responsible or involved partner:	TTI
Paper title:	Impact of critical variables on economic viability of converted diesel city bus into electric bus
Author(s):	Kristine Malnaca, Irina Yatskiv (Jackiva)
Reference:	Malnaca, K. & Yatskiv (Jackiva), I., 2018. "Impact of critical variables on economic viability of converted diesel city bus into electric bus". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.

Abstract:

Through the European Strategy for low-emission MOBILITY of 2016, the European Commission is working to strengthen the economy by promoting sustainable urban mobility and increased use of clean and energy efficient vehicles and looking into how to accelerate this process. Cities are crucial for the delivery of this strategy, and electrification of buses is a step towards reducing the fossil fuel dependency of the transportation sector as well as creation of a healthier urban environment.

At the same time electric buses are still a challenge for public transport operators due to high acquisition costs of a new vehicle and lack of charging infrastructure. Therefore conversion of diesel city bus into electric bus is one of the alternatives considered. Economic viability of converted diesel bus into electric bus can be parameterized using an economic model that allows to estimate an impact of critical variables on the total cost of ownership.

In this paper, a specific case of operating converted diesel bus into electric bus in a city of Latvia is analyzed. With the help of economic model, critical variables are determined as well as their switching values, which make the use of converted diesel engine bus into an electric vehicle economically viable. It can be used to support decision-making process of public transport stakeholders in the context of the deployment of environmentally friendly public transport.

Keywords:	Low-emission, Electric Bus, Converted Diesel Bus, Economic Analysis, Total Cost of Ownership, Sensitivity Analysis.
Session:	ALLIANCE Special Session

Table 7: Paper P7 – Shopping mall accessibility evaluation based on microscopic traffic flow simulation

Paper code:	**P7**
Responsible or involved partner:	TTI
Paper title:	Shopping mall accessibility evaluation based on microscopic traffic flow simulation
Author(s):	Mihails Savrasovs, Irina Pticina, Valery Zemlynikin
Reference:	Savrasovs, M., Pticina, I. & Zemlynikin, V., 2018. “Shopping mall accessibility evaluation based on microscopic traffic flow simulation”. 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.

Abstract:

The task of shopping mall accessibility evaluation is a vivid problem from a business perspective and in the same time from the public sector and urban development. Business entities are interested to have higher accessibility level to increase the profit in the same time the public sector is interested in sustainable development of the urban areas. Current paper presents the approach to evaluate accessibility of the shopping malls by the visitors based on microscopic traffic flow simulation. The proposed approach in based on idea, that the “last mile” challenge in logistics is also actual in case of the shopping malls. The main factors influencing “last mile” in this case are: usually location of the shopping malls is planned to have maximum of passing flows, it means that a network around shopping mall could be congested much and it is quit problematic to get into shopping mall; usually the number of parking lots are limited and in case of shopping mall popularity visitors are spending significant amount of time to find the free lots; also, a very important issue is related with leaving the shopping mall parking area, as it could be the situation that it is easier to get in when to get out from parking. To evaluate the influence of the mentioned above factors to the accessibility it is proposed to utilize microscopic traffic flow simulation. The paper formulates the methodology for evaluation of accessibility of the shopping malls and demonstrates its applicability based on case study.

Keywords:	Shopping Mall, Accessibility, Traffic Simulation, Last Mile.
Session:	ALLIANCE Special Session

Table 8: Paper P8 – Theoretical view on the designing of prototype of business model for a transport company

Paper code:	**P8**
Responsible or involved partner:	TTI
Paper title:	Theoretical view on the designing of prototype of business model for a transport company
Author(s):	Irina Kuzmina-Merlino, Oksana Skorobogatova
Reference:	Kuzmina-Merlino, I. & Skorobogatova, O., 2018. "Theoretical view on the designing of prototype of business model for a transport company". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: The term "business model" is associated with the "dot-com" firms and its exponential growth in late 90s, but in contemporary economics it is a transversal matter to any organization according to Osterwalder et al. (2004). There are many definitions of business model, but there is a common point in all of them: a business model is created to represent a certain service or product in order to create value to stakeholders and to be purchased by a company's customers. The aim of the paper is to define the theoretical way for building a successful business model, which can be useful for a passenger transport company. As a result of theoretical research the authors developed recommendations for building a prototype of business model for a company, which is operating in transport industry.	
Keywords:	Business Model, Business Model Canvas, Strategy, Transport Company.
Session:	Public transport and demand responsive systems

Table 9: Paper P9 – Development of a smart picking system in the warehouse

Paper code:	**P9**
Responsible or involved partner:	TTI
Paper title:	Development of a smart picking system in the warehouse
Author(s):	Raitis Apsalons, Gennady Gromov
Reference:	Apsalons, R. & Gromov, G., 2018. "Development of a smart picking system in the warehouse". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: In an effort to streamline warehouse logistics processes, the development of a smart picking system is becoming a mainstay for efficient work of a warehouse. A smart picking system is a set of numerous elements of an order picking process, which raises the velocity and quality of picking through using the warehouse management system. It comprises the following chain of warehouse operating processes: the way of organizing goods flow, order dividing principle, several location variants for the storing area and picking area, routing methods of picking, replenishment methods, two approaches of goods layout: one picking location for each item, or various picking locations for each single item. The sequence of building a certain model of the smart picking system depends on a variety of conditions of the warehouse. Introduction of such a system in a warehouse would ultimately result in a number of benefits, though the main purpose of a smart picking system is to prevent warehouse problems that may arise daily or due to seasonal changes.	
Keywords:	System, Order Picking System, Replenishment, Smart Picking, Picking Conditions, Picking Methods.
Session:	City logistics systems

Table 10: Paper P10 – A conceptual framework for planning transhipment facilities for cargo bikes in last mile logistics

Paper code:	**P10**
Responsible or involved partner:	Fraunhofer IFF
Paper title:	A conceptual framework for planning transhipment facilities for cargo bikes in last mile logistics
Author(s):	Tom Assmann, Sebastian Bobeth, Evelyn Fischer
Reference:	Assmann, T., Bobeth, S. & Fischer, E., 2018. "A conceptual framework for planning transhipment facilities for cargo bikes in last mile logistics". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.

Abstract:

Global urbanization processes expedite a growing demand for more sustainability and higher liveability in cities. New logistic concepts like cargo bike schemes can be a vital means towards this goal. In this respect, both logistics planning and urban planning need to address several aspects of the urban fabric, but show a lack of holistic planning tools. We develop a conceptual framework that combines planning objects and planning scales of logistics planning with urban planning. We demonstrate the application of the framework for the theoretical deployment of an urban transhipment facility (UTF). Drawing upon interdisciplinary expertise from urban logistics, urbanism, sociology and psychology, several interdependencies of an UTF implementation with the urban fabric become apparent. Regarding this, several practical recommendations for the use case can be derived. In general, we recommend the application of the framework as a guideline for urban and urban logistics planning purposes to practitioners and encourage scientists to further develop and enrich the framework.

Keywords:	Urban logistics, Cargo bikes, Urban planning, Sustainability.
Session:	City logistics systems

Table 11: Paper P11 – Assessing traffic and environmental impacts of smart lockers logistics measure in a medium-sized municipality of Athens

Paper code:	**P11**
Responsible or involved partner:	UTH
Paper title:	Assessing traffic and environmental impacts of smart lockers logistics measure in a medium-sized municipality of Athens
Author(s):	Vasileios Kiousis, Eftihia Nathanail, Ioannis Karakikes
Reference:	Kiousis, V., Nathanail, E. & Karakikes, I., 2018. "Assessing traffic and environmental impacts of smart lockers logistics measure in a medium-sized municipality of Athens". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: Home deliveries and e-commerce activities have increased substantially in the recent years. This fact led to the increase of the number of last mile trips in urban areas contributing immensely to the overall impacts on the urban environment. Communities are called to find smart solutions to alleviate these impacts, providing at the same time efficient logistics operation, service quality and user satisfaction. "Smart lockers" is a novel city logistics measure aiming at mitigating issues generated from the last mile of parcel deliveries, thus promoting the principles of sustainable urban mobility. In the present study a microscopic simulation of freight traffic flows was performed in a medium-sized municipality of Athens, Greece. Actual delivery data were obtained from a well-known logistics provider and used as input in PTV Vissim software in order to firstly assess the current operation of the deliveries in the study area. Further, an alternative scenario was developed, assuming that instead of home addresses, deliveries were made to the existing, though currently of limited use smart lockers network, assuming final collection of the order by the consumers. Consumers' traveling options and preferences, were simulated in more sub-scenarios and results were compared to provide better understanding of the potential benefits arising by implementing the measure. Impacts on traffic (i.e. travel times and delays), as well as on the environment (i.e. emissions) were further assessed in a multicriteria framework which led to the estimation of the Logistics Sustainability Indices of the tested scenarios.	
Keywords:	City Logistics, Urban Mobility, Simulation, Evaluation.
Session:	City logistics systems

Table 12: Paper P12 – Does the implementation of urban freight transport policies and measures affect stakeholders' behavior?

Paper code:	**P12**
Responsible or involved partner:	UTH
Paper title:	Does the implementation of urban freight transport policies and measures affect stakeholders' behavior?
Author(s):	Eftihia Nathanail, Giannis Adamos, Ioannis Karakikes, Lambros Mitropoulos
Reference:	Nathanail, E., Adamos, G., Karakikes, I. & Mitropoulos, L., 2018. "Does the implementation of urban freight transport policies and measures affect stakeholders' behavior?". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: The aim of this paper is to investigate potential changes in stakeholders' behavior towards Urban Freight Transport (UFT) policies and measures. In order to capture such behavioral changes, an online questionnaire survey was conducted in 12 European cities, and feedback was received from 292 stakeholders, including supply chain stakeholders, public authorities and other stakeholders. Stakeholders were asked to rate in a scale from 1 to 5, twelve variables, namely: green reputation, diffusion of information, perceived alternative mobility, quality of life, awareness level, green concern, perceived visual and audio nuisance, motivation for eco-driving, compliance with regulations, enforcement, eco-driving practice before the journey and eco-driving practice after the journey. The latter four variables, supplemented by the appropriate statements, were also used for testing the Transtheoretical Model of Change. In this case, supply chain and other stakeholders were asked to choose one of the six stages of the model that mostly represented their attitudes, before and after the implementation of UFT measures in their city. The analysis of results revealed the changes in stakeholders' knowledge, attitudes, intention and consequently behavior towards UFT policies and measures, and useful conclusions were drawn about the proportion of those stakeholders who have repudiated their previous unsustainable behavior and established the new "desired" behavior.	
Keywords:	City Logistics, Urban Freight Solutions, Stakeholder Analysis, Behavioral Modeling.
Session:	City logistics systems

Table 13: Paper P13 – Urban traffic management utilizing soft measures: A case study of Volos City

<table>
<tr><td><u>Paper code</u>:</td><td>P13</td></tr>
<tr><td><u>Responsible or involved partner</u>:</td><td>UTH</td></tr>
<tr><td><u>Paper title</u>:</td><td>Urban traffic management utilizing soft measures: A case study of Volos City</td></tr>
<tr><td><u>Author(s)</u>:</td><td>Maria Karatsoli, Ioannis Karakikes, Eftihia Nathanail</td></tr>
<tr><td><u>Reference</u>:</td><td>Karatsoli, M., Karakikes, I. & Nathanail, E., 2018. “Urban traffic management utilizing soft measures: A case study of Volos City”. 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.</td></tr>
<tr><td colspan="2"><u>Abstract</u>:
This paper examines the current and the future performance of the traffic network around the center of the city of Volos in Greece, after the implementation of local traffic management measures and the introduction of innovative Intelligent Transportation System (ITS) services.
The study focuses on the urban road of two main streets Iasonos (up to Fillelinon street) and Dimitriados (section between Fillelinon and Athanasiou Diakou streets) where during the peak hours, congestion results in high delays, bottlenecks and conflicts. System performance is based on specific indicators, which have been set to evaluate the traffic situation in the three main areas of interest: traffic quality, safety and environment.
An investigation on the current and potential problems of the study area has been performed, by modeling the current situation (base scenario) in the microsimulation software VISSIM and using the “Surrogate Safety Assessment Model” (SSAM) to assess the traffic safety. The findings were low quality of signal control, low compliance of drivers to traffic laws (illegal and unregulated parking, trespassing of the bus lane), critical safety hotspots and increased emissions. “Soft” countermeasures are simulated and evaluated in VISSIM. Such “soft” countermeasures are the ban of access to Urban Freight Transport (UFT) vehicles during the peak hours, the adoption of ITS to prevent illegal parking, the adjustment of the coordination time offset.
Apart from evaluating the impact of the countermeasures, the paper constitutes also a roadmap for achieving overall improvement of an urban traffic network without resulting into the construction of new transport infrastructure.</td></tr>
<tr><td><u>Keywords</u>:</td><td>Traffic flow, Traffic safety, Assessment, Network performance.</td></tr>
<tr><td><u>Session</u>:</td><td>City logistics systems</td></tr>
</table>

Table 14: Paper P14 – Applying unsupervised and supervised machine learning methodologies in social media textual traffic data

Paper code:	**P14**
Responsible or involved partner:	UTH
Paper title:	Applying unsupervised and supervised machine learning methodologies in social media textual traffic data
Author(s):	Konstantinos Kokkinos, Eftihia Nathanail and Elpiniki Papageorgiou
Reference:	Kokkinos, K., Nathanail, E. & Papageorgiou, E., 2018. "Applying unsupervised and supervised machine learning methodologies in social media textual traffic data". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: Traffic increasingly shapes the trajectory of city growth and impacts on the climate change in modern cities. Traffic patterns' monitoring can provide with innovative practices in understanding city traffic dynamics, especially via utilizing sensory and textual data analytics. State-of-the-art research recently has focused on processing voluminous real time data in vast quantities by capturing real time sensory observations and/or social network (textual) data regarding city traffic. In this paper, we investigate the feasibility of using Big Data produced by Twitter textual streams for extracting traffic related events. After describing a generic yet innovative application used for data capturing, we preprocess this data so they fit into the structuring of the machine learning models for clustering (unsupervised learning) and classification (supervised learning). For the case of clustering we use Apache Spark on a MapR sandbox with the use of KMeans algorithm. For the classification case we compare various machine learning methodologies including Multi-Layer Perceptron Neural Networks, (MLP-NN), Support Vector Machines, (SVM) and a Deep Convolutional Learning, (DCL) approach to contextualize citizen observations and responses via tweets. The criteria of precision, accuracy, recall and F-score are used as statistical metrics to determine the accuracy and performance of each model. Our experiments include clustering, a 2-class and a 3-class classification, where, MLP-NN gave accuracy of 89.6%, SVM 92.73% and DCL was inferior performing at 81.76%.	
Keywords:	Unsupervised, Supervised, Deep Learning, Big Data, Textual, Traffic.
Session:	Application of big data technologies in transport

Table 15: Paper P15 – A thorough review and analysis of journey planners

Paper code:	**P15**
Responsible or involved partner:	UTH
Paper title:	A thorough review and analysis of journey planners
Author(s):	Dimitrios Sourlas, Eftihia Nathanail
Reference:	Sourlas, D. & Nathanail, E., 2018. "A thorough review and analysis of journey planners". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: Mobility is highly associated to the ability of the travelers to have access to the proper information on the appropriate time, so that to facilitate their choices regarding the destination, time of the day for the trip, mode of travel and itinerary. Based on this information, travelers optimize their travel in order to reduce travel times and costs, considering also minimizing the footprint of such activities. Journey planner platforms are developed to provide customized information to travelers, and advice on optimum options for the specific trip requirements. They vary in context, contents and functionality, which affect the type, quality and reliability of the information and/or advice. The level of service provided by journey planners is the main aim of the present paper. For this very reason a thorough review and analysis of various Journey Planners was performed. The platforms were selected based on whether they provide route optimization and their detailed characteristics were reported in a structured data collection template. Mystery shopping was selected as the applied method, in order to achieve objectivity and equity in the planners' attributes. Following a statistical analysis, correlational models were developed to associate route planners' components to their popularity and usage. The relationships were compared to the stated significance of the route planners' attributes by users, based on previous research. Findings indicate that both functionality and user interface are important attributes that affect travelers in using the platforms, whereas complex and sophisticated information may deter visiting them especially when a quick response is required.	
Keywords:	Trip choices, Mystery Shopper, User Preferences, Qualitative Analysis, Evaluation.
Session:	Application of big data technologies in transport

Table 16: Paper P16 – The contribution of open big data sources and analytics tools to sustainable urban mobility

Paper code:	**P16**
Responsible or involved partner:	UTH
Paper title:	The contribution of open big data sources and analytics tools to sustainable urban mobility
Author(s):	Samaras-Kamilarakis Stavros, Vogiatzakis Petros-Angelos, Eftihia Nathanail, Lambros Mitropoulos
Reference:	Samaras-Kamilarakis, S., Vogiatzakis, P-A., Nathanail, E. & Mitropoulos, L., 2018. “The contribution of open big data sources and analytics tools to sustainable urban mobility”. 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: Sustainable urban mobility is one of the top priorities in European Union and worldwide, as there is an intense tendency of population density increase in urban areas, which results in traffic, economic, environmental and societal impacts. To allocate smart solutions and address successfully urban mobility, communities need to build awareness and knowledge on the demand for people’s mobility and goods transportation, as well as to develop appropriate tools to manage and assess transportation system performance. The above, raise the necessity of data availability. In the era of rapid technological development and endless production of data, electronic devices, including smartphones, personal computers, autonomous vehicles, GPS (Global Positioning System), SDR (Software-defined radio) devices and Bluetooth, have become sources of big data. Urban mobility is a sector that could benefit from using big data by understanding, analyzing and processing data to manage traffic, predict demand, affect travelers’ choices and assess level of service. The purpose of this paper is to identify and review available open big data sources, big data tools and transport related applications in European and international transport platforms. Collected information is used to formulate a roadmap of available and open big data sources, open big data processing tools and applications which aim at improving urban mobility.	
Keywords:	Open Big Data Sources, Sustainable Urban Mobility, Data Processing, Prediction, Analytics Tools.
Session:	Application of big data technologies in transport

Table 17: Paper P17 – Connected and autonomous vehicles – Legal issues in Europe, the USA and Greece

Paper code:	**P17**
Responsible or involved partner:	UTH
Paper title:	Connected and autonomous vehicles – Legal issues in Europe, the USA and Greece
Author(s):	Elissavet Demiridi, Pantelis Kopelias, Eftihia Nathanail, Alexander Skabardonis
Reference:	Demiridi, E., Kopelias, P., Nathanail, E. & Skabardonis, A., 2018. "Connected and autonomous vehicles – Legal issues in Europe, the USA and Greece". 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.

Abstract:

Autonomous (AV) and Connected Vehicle (CV), often mentioned as CAV's, rush their way into automobile market. Consumer cars are increasingly equipped with systems that perform driving functions, either by themselves or by communicating with external systems, thus cancelling the need for a person to be driving. Given the fact that road traffic is a highly regulated area, as it bears huge risks for all traffic users, redefining current regulations is more than ever a necessity.

Many countries in the EU and many states of the USA are making effort to create the appropriate legal conditions for full CAV distribution, through amendments of current regulation or introduction of new more sufficient laws and standards. Most of legislative efforts so far, aim in introducing definitions or determine on road testing procedures though there are few more invasive regulations. Two parameters are taken into consideration on most cases: tort liability and data privacy. Tort liability is used to define who is to blame in case of an accident. Data Privacy is also very important as data sharing is greatly involved in CAV's operation. This paper presents current legal framework in EU, USA and Greece along with the most significant efforts in adopting new CAV friendly legislation, leading to a variety of issues that need to be addressed so as to ensure public safety and to ease CAV's deployment.

Keywords:	Autonomous Vehicles, Connected Vehicles, Legal Issues.
Session:	Data security and legal issues

Table 18: Paper P18 – Investigating the role and potential impact of social media on mobility behavior

Paper code:	**P18**
Responsible or involved partner:	UTH
Paper title:	Investigating the role and potential impact of social media on mobility behavior
Author(s):	Maria Karatsoli, Eftihia Nathanail
Reference:	Karatsoli, M. & Nathanail, E., 2018. “Investigating the role and potential impact of social media on mobility behavior”. 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: Social media are considered as a major communications channel for information exchange, opinion statement, social network enabling, decisions influencing and business promotion. New activities can be triggered by web friends and followers, as a mutual trust on choices is developed during peoples' interactions on social media. Visited places, attended events, bought merchandise that are disseminated on the web turn into possible attractors for others to visit, attend and buy, thus affecting individual's travel preferences and behavior. The impact of social media in travel/mobility decisions is the main objective of this paper. A digital questionnaire was formulated to investigate the degree of social media usage in terms of type of information searched, reached and shared, time of information and purpose for which the information was created. The final sample size comprised 237 users and was grouped according to gender (women-men) and occupation (students - full-time job). In addition, statistical analysis results that were based on this grouping are included and further described in this paper.	
Keywords:	Travel choices, Travel Behavior, Questionnaire Survey.
Session:	Social networks and traveller behavior

Table 19: Paper P19 – Campaigns and awareness-raising strategies on sustainable urban mobility

Paper code:	**P19**
Responsible or involved partner:	UTH
Paper title:	Campaigns and awareness-raising strategies on sustainable urban mobility
Author(s):	Vissarion Magginas, Maria Karatsoli, Giannis Adamos, Eftihia Nathanail
Reference:	Magginas, V., Karatsoli, M., Adamos. G. & Nathanail, E., 2018. “Campaigns and awareness-raising strategies on sustainable urban mobility”. 4th Conference on Sustainable Urban Mobility, Volos, Greece, 24-25 May 2018.
Abstract: The increasing demand for urban mobility in modern cities leads to traffic congestion and other environmental and societal impacts, requiring a shift to more sustainable mobility behavior. However, travelers are not well informed about the possible sustainable modes and their advantages, as traffic education is often limited to learning traffic rules. To raise awareness on sustainability, various techniques may be used, such as designated educational programs, training sessions, seminars and campaigns. Acknowledging the spread and popularity of social media, the aim of the paper is to investigate how a shift in behavior towards more sustainable modes of transportation may be affected by a digital campaign. The coherent production of a successful sustainable urban mobility campaign is a complex task and requires a thorough understanding of the general needs of those affected. Firstly, the paper reviews and analyses previous campaigns and strategies related to sustainable urban mobility implemented in European countries. Analysis includes the organization, which was responsible for initiating the campaign, the time period, theme, scope, target group and type of approach. In those cases, that evaluation of the campaign was conducted, impacts on attitudes and behavior are also identified and the success attributes of the campaigns are selected. In the context of further research, an on-line questionnaire survey was carried out for the identification of travelers’ preferences and attitudes towards innovative strategies that raise awareness in sustainable urban mobility, promoted and supported by social media (Facebook, Instagram, Twitter, etc.).	
Keywords:	Sustainability, Alternative Transport Modes, Promotional Campaigns, Social Media, Digital Campaigns.
Session:	Social networks and traveller behavior

3 Analysis of the submitted papers

Nineteen papers were prepared by TTI, UTH and Fraunhofer IFF staff and students, and were submitted and presented at the 4th Conference on Sustainable Urban Mobility. The proportion of the contribution of each partner and the collaboration among partners is presented in Figure 1.

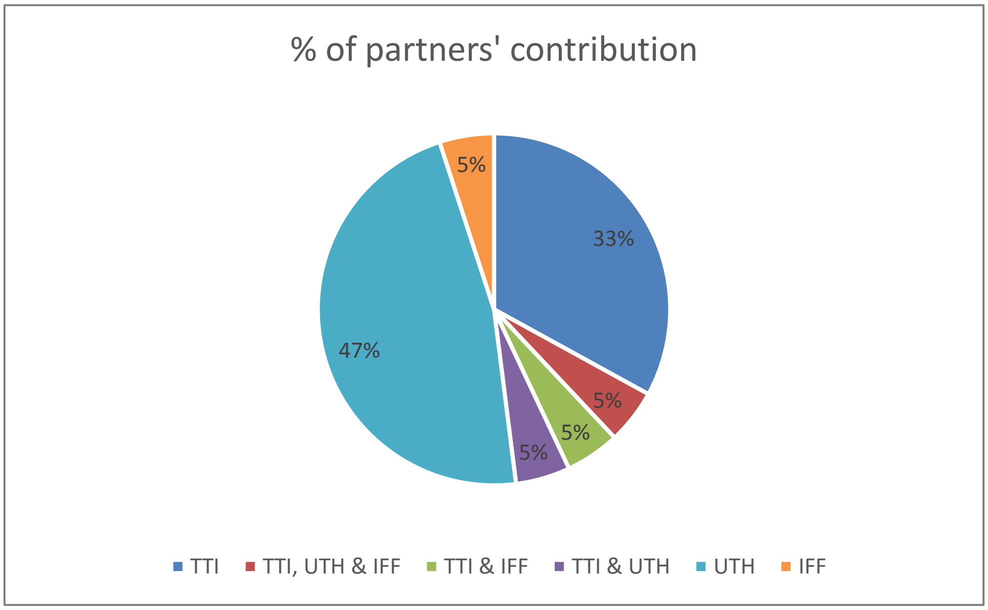


Figure 1: Proportion of partners' contribution

In total 35 researchers from TTI, UTH and Fraunhofer IFF were involved in the preparation of papers. The distribution of authors per institute is given in Figure 2.

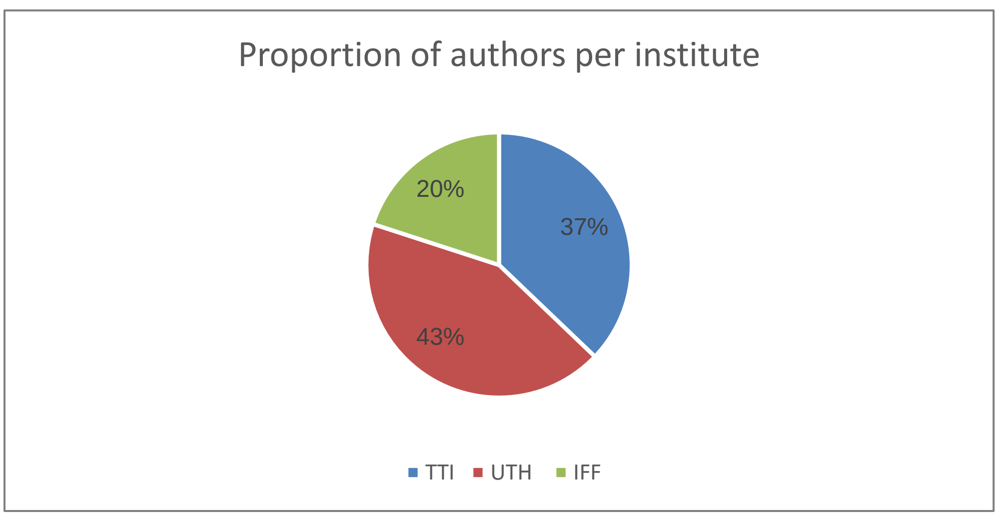


Figure 2: Proportion of authors per institute

In addition, the 37% of the authors or co-authors of the papers are women, and the rest 63% are men, showing a good gender balance (Figure 3).

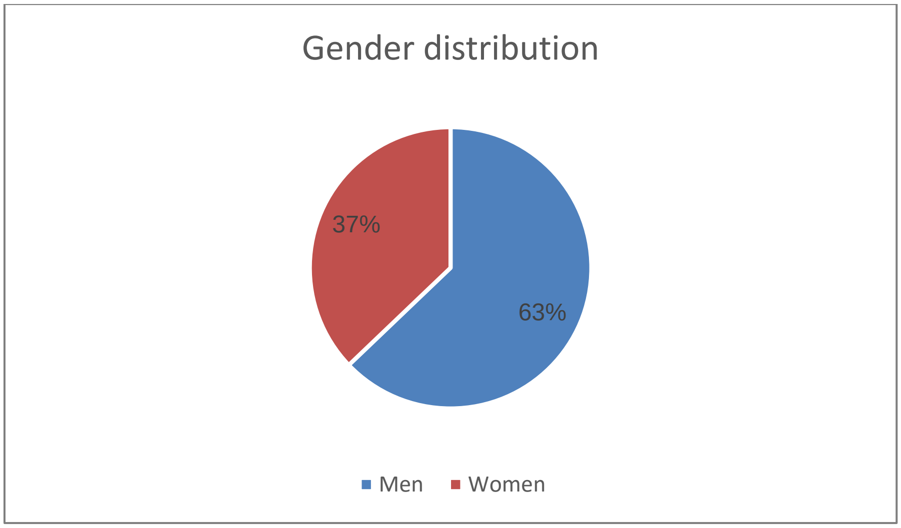


Figure 3: Gender distribution

Lastly, 66% of the authors or co-authors are young researchers and the rest 34% are senior researchers, addressing the scope of ALLIANCE for the active involvement of students and young researchers in its activities (Figure 4).

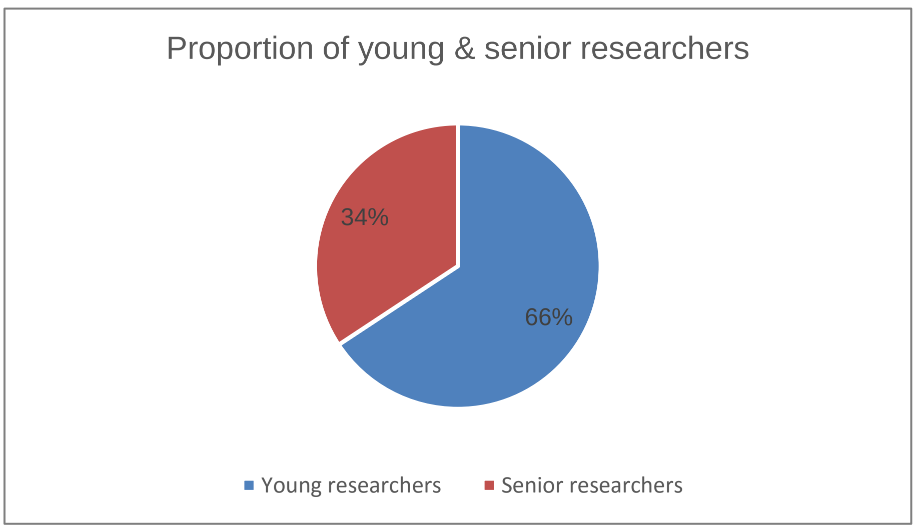


Figure 4: Proportion of young & senior researchers

4 Synopsis

This deliverable is the compendium of ALLIANCE contribution to the 4th Conference on Sustainable Urban Mobility (CSUM2018) which was held on 24 - 25 May, 2018 in Skiathos Island, Greece.

Nineteen from TTI, UTH and Fraunhofer IFF staff were submitted to the Conference and an overview of the activity and the papers is presented in Table 20 and Table 21, respectively.

Table 20: Overview of the activity

No.	Type of activity	Main Leader	Title	Date/period	Place	Type of audience	Size of audience	Countries addressed
1	International Conference	UTH	4th Conference on Sustainable Urban Mobility	24 - 25 May, 2018	Skiathos Island, Greece	Research & academics communities, Local & regional authorities, Transport & terminal operators, Transport policy makers & influencers, Enterprises /Businesses, General public	120 participants	28

Table 21: Overview of the papers

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	Integrating logistics and transportation simulation tools for long-term planning	Ioannis Karakikes, Wladimir Hofmann, Lambros Mitropoulos, Mihails Savrasovs	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
2	Development and simulation of priority based control strategies of ground vehicles movements on the aerodrome	David Weigert, Alina Rettmann, Iyad Alomar, Juri Tolujew	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
3	Design and prototyping of IoD shared service for small and medium enterprise	Aleksandrs Avdekins, Mihails Savrasovs	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

4	Comparing the customer use and satisfaction in two Latvian transport interchanges	Irina Yatskiv (Jackiva), Vaira Gromule	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
5	Investigating the accessibility level in Riga's International Coach Terminal: A comparative analysis with European interchanges	Evelina Budilovich (Budiloviča), Vissarion Magginas, Giannis Adamos, Irina Yatskiv (Jackiva), Maria Tsami	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
6	Impact of critical variables on economic viability of converted diesel city bus into electric bus	Kristine Malnaca, Irina Yatskiv (Jackiva)	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
7	Shopping mall accessibility evaluation based on microscopic traffic flow simulation	Mihails Savrasovs, Irina Pticina, Valery Zemlynikin	Compendium of abstracts presented at the International Conference of	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

			Sustainable Urban Mobility 2018							
8	Theoretical view on the designing of prototype of business model for a transport company	Irina Kuzmina-Merlino, Oksana Skorobogatova	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
9	Development of a smart picking system in the warehouse	Raitis Apsalons, Gennady Gromov	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
10	A conceptual framework for planning transhipment facilities for cargo bikes in last mile logistics	Tom Assmann, Sebastian Bobeth, Evelyn Fischer	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
11	Assessing traffic and environmental impacts of smart lockers	Vasileios Kiousis, Eftihia Nathanail, Ioannis Karakikes	Compendium of abstracts presented at the International	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

	logistics measure in a medium-sized municipality of Athens		Conference of Sustainable Urban Mobility 2018							
12	Does the implementation of urban freight transport policies and measures affect stakeholders' behavior?	Eftihia Nathanail, Giannis Adamos, Ioannis Karakikes, Lambros Mitropoulos	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
13	Urban traffic management utilizing soft measures: A case study of Volos City	Maria Karatsoli, Ioannis Karakikes, Eftihia Nathanail	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
14	Applying unsupervised and supervised machine learning methodologies in social media textual traffic data	Konstantinos Kokkinos, Eftihia Nathanail and Elpiniki Papageorgiou	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
15	A thorough review and analysis of	Dimitrios Sourlas, Eftihia Nathanail	Compendium of abstracts presented at	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

	journey planners		the International Conference of Sustainable Urban Mobility 2018							
16	The contribution of open big data sources and analytics tools to sustainable urban mobility	Samaras-Kamilarakis Stavros, Vogiatzakis Petros-Angelos, Eftihia Nathanail, Lambros Mitropoulos	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
17	Connected and autonomous vehicles – Legal issues in Europe, the USA and Greece	Elissavet Demiridi, Pantelis Kopelias, Eftihia Nathanail, Alexander Skabardonis	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes
18	Investigating the role and potential impact of social media on mobility behavior	Maria Karatsoli, Eftihia Nathanail	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

19	Campaigns and awareness-raising strategies on sustainable urban mobility	Vissarion Magginas, Maria Karatsoli, Giannis Adamos, Eftihia Nathanail	Compendium of abstracts presented at the International Conference of Sustainable Urban Mobility 2018	June 2018	ALLIANCE Project	Volos, Greece	2018	Abstract, paper, presentation	www.alliance-project.eu/deliverables/	Yes

Annexes

Annex A: Conference's programme
Annex B: Presentations

Annex A: Conference’s programme

Programme

Location: THE SKIATHOS PALACE HOTEL

Date: Thursday, 24/5/2018

Room: "Lalaria"

08:00-09:00	Registration
09:00-11:00	**Session 1A: Social networks and traveller behavior I** Moderators: Odile Heddebaut, Piyushimita Thakuriah
	The walkability of Thessaloniki: citizens' perceptions - *Roxani Gkavra, Dimitrios Nalmpantis, Evangelos Genitsaris and Aristotlelis Naniopoulos*
	Perception of smartphone applications about transportation among university students - *Charis Chalkiadakis, Rallou Taratori, Socrates Basbas and Ioannis Politis*
	Social networking and Driving. A study about young Greeks - *Theonymphi Xydianou, Pantelis Kopelias, Christos Marios Polymeropoulos and Elissavet Demiridi*
	Crowdsourcing and visual research methodologies to promote data collection for sustainable mobility planning - *Efthimios Bakogiannis, Maria Siti, Konstantinos Athanasopoulos, Avgi Vassi and Charalampos Kyriakidis*
	Megatrends, a way to intentify the future transport challenges - *Vladislav Maras, Mirjana Bugarinovic, Eleni Anoyrkati and Alba Lina Avarello*
	Unveiling the potential of C-ITS: market research analysis - *Ivan Zaldivar, Eleni Anoyrkati, Alexeis García-Pérez, Alba Lina Avarello, Viara Bojkova, Xavier Leal and Victor Corral*
	Tactical urbanism: Reclaiming the right to use public spaces in Thessaloniki, Greece - *Margarita Angelidou*
	How big data affects the design of urban furniture: An approach from the perspective of industrial design - *Selim Hikmet Şahin and Füsun Curaoğlu*
11:00-11:30	Coffee Break
11:30-13:30	**Keynote Speakers Session** Moderator: Eftihia Nathanail
	"A Geospatial Perspective on Sustainable Urban Mobility in the Era of Big Data" - *Prof. Bin Jiang*
	"Exploring social and economic implications of big data for mobility" - *Prof. Piyushimita Thakuriah*
	"ECO Driving: Strategies and Impacts" - *Prof. Alexander Skabardonis*
13:30-14:00	**Sponsors Session** Moderator: Eftihia Nathanail
	"Attica Tollway Traffic Operations. Enhancing Road Safety with the use of new technologies" - ATTIKI ODOS: *Dr. Dimitris Serbis*
	Capabilities and applications of ArcGIS"- *Marathon Data Systems*
14:00-15:00	Lunch
15:00-17:00	**Session 2A: Traffic emissions and environmental impacts I** Moderators: Fotini Kehagia, Dimitris Serbis
	Development of a methodology, using Multi-criteria Decision Analysis (MCDA), to choose between full pedestrianization and traffic calming area (woonerf zone type) - *Ioannis Vasileiadis and Dimitrios Nalmpantis*
	Influence of traffic emissions on urban air quality: a case study of a medium sized city - *Aggelos Aggelakakis, Afroditi Anagnostopoulou, Alkiviadis Tromaras and Maria Boile*
	Cycling as a key component of the Athenian sustainable urban mobility plan - *Efthimios Bakogiannis, Maria Siti, Georgia Christodoulopoulou, Christos Karolemeas and Charalampos Kyriakidis*
	Assessment of CO2 footprint of the new Athens Metro line 4 during the operation phase - *Aristidis Giakoumis, Fotini Kehagia and Efthimios Zervas*
	Considerations on sustainable mobility: The contribution of cycling to the shift of transportation behaviour - *Elias Papastavrinidis, George Kollaros, Vasiliki Kollarou and Antonia Athanasopoulou*
	Modelling travelers' behavior in the presence of reward schemes offered for green multimodal choices - *Amalia Polydoropoulou, Ioanna Pagoni, Athena Tsirimpa and Ioannis Tsouros*
	Densification of cities or improved transport technology to curb CO2 emissions? - *Harald Nils Rostvik*
	Traffic and environmental rehabilitation of the Agioi Anargyroi square of the Municipality of Agioi Anargyroi – Kamatero - *Christina Margariti, Efthimios Zervas and Dimitrios Nalmpantis*
17:00-17:30	Coffee Break
17:30-19:30	**Session 3A: Data security and legal issues** Moderators: Antonio Comi, Pantoleon Skayannis
	Major limitations and concerns regarding the integration of autonomous vehicles in urban transportation systems - *Panagiotis Fafoutellis and Eleni Mantouka*
	Data protection in smart cities: application of the EU GDPR - *Maria Stefanouli and Chris Economou*
	Connected and autonomous Vehicles – Legal issues in Greece, Europe and USA - *Elissavet Demiridi, Pantelis Kopelias, Eftihia Nathanail and Alexander Skabardonis*
	Implementing a blockchain infrastructure on top of vehicular ad hoc networks - *Anargyros Gkogkidis, Nikolaos Giahoudis, Georgios Spathoulas and Ioannis Anagnostopoulos*
	Shared autonomous electrical vehicles and urban mobility: a vision for Rome in 2035 - *Agostino Nuzzolo, Luca Persia, Antonio Comi and Antonio Polimeni*
	Do urban transport planning principles apply to Norwegian medium-sized sprawling city regions? The case of Stavanger region - *Daniela Mueller-Eie*
	Health related benefits of non-motorised transport: an application of the Health Economic Assessment tool of the World Health Organisation to the case of Trikala, Greece - *Pantoleon Skayannis, Marios Goudas, Diane Crone, Sonja Kahlmeier, Nick Cavill and Vasilena Mitsiadi*
	Autonomous vehicles and blockchain technology are shaping the future of transportation - *Panagiota Georgia Saranti, Dimitra Chondrogianni and Stylianos Karatzas*
20:30-23:30	Gala Dinner @ My Ithaki Restaurant

Programme

	Location: THE SKIATHOS PALACE HOTEL
	Date: Thursday, 24/5/2018
	Room: "Kechria"
08:00-09:00	Registration
09:00-11:00	**Session 1B: Public transport and demand responsive systems I** Moderators: Antonio Polimeni, Mihails Savrasovs
	Evaluation of probabilistic demands usage for the online dial-a-ride problem - *Athanasios Lois, Athanasios Ziliaskopoulos and Tsalapatas Spyros*
	Understanding taxi travel demand patterns through Floating Car Data - *Agostino Nuzzolo, Antonio Comi, Enrica Papa and Antonio Polimeni*
	Critical Moment for Taxi Sector: What should be done by traditional Taxi sector after the TNC disruption? - *Kaan Yildizgoz and Prof. Dr. Murat Celik*
	Predictive maintenance for buses: Outcomes and potential from an Italian case study - *Maria Vittoria Corazza, Daniela Vasari, Enrico Petracci and Luigi Brambilla*
	Electrification of public transport: lessons from the ELIPTIC project - *Yannick Bousse, Maria Vittoria Corazza, Jan Kowalski, Gerhard Sessing, Diego Salzillo Arriaga and Marjorie De Belen*
	Conjoint Analysis for the optimization of a potential flexible transport service (FTS) in the region of Zagori, Greece - *Alexandros Tsoukanelis, Evangelos Genitsaris, Dimitrios Nalmpantis and Aristotelis Naniopoulos*
	Theoretical view on the designing of prototype of business model for a transport company - *Oksana Skorobogatova and Irina Kuzmina-Merlino*
11:00-11:30	Coffee Break
14:00-15:00	Lunch
15:00-17:00	**Session 2B: Public transport and demand responsive systems II** Moderators: Umberto Crisalli, Ioannis Politis
	Investigating potential synergies among social entrepreneurship and public transport through experts' consultation in Greece - *Afroditi Stamelou, Evangelos Genitsaris, Dimitrios Nalmpantis and Aristotelis Naniopoulos*
	Modeling transit user travel time perception in a post-economic recession era: The case of Athens, Greece - *Athanasios Kopsidas, Konstantinos Kepaptsoglou, Eleni Vlahogianni and Christina Iliopoulou*
	The aesthetic integration of a tramway system in the urban landscape- evaluation of the visual nuisance - *Christos Pyrgidis, Antonios Lagarias and Alexandros Dolianitis*
	Redefinition of public transport in the Alto Minho region, Portugal – an overview - *Sara Baltazar, Luís Barreto and António Amaral*
	A criteria-based evaluation framework for assessing public transport related concepts resulted from collective intelligence approaches - *Evangelos Genitsaris, Afroditi Stamelou, Dimitrios Nalmpantis and Aristotelis Naniopoulos*
	A concept for smart transportation user-feedback utilizing volunteered geoinformation approaches - *Benjamin Dienstl and Johannes Scholz*
	Operating resilience of severely disrupted urban transport systems - *Sofia Bouki, Alexandros Deloukas, Efthymia Apostolopoulou and Anna Anastasaki*
	Public transport in transnational peripheral areas: challenges and opportunities - *Federico Cavallaro and Giulia Sommacal*
17:00-17:30	Coffee Break
17:30-19:30	**Session 3B: Application of big data technologies in transport** Moderators: Spyridon Vougias, Irina Yatskiv
	Applying unsupervised and supervised machine learning methodologies in social media textual traffic data - *Konstantinos Kokkinos, Eftihia Nathanail and Elpiniki Papageorgiou*
	Making big data real in upcoming future: the dynamic toll prices in the Portuguese highways - *André Ramos, Alexandra Rodrigues, Sónia Machado, Filipa Antunes, Pedro Ventura, Artur Martins and Akrivi Vivian Kiousi*
	Assessment of dynamic geo-positioning using multi-constellation GNSS in challenging environments - *Stella Strataki, David Bétaille and Urs Hugentobler*
	A thorough review and analysis of journey planners - *Dimitrios Sourlas and Eftihia Nathanail*
	Investigating multiple areas of mobility using mobile phone data (Smartcare) in Chile - Paul *Elliott and Romain Deschamps*
	The contribution of open big data sources and analytics tools to sustainable urban mobility - *Stavros Samaras-Kamilarakis, Petros Angelos Vogiatzakis, Teti Nathanail and Lambros Mitropoulos*
	Beyond travel time savings: Conceptualizing and modelling the individual value proposition of mobility - *Giuseppe Lugano, Zuzana Kurillová, Ghadir Pourhashem and Martin Hudak*
	Future technologies in the EU transport sector and beyond: an outlook of 2020-2035 - *Alkiviadis Tromaras, Aggelos Aggelakakis, Merja Hoppe, Thomas Trachsel and Eleni Anoyrkati*
20:30-23:30	Gala Dinner @ My Ithaki Restaurant

Programme

	Location: THE SKIATHOS PALACE HOTEL
	Date: Friday, 25/5/2018
P	Room: "Lalaria"
09:00-11:00	**Session 4A: ALLIANCE Special Session** Moderators: Irina Kuzmina-Merlino, Irina Pticina
	Integrating logistics and transportation simulation tools for long-term planning - *Ioannis Karakikes, Wladimir Hofmann, Lambros Mitropoulos and Mihails Savrasovs*
	Development and simulation of priority based control strategies of ground vehicles movements on the aerodrome - *David Weigert, Alina Rettmann, Iyad Alomar and Juri Tolujew*
	Design and prototyping of IoD shared service for small and medium enterprise - *Aleksandrs Avdeikins and Mihails Savrasovs*
	Comparing the customer use and satisfaction in two Latvian transport Interchanges - *Irina Yatskiv and Vaira Gromule*
	Investigating the accessibility Level in Riga's International Coach Terminal: A comparative analysis with European Interchanges - *Evelina Budilovich, Vissarion Magginas, Giannis Adamos, Irina Yatskiv and Maria Tsami*
	Impact of critical variables on economic viability of converted diesel city bus into electric bus - *Kristine Malnaca and Irina Yatskiv*
	Shopping malls accessibility evaluation based on microscopic traffic flow simulation - *Mihails Savrasovs, Irina Pticina and Valery Zemljanikins*
11:00-11:30	Coffee Break
11:30-13:30	**Session 5A: Data-driven infrastructure management** Moderators: Socrates Basbas, Alexander Skabardonis
	Performance evaluation of GLOSA-algorithms under realistic traffic conditions using C2I-communication - *Michael Kloeppel, Jan Grimm, Severin Strobl and Rico Auerswald*
	Have information technologies forgotten pedestrians? to what extent can it/its improve pedestrian's mobility and safety - *Hector Monterde-I-Bort, Socrates Basbas, Charlotta Johansson, Lars Leden and Per Garder*
	Trip generation rates for a University campus: the case of the Aristotle University of Thessaloniki, Greece - *Socrates Basbas, Konstantinos Takatzoglou, George Mintsis, Christos Taxiltaris and Ioannis Politis*
	An analysis on drivers' self-reported questionnaire responses, regarding aggressive driving, attitude toward cyclists and personal values - *Kyriakos Andronis, Nikolaos Mavridis, Alexandros Oikonomou and Socrates Basbas*
	Redesigning the seafront area of Pafos - *Spyridon Vougias, Konstantina Anastasiadou and Giorgos Vergas*
	Development of an aggregate indicator for evaluating sustainable urban mobility in the city of Xanthi, Greece - *Anastasis Tsiropoulos, Apostolos Papagiannakis and Dionisis Latinopoulos*
13:30-14:30	Lunch
14:30-16:30	**Session 6A: City logistics systems** Moderators: Athanasios Galanis, Daniela Mueller-Eie
	A new gold mine? Identifying crucial factors affecting the potential of a freight tram for urban freight distribution - *Katrien De Langhe, Hilde Meersman, Christa Sys, Eddy Van de Voorde and Thierry Vanelslander*
	Development of a smart picking system in the warehouse - *Raitis Apsalons and Genadijs Gromovs*
	A conceptual framework for planning transhipment points for cargo bikes in last mile logistics - *Tom Assmann, Evelyn Fischer and Sebastian Bobeth*
	SWOT analysis for the introduction of night deliveries policy in the Municipality of Thessaloniki - *Efstathios Bouhouras and Socrates Basbas*
	Design of a digital collaborative tool to improve mobility in the Universities - *Ariela Goldbard, Ana Velazquez, Rodrigo Rebollo, Erick López, Octavio Mercado and Felipe Victoriano*
	The implementation of environmental friendly city logistics in south Baltic Region cities - *Stanisław Iwan and Kinga Kijewska*
16:30-17:00	Coffee Break
17:00-19:00	**Session 7A: NOVELOG Special Session** Moderators: Giannis Adamos, Harald Nils Rostvik
	Environmental aspects of urban freight movement in private sector - *Afroditi Anagnostopoulou and Maria Boile*
	Assessing traffic and environmental impacts of smart lockers logistics measure in a medium-sized municipality of Athens - *Vasileios Kiousis, Eftihia Nathanail and Ioannis Karakikes*
	Adaptability/transferability in the city logistics measures implementation - *Stanisław Iwan and Kinga Kijewska*
	Does the implementation of urban freight transport policies and measures affect stakeholders' behavior? - *Eftihia Nathanail, Giannis Adamos, Ioannis Karakikes and Lambros Mitropoulos*
	An agent-based simulation of retailers' ecological behavior in central urban areas. The case study of Turin - *Elena Maggi, Elena Vallino and Elena Beretta*
	Diagnostic of the European logistics and road freight transportation sector - *Georgia Aifadopoulou, Iraklis Stamos, Monica Giannini and Josep-Maria Salanova*
	Urban traffic management utilizing soft measures: A case study of Volos city - *Maria Karatsoli, Ioannis Karakikes and Eftihia Nathanail*
19:00-19:15	**Conference closure**
	End of CSUM2018

Programme

Location: THE SKIATHOS PALACE HOTEL

Date: Friday, 25/5/2018

Room: "Kechria"

Time	
09:00-11:00	**Session 4B: Traffic emissions and environmental impacts II** Moderators: Apostolos Papagiannakis
	Investigating mobility gaps in University campuses - Panagiotis Papantoniou, Eleni Vlahogianni, George Yannis, Maria Attard, Pedro Valero Mora, Eva Campos Diaz and Maria Tereza Tormo Lancero
	Big and open data supporting sustainable mobility in smart cities – the case of Thessaloniki - *Georgia Aifadopoulou, Josep-Maria Salanova, Panagiotis Tzenos, Iraklis Stamos and Evangelos Mitsakis*
	Economic cost of urban freight GHG mitigation - *Christophe Rizet and Tu Thi Hoai Thu*
	Road traffic noise reduction and sustainable transportation: A case survey in the cities of Athens and Thessaloniki, Greece - *Vassilios Profillidis, George Botzoris and Athanasios Galanis*
	Sustainable urban mobility plans in Mediterranean port-cities: The SUMPORT project - *Marios Miltiadou, George Mintsis, Socrates Basbas, Christos Taxiltaris and Antonia Tsoukala*
	Cooperative intelligent transport systems as a policy tool for mitigating the impacts of climate change on road transport - *Evangelos Mitsakis and Areti Kotsi*
	Analysis of mobility patterns in selected University campus areas - *Eleni Vlahogianni, Panagiotis Papantoniou, George Yannis, Maria Attard, Alberto Regattieri, Francesco Piana and Francesco Pilati*
11:00-11:30	Coffee Break
11:30-13:30	**Session 5B: Social networks and traveller behavior II** Moderators: Francesco Viti
	Investigating the role and potential impact of social media on mobility behavior - *Maria Karatsoli and Eftihia Nathanail*
	Campaigns and awareness-raising strategies on sustainable urban mobility - *Vissarion Magginas, Maria Karatsoli, Giannis Adamos and Eftihia Nathanail*
	A comparison of bicyclist attitudes in two urban areas in USA and Italy - *Nikiforos Stamatiadis, Giuseppina Pappalardo and Salvatore Cafiso*
	Behavior and perceptions of University students at pedestrian crossings - *Socrates Basbas, Andreas Nikiforiadis, Evaggelia Sarafianou and Nikolaos Kolonas*
	Influence of ICT evolution and innovation on travel and consumption behaviour for determining sustainable urban mobility - *Odile Heddebaut and Anne Fuzier*
	ProMaaS - Mobility as a Service for Professionals. Integrated sectorial business platform for multimodal cross border mobility - *Christophe Feltus, Adnan Imeri, Sebastien Faye, Gerald Arnould and Djamel Khadraoui*
	TRACE – Cycling & walking tracking data for planning and policy - *Pasquale Cancellara, Giacomo Lozzi, André Ramos*
	The use of social computing in travelers' activities preference analysis - *Charis Chalkiadakis, Panagiotis Iordanopoulos, Evangelos Mitsakis and Eleni Chalkia*
13:30-14:30	Lunch
14:30-16:30	**Session 6B: Big data and transport modelling** Moderators: Vitalii Naumov, Nikiforos Stamatiadis
	New indicators in the performance analysis of a public transport interchange using microsimulation tools - The Colégio Militar case study - *André Ramos and João de Abreu E Silva*
	Improving the assessment of transport external costs using FCD data - *Livia Mannini, Ernesto Cipriani, Umberto Crisalli, Andrea Gemma and Giuseppe Vaccaro*
	A big data demand estimation framework for multimodal modelling of urban congested networks - *Guido Cantelmo and Francesco Viti*
	Exploring temporal and spatial structure of urban road accidents: some empirical evidences from Rome - *Antonio Comi, Luca Persia, Agostino Nuzzolo and Antonio Polimeni*
	Modeling demand for passenger transfers in the bounds of public transport network - *Vitalii Naumov*
	Microsimulation modelling of the impacts of double-parking along an urban axis - *Katerina Chrysostomou, Achilleas Petrou, Georgia Aifadopoulou and Maria Morfoulaki*
	Problems, risks and prospects of ecological safety's increase while transition to green transport - *Irina Makarova, Ksenia Shubenkova, Vadim Mavrin, Larisa Gabsalikhova, Gulnaz Sadygova and Timur Bakibayev*
	Short-term prediction of the traffic status in urban places using neural network models - *Georgia Aifadopoulou, Charalampos Bratsas, Kleanthis Koupidis, Aikaterini Chatzopoulou, Josep-Maria Salanova and Panagiotis Tzenos*
16:30-17:00	Coffee Break
17:00-19:00	**Session 7B: Transport data and analytics** Moderators: Konstantinos Kokkinos, Agostino Nuzzolo
	Measuring the spatial accessibility of public transport: the case of the new urban rail systems in the city of Thessaloniki, Greece - *Ioannis Baraklianos, Konstandina Karagouni and Apostolos Papagiannakis*
	TAToo – A Tracking for plAnning Tool applied to cycling and walking data - *André Ramos and João Bernardino*
	Combining land use, traffic and demographic data for modelling road safety performance in urban areas - *Efthymis Papadopoulos and Ioannis Politis*
	Urban form and transportation infrastructure in European cities - *Poulicos Prastacos and Apostolos Lagarias*
	Assessing the impact of changes in mobility behaviour to evaluate sustainable transport policies: case of university campuses of Politecnico di Milano - *Samuel Tolentino, Alberto Bertolin, Paolo Beria, Eleonora Perotto, Fabio Carlo Guereschi, Paola Baglione and Stefano Caserini*
	Neural network-based road accident forecasting in transportation and public management - *Georgios N. Kouziokas*
	Assessment of drivers' perception of quality of service on urban roundabouts - *Maria Perpinia, Efterpi Damaskou and Fotini Kehagia*
	Luminance adaptive dynamic background models for vision-based traffic detection - *Nazmul Haque, Md Hadiuzzaman, Md Yusuf Ali and Farhana Mozumder Lima*
19:00-19:15	**Conference closure**

End of CSUM2018

Annex B: Presentations

4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Integrating Logistics and Transportation Simulation Tools for Long-term Planning

Presenter: Ioannis Karakikes

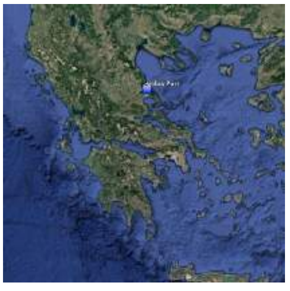
University of Thessaly, Department of Civil Engineering

Co-authors: Wladimir Hofmann, Lambros Mitropoulos, Mihails Savrasovs

Aim and Steps

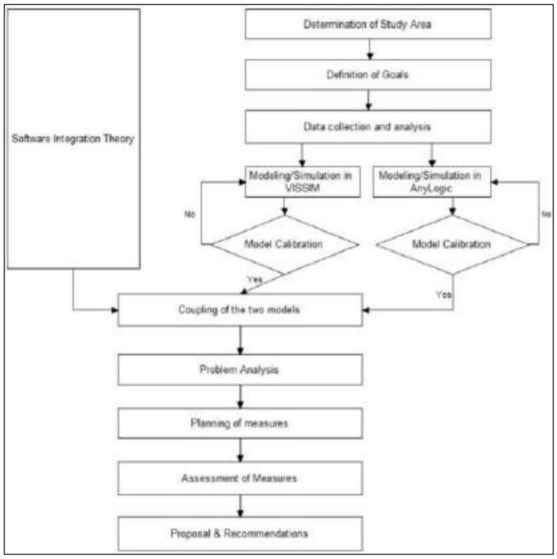
✓ Integrate two simulation software

✓ Test the resulting model in a study at local level



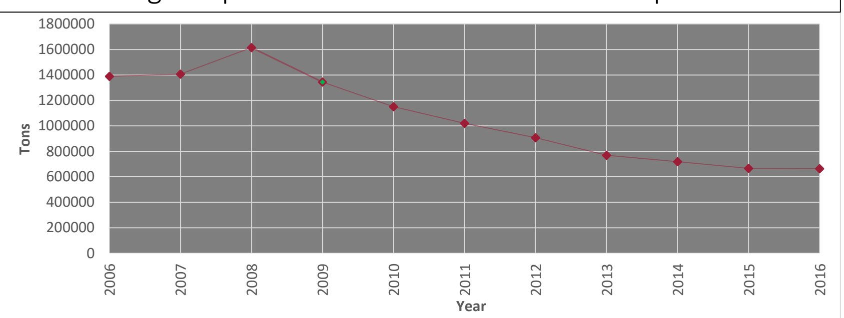
Case Study: Volos Commercial Port

Methodological approach



Data collection

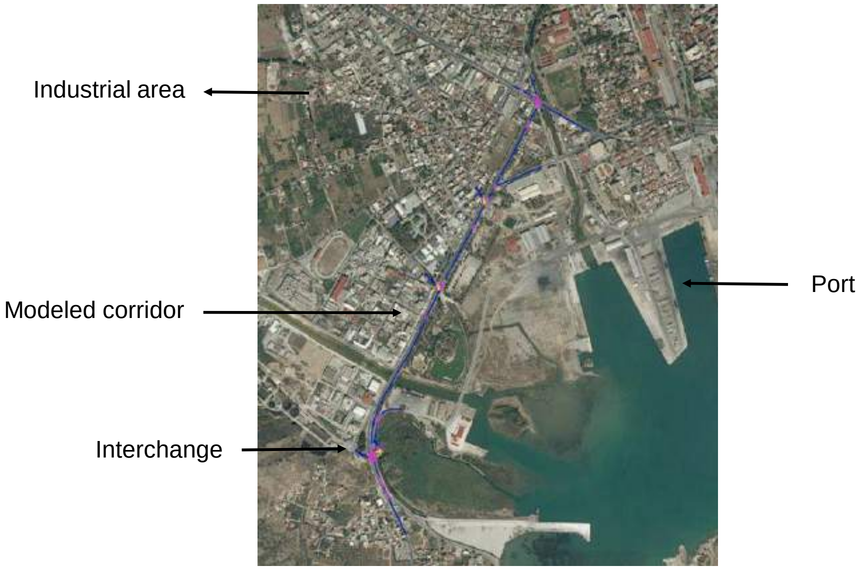
Cargo shipment loads at Volos commercial port



Traffic data

- Volumes and vehicles' composition (counted on 07/06/2017 by observation) in 5 spots
- Peak hour (09:45-10:45)
- Google maps or on-site observation

Vissim



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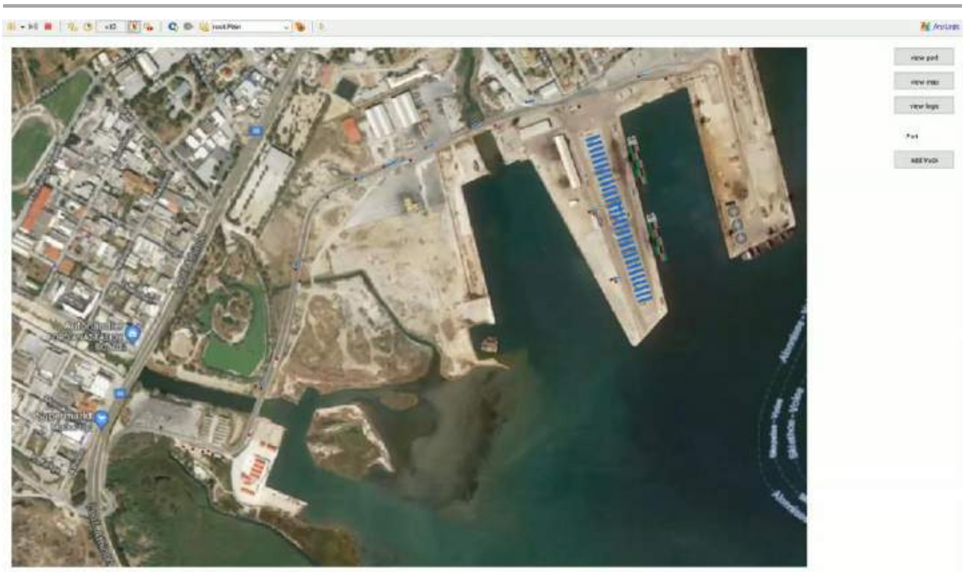
AnyLogic



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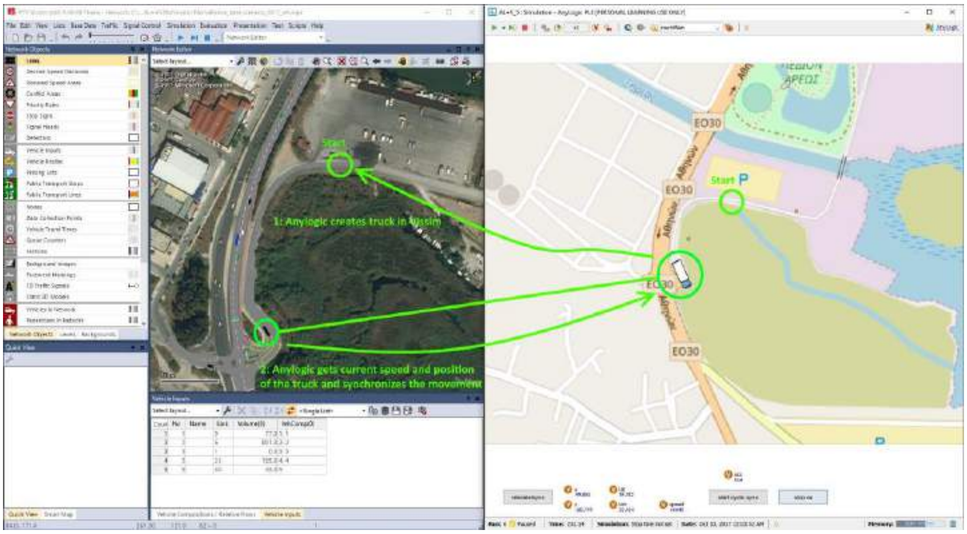
Integration (1/2)



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Integration (2/2)

Input field	
Computed field	

PI	3,14159265358979000000
Sphere radius	6378137

	x (Mercator)	y (Mercator)	lon	lat
refPointMap	969855,696000	6261644,163000	8,722121818	48,96756151

	x (VISSIM)	y (VISSIM)
refPointNet	0,000000	0,000000

Local scaling factor	1,523261245

	x (VISSIM)	y (VISSIM)	x (Mercator)	y (Mercator)	lon	lat
Vehicle 1 t0	-25798,974000	2097,605000	930557,1187	6264839,363	8,36870122	48,9864358
Vehicle 2 t0	-20062,122000	9117,574000	939295,8431	6275532,61	8,44729046	49,04954975

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Measures

Measure 1 – Real time online system for better monitoring

- ❖ The adoption of information systems in conjunction with better programming could end up to an average 95% load factor.
- ✓ 5.5% reduction of HGVs entering/exiting the commercial port
- ✓ Weight distribution for 50% of HGVs has been increased (10%).

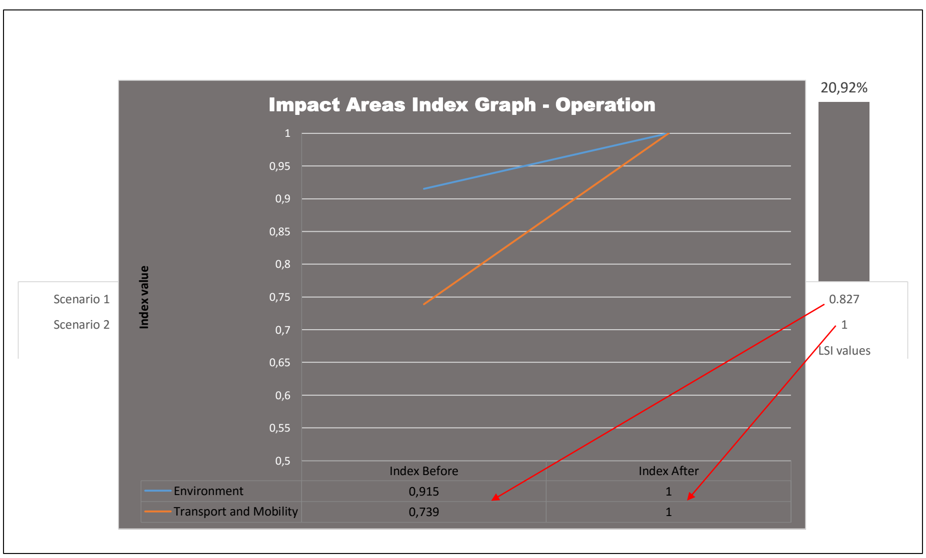
Measure 2 – Green fleet

- ❖ Diesel HGV: 73% (from 78%)
- ❖ Compressed Natural Gas HGV: 4% (from 2%)
- ❖ Electric HGV: 23% (from 20%)
- ✓ Change the parameters of share for "Heavy-Duty" vehicles to estimate the environmental impacts, in EnViVer software.

Measure 3 – Local traffic management

- ❖ Minimization of the percentage of vehicles that drive through the intersection without stopping, allows loaded HGVs to avoid unnecessary deceleration and acceleration which results to smoother rolling with fewer emissions and noise, and lower fuel consumption.
- ✓ Offset the signal programs of the last two intersections of our network, by 8 and 6 seconds earlier.

Results



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Conclusion

The two well-known software can be integrated effectively.

- supports local long term planning (diminishes the need for human resources)
- the approach can serve as a guidebook for future studies willing to assess transport systems such as transport interchanges, commercial ports or urban consolidation centers, since it connects a facility's intra-processes with the nearby transport network.

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Development and simulation of priority based control strategies of ground vehicle movements on the aerodrome

Alina Rettmann, Fraunhofer IFF Magdeburg

Iyad Alomar, Transport and Telecommunication Institute Riga
David Weigert, Fraunhofer IFF Magdeburg
Juri Tolujew, Fraunhofer IFF Magdeburg

Content

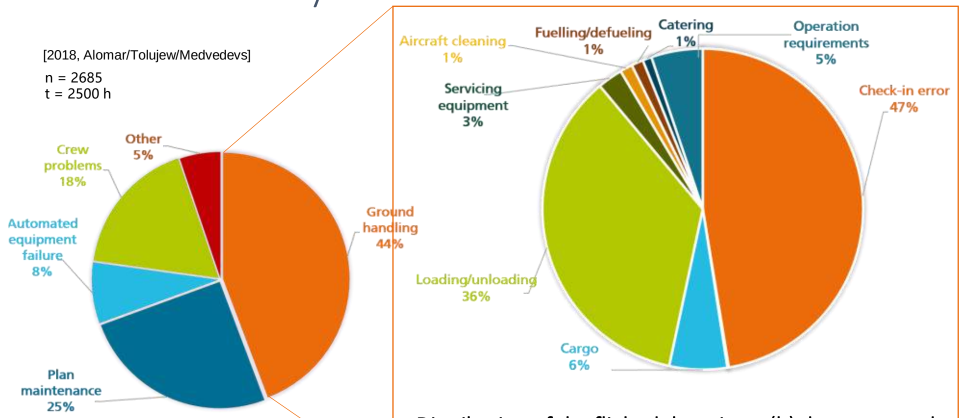
- **Motivation and Problem formulation**
- **Model of Riga International Airport (Apron 3) and Methodology**
- **Outlook**

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

Motivation
Reasons for delay

[2018, Alomar/Tolujew/Medvedevs]

n = 2685
t = 2500 h



Distribution of the flight delay times (h)

Distribution of the flight delays times (h) due to ground handling services

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Motivation
Current state of the Art

Modelling of passenger flows [2013, Mad et al]

Support individual or all processes with simulation [2008, Norin;

Simulation of flight movements [2009, Liang]

Methodology to balance scale and delay costs [2013, Silverio et al]

Simulation and improvement of ground handling by ABS

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Problem formulation
Hypothesis and Goals

- Hypothesis:

Prioritization of certain ground vehicles improves the turnaround time of aircrafts at an apron of an airport

- Goals
  - Improve driving times of ground vehicles
  - Find indicators what kind of prioritization to use under which constraints

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Problem formulation
Performance indicators and control factors

Performance indicators

- Non-operation period of an aircraft (also: handling time of an aircraft)
  => [min/aircraft]
- Estimated and actual time of travel for ground vehicles
  => [min/aircraft]
- Driving Distance for ground vehicles
  => [meters/ground vehicle]
- Utilizations of resources
  => [percent]

Control factors

- Parking Position for Aircrafts
- Routing algorithm for ground vehicles
- Constraints for prioritization

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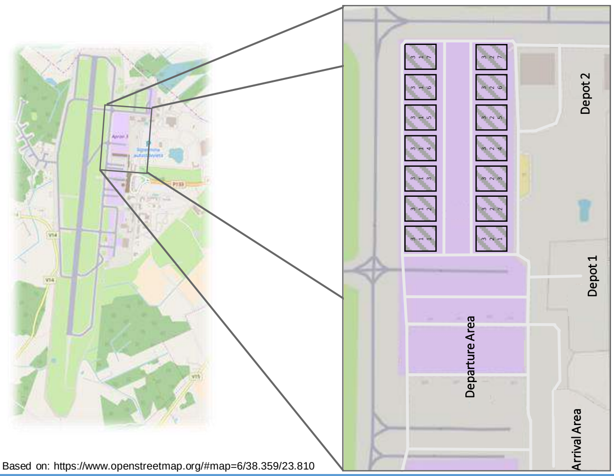
Model of RIX

Riga International Airport (RIX)



Based on: https://www.openstreetmap.org/#map=6/38.359/23.810

Apron 3

- Area with the highest throughput
- More passengers expected by the board of RIX
- Renovation planned for the coming years
- Greatest need for improvement analyzed

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24-25 May 2018
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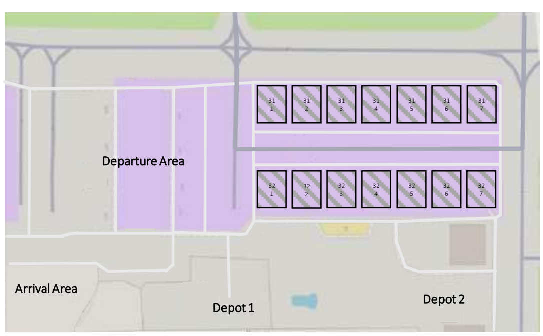
Model of RIX

RIX – Apron 3

Caption:

Ground vehicle lane
Lane for aircrafts



Based on Open Street Map

arrive → unload → refuel → load → depart

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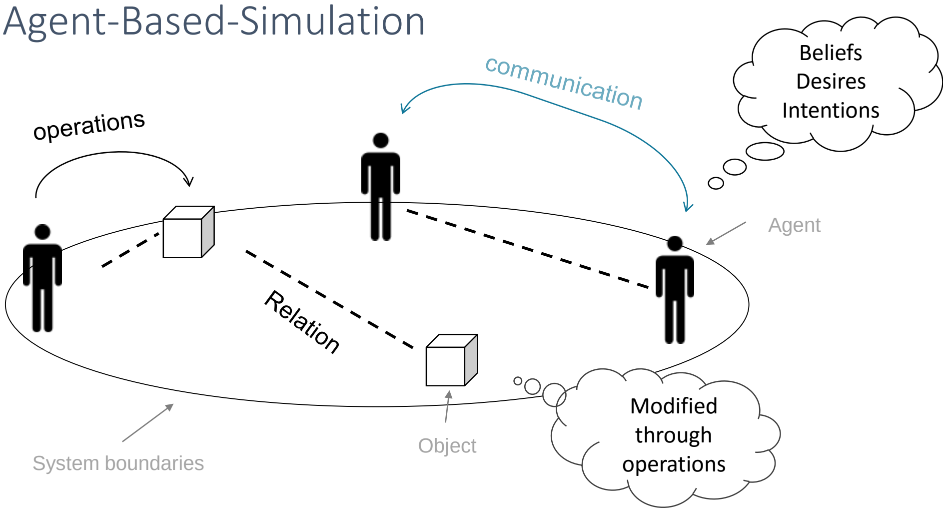
Model of RIX

Agent-Based-Simulation



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Simulation

The agents and some of their characteristics

Aircraft	Ground vehicles		
			
Next free stand i.c.o. prio	Cycle time	Cycle time	utilization
Long/middle/short prio stand	Next free stand i.c.o. prio	Short driving distance	Cycle time
⋮	⋮	⋮	⋮
Cycle time	Prio loading/unloading	utilization	Served aircrafts

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Model of RIX

Preparing the simulation model

Influencing factors
- Modified handling routine
- Modified GV control
- Priority Based Control

Input factors
- Flight schedule
- Aircraft properties
- Handling routine
- Ground vehicle control

System
- Agents and objects
- operations
- relations

Output factors
- Number of GV
- Periods of slow movement
- Periods of fast movement

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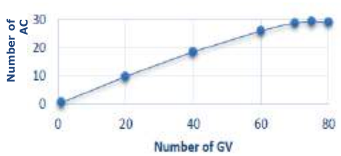
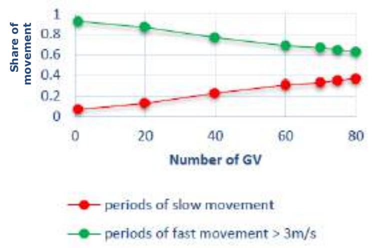
Outlook

Experiments and first results



- Number of served aircrafts per hour
- Saturation effect with more than 80 vehicles



- Share of slow movement growth with increasing number of vehicles in the system

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Thank you for your time!

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Design and prototyping of IoD shared service for small and medium enterprise

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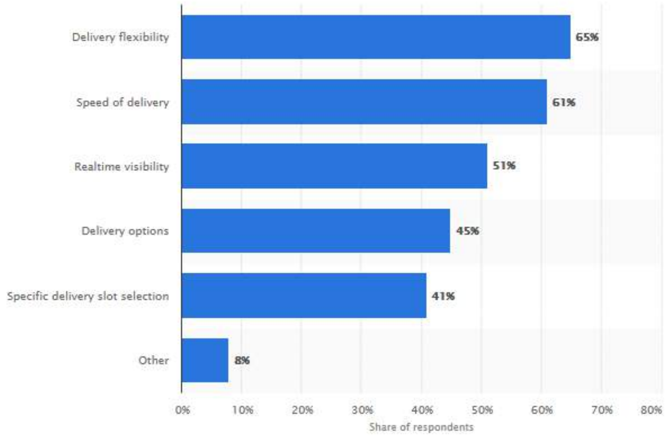
Outline

- Actuality of the reseach
- Requirements
- IoD (Information of Delivery) shared service
  - Shipper actions
  - Driver actions
  - Action flows
- Next steps
- Conclusions

What are your customers demanding most from their last mile services?



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Actuality of the research

The importance to have information on delivery accurate and on-time is considered quite high in business-to-business and business-to-consumer segments

Market demands a high level of IT integration between shippers or 3PL (third party logistics) providers and last mile delivery companies

Motivation

The majority of Eastern European last mile delivery companies are the small business entities(SME), who do not have modern ERP (Enterprise Resource Planning) systems and still manage booking in Excel tables

Industry 4.0 relating to digital supply chain

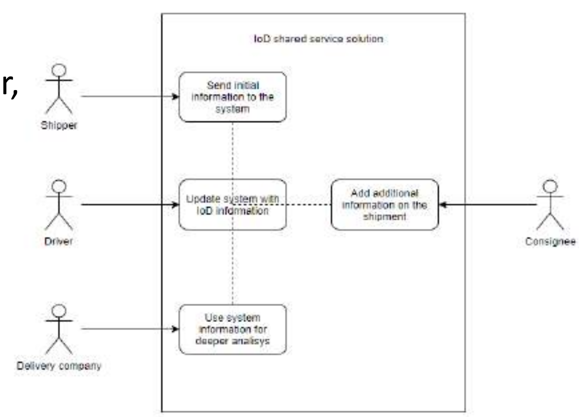
Requirements

The proposed software solution corresponds to the vision of the Industry 4.0 approach and force to enable smart logistics solutions to move to digital supply chain

The main purpose of the solution is to help small transport companies to enter the delivery market, where the demand for IoD (information of delivery) exists

IoD shared service

Service stands in between of shipper, last mile delivery company and consignee



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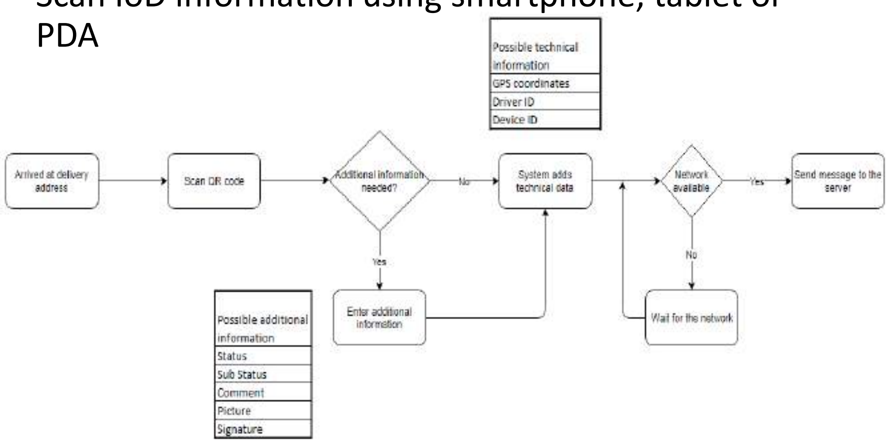
Shipper actions

- Label the goods
- Upload goods data to the information service

Driver actions

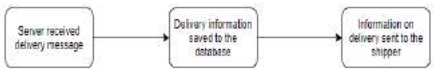
Scan IoD information using smartphone, tablet or PDA



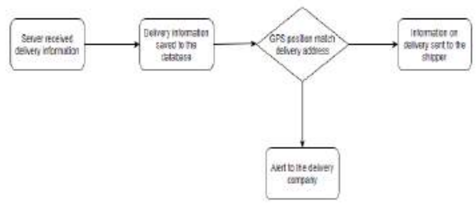
Action flows

Additional benefits from the service delivery company can get from the action flows

Basic flow



Advanced flow



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Future developments

- Extend usage of action flows
- Online Shipment tracking
- Add posibility to create delivery KPI's by transport company and driver

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Conclusions

- Chance for the small last mile delivery companies enter the market without high investments in the technology

- Shipper or 3PL will receive the possibility to make deliveries with any transport company they want, not taking into consideration, if transport company can provide IoD information or not.

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Conclusions

- The client will receive transparent service and online information about their shipments and packages

- Data received from the solution can be used for delivery efficiency analisys

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Comparing the Customer Use and Satisfaction in Two Latvian Transport Interchanges

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[1]Transport and Telecommunication Institute, [2]JSC Riga International Coach Terminal, Riga, Latvia

Outline

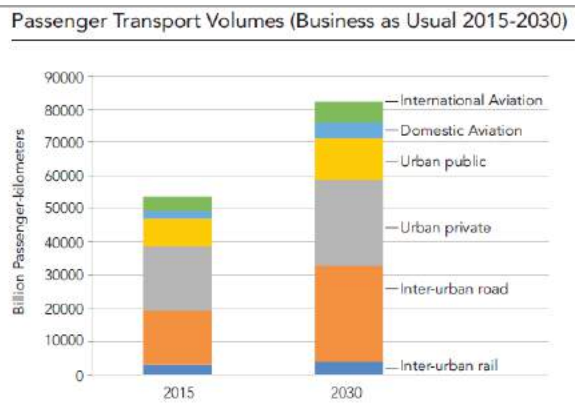
- Introduction
- Basic Concepts. Key Facts
- Methodology
- Analysis and Results
- Conclusions and next steps

Introduction

The world around us is transforming rapidly, changing the way people and goods travel within and across cities, regions, and countries.

Source:. Transforming our world: the 2030 Agenda for Sustainable Development. Sustainable Development Knowledge Platform. https://sustainabledeve lop-ment.un.org/post2015/transformingourworld

Motivation



- By 2030, annual passenger traffic will exceed 80 trillion passenger-kilometers — a **50% increase** and an additional 1.2 billion cars will be on the road by 2050 — double today's total.
- **Transport infrastructure and services will have an ever-greater role to play in meeting this additional demand.**

Source:. Urban Public Transport in the 21st Century, UITP. (2017). http://www.uitp.org/urban-public-transport-21st-century

Transport for Sustainable Development

Sustainable transport and mobility are basis to progress in realizing the 17 Sustainable Development Goals (SDG) and the concept of **universal access features** directly in the next SDG targets that addresses the need:

- in (9.1) **to develop quality, reliable, sustainable, and resilient infrastructure, and focuses on affordable and equitable access for all groups of population**
- in (11.2) for access to safe, affordable, accessible, and sustainable transport systems for all, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons.

Source:. Transforming our world: the 2030 Agenda for Sustainable Development. Sustainable Development Knowledge Platform. https://sustainabledeve lop-ment.un.org/post2015/transformingourworld

The Vision of Sustainable Mobility for All

The Universal Access objective aims to "ensure equity in access to economic and social opportunities by 2030"

Attainment of SDG target 11.2, by focusing on urban access, and **SDG target 9.1, by focusing on rural access,** should be the main targets (to be achieved by 2030) for the Universal Access objective.

While both SDGs 9.1 and 11.2 acknowledge that transport should "leave no one behind," there is no internationally quantified target for this objective.

Source:. Global Mobility Report (2017)

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However…

- Setting a unified global target for "**access for all**" will be a long and drawn out process.
- Instead, it is proposed that countries set their own voluntary targets that account for **their individual circumstances, needs, national and local capacities, and political realities.**
- This will allow to set a target that is ambitious enough to spur real action, but is not so far-reaching as to be ignored.

Latvia. Key concept and situation

- Common European Market and integration of Latvia in the EU has presented new demands to passenger transport – high mobility, inter-modality, comfort observing of passengers' rights, as well as new requirements to the interaction of transport.
- The concept of a sustainable transport system as stated in **Latvian Transport Development Guidelines for 2014 – 2020** is a high-quality transport infrastructure, high level of traffic safety, transport and logistics services, which create pre-conditions for the development of other sectors, provide jobs and the **affordable public transport within the reach of the entire territory of Latvia.**

Latvia. Key concept and situation

- Mobility is one of the key elements that promote social equity and **with ageing society and dramatically decreasing population in Latvia and especially in small cities and rural areas it is becoming essential for the local authority to monitor the running of the service** with a view to adjusting the offer as closely as possible to users' needs.
- Interchange infrastructures and services should support smart and seamless intermodality and equitable access for all groups of travelers.
- The objectives of rural access planning - to improve the access to the facilities, goods and services that rural communities live a socially and economically productive and decent life.

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But…

- many different authorities are responsible for the administration, procurement and planning of various passenger transport services and it is real problem on the way of integration to realization services which support multimodality; MaaS etc.
- the public transport operators face not only the challenge to provide cheap and efficient service from the passenger 's point of views but also to maximize operational efficiency.
- The public transport system in rural area, as its extensive coverage depends on strategic position of terminal that connect, the operational efficiency of the system depends heavily on the safe, comfortable, and quick transfer of its passengers at these transport interchanges.
- **Transport interchanges** often are **significant pain points in regional transport system.**

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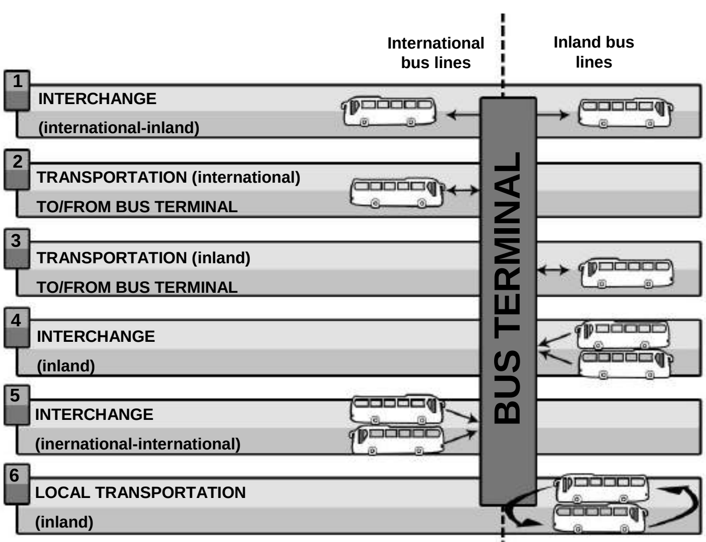
Research aim

- to compare the quality of services that were provided by two different interchanges in Latvia: **one – in capital and one regional.**

- It is actual and important as a core condition for the integration these interchanges into the multimodal system and formation of the multimodal passenger hubs on the basis of interchanges.

- These interchanges were choosing because they have one operator and are included in Strategic plans of reconstruction and be integrated in multimodal hubs with rail station.

Possibilities of intermodal passengers transfers

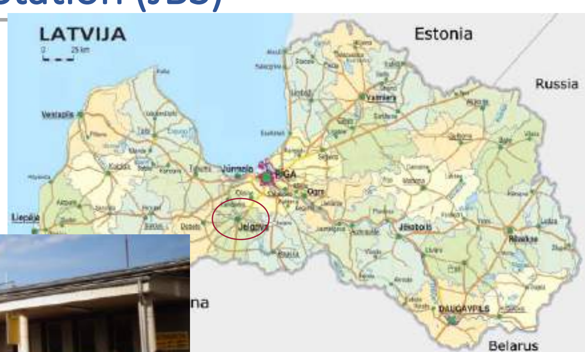


http://www.investeriga.lv/en/wp-content/uploads/2017/12/R%C4%ABga-skait%C4%BCos-2018-ENG-Web.pdf

Riga International Coach Terminal (RICT)

Riga International Coach Terminal (RICT) is one of the most important transportation hubs in Latvia; the node of regional and international transportation networks, which generates a number of routes.

Jelgava Bus Station (JBS)



- Elgava Bus Station (EBS) is situated in Elgava City, which is the 4th largest city in Latvia and just 42 km away from Riga and the total area is 60.3 km^2.
- Elgava city is the hub of 6 main motorways and 5 railway lines that gives the basis for transferring EBS to Multimodal Terminal..

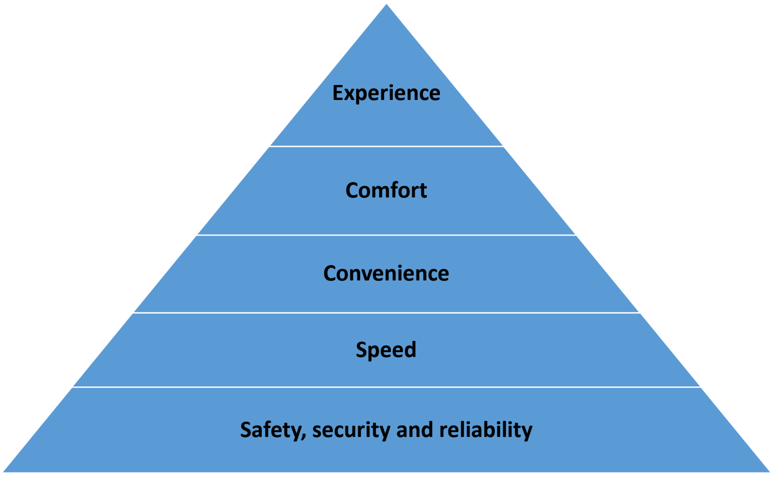
Key characteristics of two Latvian transport interchanges

	RICT (Riga)	JBS (Jelgava)
Interchange size	13 193 m^2	186.5 m^2
Bus platforms	24	6
Routes in 2017, including:	605 959	156 865
Transit routes	21 648	3 320
International routes	24 843	498
Tickets sold (passengers)	1 661 529	166 722

- Both terminals are long distance terminals within the city center and connected with city transport network and attract different activities to its surrounding area.
- In connection with the necessity of providing the accessibility of PT, the interchanges can be considered as **a part of the transport system**, which transforms the demand flows into a product – a set of the required services offered to passengers.
- As **a public space** RICT and EBS should carry out about the passengers and should manage all the public space existing risks.

Quality Factors

Maslow Pyramid of quality factors in public transport



adapted by authors from Peek and Van Hagen, 2002

Surveying system for monitoring of the quality of services provided by the terminal

N	How often	Title	Task	Expected Results	Management Level
1	Once a year	Passenger survey on the quality of services	Passenger satisfaction analysis	Use of the results for the Quality Management System. Development and improvement of services	Operational
2	At least once a year, preferably automatically	Register and analysis of delays, passenger survey	Punctuality index calculation, analysis of influencing factors	Analysis and increasing of reliability	Strategic, operational
3	2-3 years	Transport mode choice and preference survey	Identification of the factors that influence passenger choice of transport mode	Determination of the most important factors in attracting passengers to a certain mode of transport	Strategic

Outline

Introduction

Basic Concepts. Key Facts

Methodology

Analysis and Results

Conclusions

Data Collection

The surveys were conducted in long distance terminals in Riga and Jelgava in August 2017 and the questionnaire included the users' opinion about service usability and quality of services

Data were collected through the questionnaire survey conducted both face-to-face with customers (passengers; terminal services users) and online, and included 22 questions

Socioeconomic information

gender, age and living place

Travel Habits of the users

trip frequency and regularity, trip purpose, the information source, for ticketing: type and place of selling etc.

Users' views on various aspects of service quality provided by RICT and ESB

1. ***Safety and security***
2. ***Cleanliness*** – the important element for comfort feeling.
3. ***Easiness of boarding and disembarking procedures.***
4. ***Bus location.***
5. ***Waiting room location***.
6. As indicator of customer care - ***attitude of the personnel***.
7. ***Information availability.***

Data Analysis

- Descriptive statistics:
  - Average, median
  - Standard deviation
  - Correlation analysis
- Inferential statistics:
  - Mann-Whitney two-sample U-test was performed to assess differences among and between the samples in characteristics measured on the 5-point scale.

Sample characteristics - 1

- In total, 405 respondents (1st Sample) were interviewed in Riga and 102 (2nd Sample) - in Jelgava.
- 98 respondents answered online.
- But using U-test, the homogeneity of answers tested and for almost all indicators have very significant difference between respondents that answered face-to-face and online (p-value<0.001). So, these on-line responses were excluded from analysis about perceived quality of services.

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Sample characteristics - 2

RICT

	skaits	%
Izlases lielums	**527**	**100%**
Datu avots		
Tiešās intervijas autoostā	410	78%
Datorizētas interneta anketas	117	22%
Dzīvesvieta		
Rīga	178	34%
Cita Latvijas pilsēta vai novads	317	60%
Ārpus Latvijas	21	4%
Nav norādīts	11	2%
Dzimums		
Sieviete	307	58%
Vīrietis	212	40%
Nav norādīts	8	2%
Vecums		
Līdz 18 gadiem	73	14%
No 19 līdz 29 gadiem	174	33%
No 30 līdz 45 gadiem	95	18%
No 46 līdz 59 gadiem	78	15%
60 gadi un vairāk	97	18%
Nav norādīts	10	2%

Jelgava

	skaits	%
Izlases lielums	**102**	**100%**
Dzīvesvieta		
Rīga	2	2%
Cita Latvijas pilsēta vai novads	95	93%
Ārpus Latvijas	3	3%
Nav norādīts	2	2%
Dzimums		
Sieviete	63	62%
Vīrietis	39	38%
Vecums		
Līdz 18 gadiem	13	13%
No 19 līdz 29 gadiem	25	24%
No 30 līdz 45 gadiem	20	20%
No 46 līdz 59 gadiem	22	22%
60 gadi un vairāk	21	21%
Nav norādīts	1	1%

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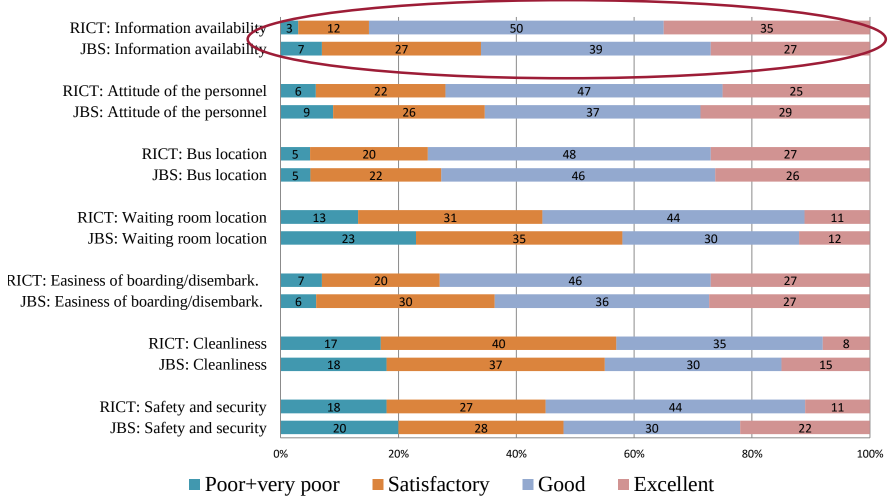
Respondents' Answers. Perceived Quality aspects for RICT and JBS



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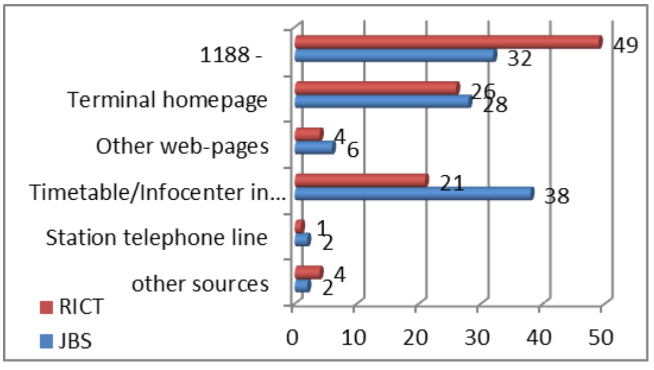
Indicators of perceived quality of the RICT and JBS. Descriptive Statistics

Indicators	Average rating		Standard deviation	
	RICT	JBS	RICT	**JBS**
Safety and security	3.46	3.52	0.062	**0.124**
Cleanliness	3.31	3.35	0.059	**0.116**
Easiness of boarding and disembarking procedures	3.98	3.83	0.054	**0.106**
Waiting room location	3.54	3.34	0.056	**0.111**
Bus location	3.99	3.98	0.047	**0.094**
Attitude of the personnel	3.92	3.80	0.055	**0.109**
Information availability*	**4.20**	**3.87**	**0.049**	**0.096**

*Z-test= -2.756; p-value=0.0057

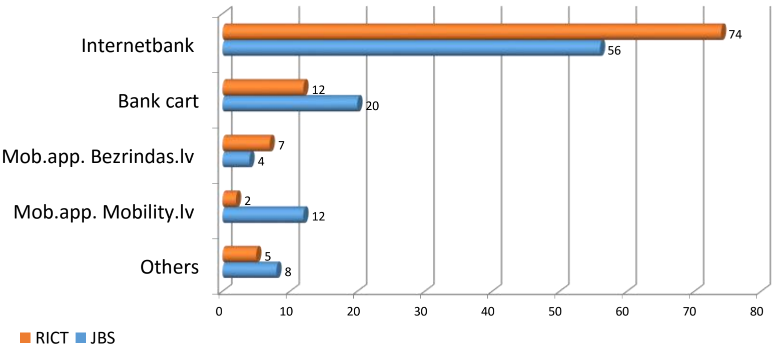
Information Availability.

Source of information on bus services of the interchanges (in %)



Information Availability.

Preferable payment method if users pay for services on the Internet (in %)



Conclusions

- There are no significant differences for considered Terminals between average ratings for quality indicators: 1) Safety and security; 2) Cleanliness; 3) Easiness of boarding and disembarking procedures: 4) Bus location; 5) Waiting room location; 6) Attitude of the personnel
- Only aspects of 'information availability' are critical from the point of view of the multi-faceted access. This is due to the different structure of population in the region surrounding the JBS and other level of life in comparison with the capital.
- The comparison between the RICT and the JBS shows similarities, leads to the conclusion that users are satisfied with the services. The three most valued services are luggage storage, ticket reservations and ticket sales.
- Considering the easy access to city networks, travelers reach or move from the Jelgava station mainly by walking (37%) or using other modes of public transport (43%). In the RICT more than 65% travelled from/to the RICT by public transport and 23% by walking. In both cases no significant percent of travelers used train for access and entrance to terminals. And the reasons of it are: 1) the absence of schedule and ticketing integration and 2) infrastructure integration

Conclusions

- In the future, it is necessary to analyze the differences in detail, more taking into account the socio-economic aspects of respondents.
- This is particularly important in the area of planned serious reconstruction and integration with the railways, both in the regional station (JBS) and in the capital (RICT).
- It is impossible to fully consider all users' requirements without a systematic approach to the formation and management of the passengers' services market, taking into account public transport at the level of the country, region and cities and to the activation of business potential around terminals for achieving customer oriented and liveable neighborhoods.

Traffic Transportation and Logistics Laboratory

Thank you for attention!

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alliance

This paper is based on the research and work that has been conducted in the framework of the ALLIANCE project (http://alliance-project.eu/), which has received funding from the European Union's Horizon 2020 Research and Innovation Programme.

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Investigating the Accessibility Level in Riga's International Coach Terminal: A Comparative Analysis with European Interchanges

M.Sc. Maria Tsami, B.Sc. Vissarion Magginas, Dr. Giannis Adamos - University of Thessaly, Greece

M.Sc. Evelina Budilovich (Budiloviča), Prof. Irina Yatskiv (Jackiva) – Transport and Telecommunication Institute, Latvia

Outline

- **Introduction**
- **Methodology**
- **Analysis and Results**
- **Conclusions**

Transport 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, such as railway stations, airports, coach stations, or port terminals, as well as various inner-city transport systems, including subways, buses, taxis, and cars."

- The function of an interchange station is to
  - reduce the distance between two different urban areas
  - facilitate multi-activity patterns

Source: City-Hub, 2016

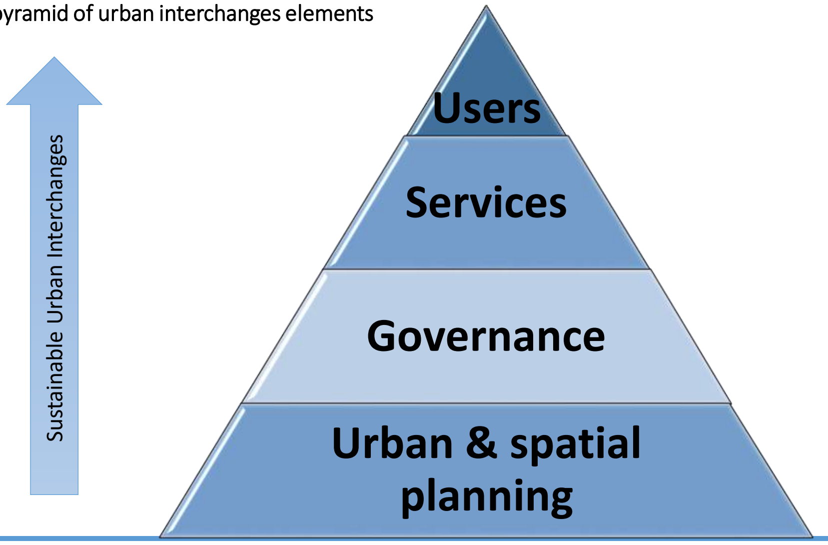
Transport interchanges

- Provide reliable and adequate level of the direct services offered, such as information and ticketing
- Develop satisfactory facilities serving the transfer in service areas and waiting areas/platforms, through offering amenities, Internet access, comfort, and so on
- Provide adequate accessibility to the site for all users (especially the disabled)
- Afford assistance to travellers with navigating aids, so that they can find their way from where they are to where they wish to go, both within the interchange, as well as to and from the local vicinity (way-finding)
- Offer easy and seamless navigation and movement of users, improving also their understanding, enjoyment and experience (legibility)
- Allow users to move around the interchange under several alternatives, providing at the same time clear connections to existing routes, facilities and services (permeability)

Pitsiava-Latinopoulou and Iordanopoulos 2012

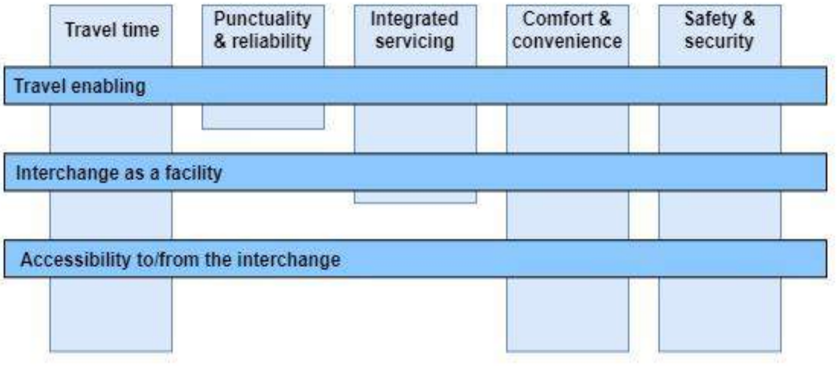
Transport interchanges

The pyramid of urban interchanges elements



Source: Adamos et al., 2015

Interchange quality parameters



Source: CITY-HUBs, 2016

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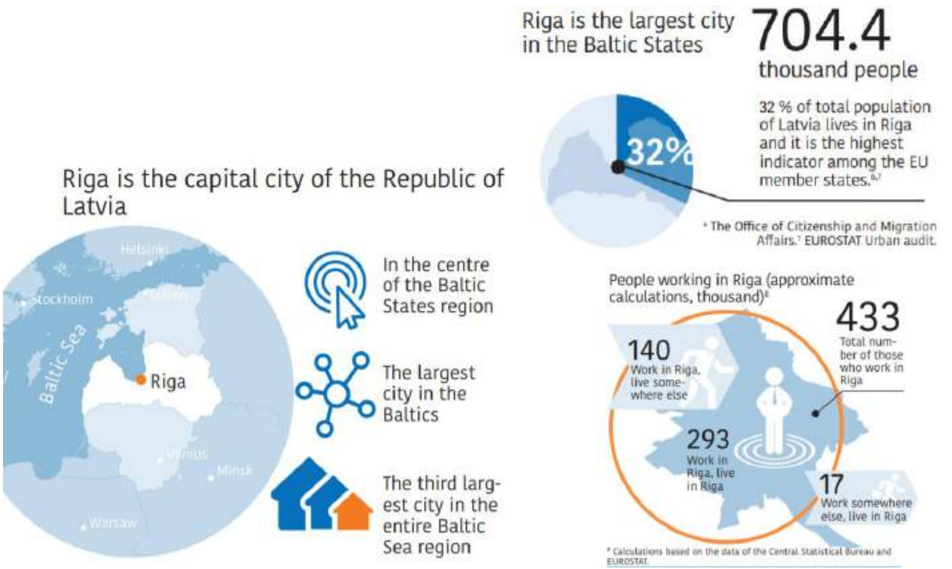
Riga transport system - Key factors about Riga



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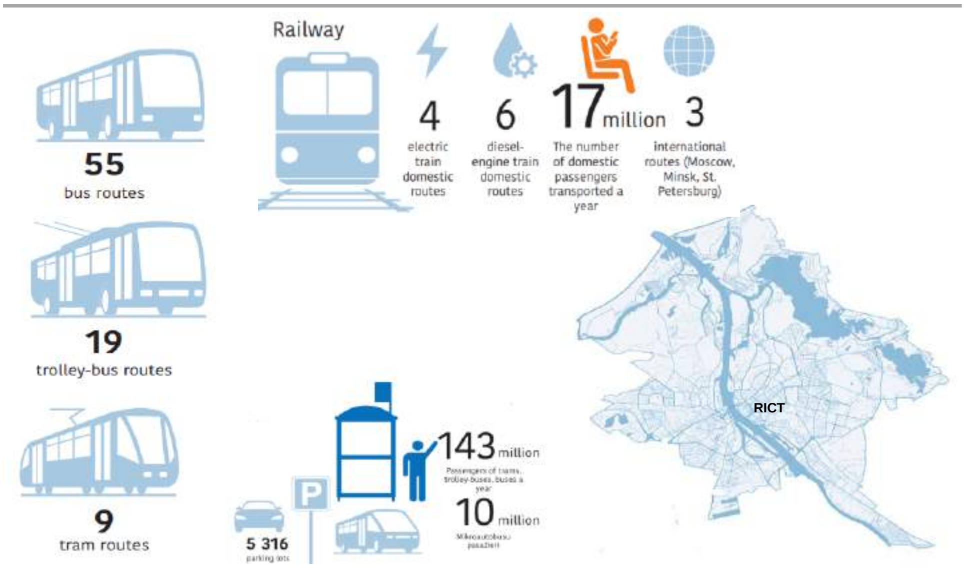
Riga transport system



RP SIA "Rīgas satiksme". Annual report 2016

Riga International Coach Terminal (RICT)

CASE STUDY

more 2 million of passengers

Research aim: RICT accessibility level

Source: Riga International Coach Terminal. Annual report 2016

Previous research

A Comprehensive Analysis of the Planned Multimodal Public Transportation HUB
- Accessibility as main sustainability transportation issue
- Stakeholders' identification
- Definition of indicators for accessibility assessment

Evaluating Riga transport system accessibility
- Calculation of time impedance for public transport
- Calculation of time impedance for cars

Accessibility to Riga Public Transport Services for Transit Passengers
- Analysis of the long-distance journey time and their distribution between inter- and intra- parts of multimodal trip

Accessibility on long-distance terminals: Case study Riga Coach International Terminal
- Design and implementation of passenger satisfaction survey in RICT

Assessing the Design and Operation of Riga's International Coach Terminal
- Extended state-of-the-art review of best practices
- Assessment of RICT performance level in terms of design and operation

Methodology

- Survey
- Data analysis
- Meta-analysis

11

Survey set up & data collection

Preliminary planning
- City-HUB
- Ilford railway station, UK

Survey method
- Face-to-face
- Internet base

Sample design
- Translation into 2 languages (from English into Latvian and Russian)
- Face-to-face sample written in MS Word
- The electronic sample written in the docs.google.com template

Pilot survey
- 33 questions
- 1 language
- 1 week
- 43 answers

Main survey
- 27 questions
- 3 languages
- 1 month
- 252 answers
- duration 4.2017 - 5.2017

12

Questionnaire structure

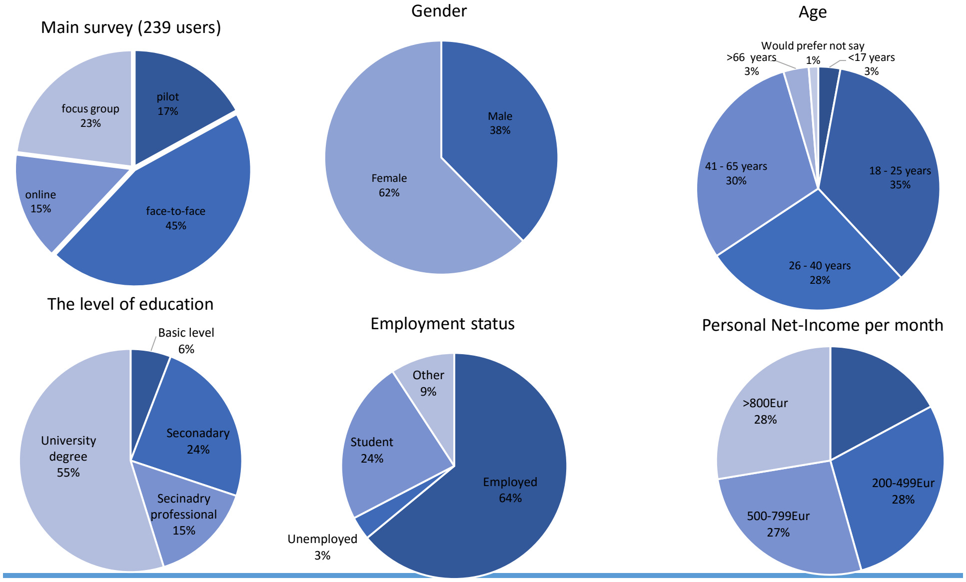
Your trip
1. Origin of your trip (address, district) 2. Destination of your trip (address, district) 3. When you were invited to participate in this questionnaire, were you? 4. ……….. 13. How did this time break down (approximately)? (in min). 14. How often do you use this interchange?
Travellers' satisfaction survey RICT (Riga international coach terminal)
1. to the TRAVEL INFORMATION provided at RICT? 2. What is your level of satisfaction with the information provided at RICT on how to find your way around the station and associated transport facilities? 3. What is your level of satisfaction with regard to the following TIME & MOVEMENT aspects inside the interchange? 4. ……………………….. 9. Please, give a final overall value for your satisfaction with the service at this interchange: 10. Finally, which of the following are in your opinion the 3 most important aspects of an interchange?
New multi-modal transport hub
1. Would it be convenient to use bus station services for your trip to/from Kurzeme and Zemgale destinations if regional bus station will be located in Tornakalns neighbourhood? 2. What kind of public transport or private transport would you need to use to get to / from regional bus station in Tornakalns neighbourhood to get to/from your destination in Riga? 3. Other location of coach terminal or multimodal hub, which will be interesting for you
Socioeconomic information
1. Gender 2. Do you have…? (driver licence, bicycle, car) 3. How old are you? 4. Education level 5. What is your employment status? 6. Number of people in your household 7. Personal Net-Income per month

https://goo.gl/forms/H59dcV0hNDXtIECw2

Data Analysis

- Descriptive statistics:
  - Average median
  - Standard deviation
  - Correlation analysis
- Inferential statistics:
  - Non-parametric test for difference between pairs
  - Kruskal-Wallis testing
  - Mann-Whitney two-sample U-testing

Sample characteristics



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Interchange accessibility level evaluation I

Criteria	Indicators	Average rating (M)	Standard deviation (SD)
Wayfinding information 3	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 2	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 1	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**

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Interchange accessibility level evaluation II

Criteria	Indicators	Average rating (M)	Standard deviation (SD)
Access	Ease of access to the interchange	3.97	0.94
	Ease of access from the interchange	4.02	0.93
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
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
Overall satisfaction	Level of services provided by the interchange	3.50	0.79

Bivariate correlations

Criteria	1.	2.	3.	4.
1. Overall satisfaction	-			
2. Wayfinding information	0.707*	-		
3. Time and movement	0.548*	0.590*	-	
4. Access	0.615*	0.627*	0.487*	-
*p-value<0.05				

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Meta analysis I

Interchange	Operating since	Scale	Transport mode accommodation							Daily no. of passengers	Accessib. for people with disab.	Services parking, renting, taxi	Access on feet	Extra
			interurban	regional	Metropolitan bus	Urban bus	Metro lines	Tram line	train					
Moncloa Madrid	1995				56	3	2		-	266 099	+	-	+	Bus tunnels
Kamppi Helsinki	2005	Local, regional, national, intern.	15	40		21	1	2	-	57 060		+		
Ilford Railway Station London	1839/ 1980	Local, regional		+		+			+	21 000		+	+	
New Railway Station Thessaloniki	1961	Local, regional national importance		+		+	1			152 506		+		
Kobanya-Kispest Station Budapest	1978/2011	Local, regional, national, intern.		+		+	+		+	145 758		+		
RICT	1964	regional, national, intern.	-	+	+	-	-	-	-	5 480	+	+	+	

Meta analysis II

Interchange	Satisfaction rate	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

Conclusions I

- RICT users are less satisfied with the station's accessibility compared to Kamppi and Kobanya-Kispest
- RICT users are more satisfied regarding time spent and information provided in the station compared both to Kobanya-Kispest (3.52) and to Kamppi (3.69)
- **Ease of access** - the station was rated lower compared to Moncloa

Conclusions II

- Findings are important in the context of future tasks of Riga Municipality to develop the Central Multi-Modal Public Transport Hub that integrates the Riga Central Railway Station and RICT
- The local situation regarding the organization of transport in the Riga city is moving to integration soft modes and functional integration appear to be essential in order for transport policies to play a role in interchange "time penalty" reduction
- The quality of the process in RICT is compromised by gaps in the information chain
- The complex workflows in RICT can be effectively improved through state-of-the-art technology: ticket validation systems, real-time information system for all modes of transport, either in panels at RICT, or via smart phone applications
- The main point to solve is to be more integrated with the help of the same technological platforms and integration of all stakeholders on public policy

Thank you for attention!

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alliance

This paper is based on the research and work that has been conducted in the framework of the ALLIANCE project (http://alliance-project.eu/), which has received funding from the European Union's Horizon 2020 Research and Innovation Programme.

4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Impact of Critical Variables on Economic Viability of Converted Diesel City Bus Into Electric Bus

Kristine Malnaca and Irina Yatskiv (Jackiva)

JSC Ferrus, Transport and telecommunication institute

Content

- Background
- Study objective and tasks
- TCO model
- TCO results
- Sensitivity analysis
- Conclusions
- Future steps

Background

- Transition to a low-carbon economy in EU (Strategy for low-emission mobility)
- Urban public transport (PT) in the process of transformation driven by technological developments
- Electric buses – still a challange for PT operators due to high acquisition costs
- Conversion of used diesel bus into electric bus - alternative for PT services

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FERRUS ERAF project

«ENHANCING EXCELLENCE AND INNOVATION CAPACITY IN SUSTAINABLE TRANSPORT INTERCHANGES» Grant agreement number: 692426	«Development of economically justified technology of conversion of the traditional diesel city bus into the environmentally friendly electrobus» Project number: 1.1.1.1/16/A/267
• Strengthen the scientific and technological capacity of Latvia • Facilitate stakeholder collaboration and the development of strong linkage among education, research and industry	• Find the most economically sound and environmentally friendly technical solution by developing a technology for the conversion of existing diesel bus into electric bus
2016 - 2018	2017-2019

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

NACIONĀLAIS ATTĪSTĪBAS PLĀNS 2020
EIROPAS SAVIENĪBA
Eiropas Reģionālās attīstības fonds
IEGULDĪJUMS TAVĀ NĀKOTNĒ

Study objective and tasks

Objective: to assess economic viability of the conversion of used diesel bus (DB) into electric bus (EB) for PT services in the urban environment.

Tasks:

- Develop economic model to estimate TCO of DB and converted EB
- Compare TCO results by components in order to assess the advantages of the bus conversion
- Determine main critical variables and their limit values, which make the conversion of DB into an electric vehicle economically viable

Limitation: suitable for PT services in small and mid-size cities with a population of 20 000 up to 200 000

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Conversion of a used diesel bus into electric bus

- A **mid-size** bus up to 12 m long with the capacity of up to 80 passengers used in the urban environment
- The average annual distance travelled 60 000 km
- Age of a diesel bus to be converted - 7 years

Conversion process within 2 months:

- dismantling the obsolete elements of the combustion power transmission system in a bus (the engine, gearbox, cooling system, exhaust system, adblue system, and a fuel tank)
- assembling of the main elements of electric drive including electric motor, converter, control system
- installing the battery
- installing contact rails positioned on the roof of the vehicle for automatic charging above the front axle (fast charging)

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TCO model (1)

TCO analysis - a method to assess life-cycle costs including all costs of purchasing, operating, and maintaining the vehicle.

$$TCO = CInv\ (bus) + CInv\ (charger) + CInv\ (grid) + C(O\&M) + I*C(ext)$$

C_{Inv} (bus) - investment costs of a bus;

C_{Inv} (charger) - investment costs of a charger;

C_{Inv} (grid) - investment costs of a grid connection;

C(O&M) - operating and maintenance costs for the vehicle and the charger;

C(ext) - external (environmental) costs;

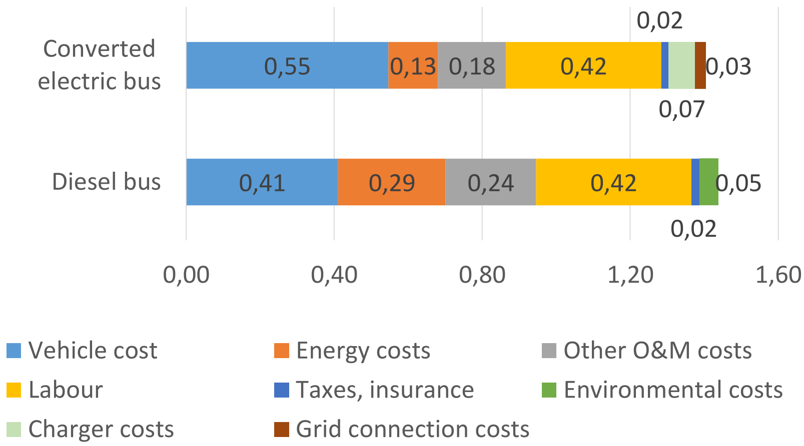
and indicator *I,* that equal to 1 for DB, and to 0 for EB.

TCO is expressed in Equivalent Annual Cost (EAC) as cost per kilometer (€/km).

TCO model (2)

Asset	Variable	Value (DB)	Value (EB)
Vehicle	Investment cost	200 000 €	196 700 €
	Useful life	10 years	7 years
	Energy consumption	10.4MJ/km (29l/100km)	1.2 kWh/km
	Energy price	1.00 €/liter	0.11215 €/kWh
	Urea, oil	0.011€/km	n/a
	Maintenance and repair	0.15€/km	0.10€/km
	Transport operating tax	0.002€/km	n/a
Charging infrastructure	Investment cost of charging infrastructure	n/a	150 000 €
	Charging infrastructure maintenance	n/a	1 000 €/year
Grid connection	Investment cost of grid connection	n/a	30 000 €
	Transmission power maintenance	n/a	19.56€/kW/year
	Electricity transmission tariff	n/a	0.02129 €/kWh

TCO results (EUR/km)



Sensitivity analysis (1)

- Helps to identify under which circumstances the DB conversion into EB becomes, respectively, economically and financially unjustified.
- Carried out using disaggregated variables (i.e. energy consumption and prices separately) to better identify possible critical variables.
- The parameter is considered as critical (with significant impact) if a 1% change in parameter value leads to a change of annual TCO equal to or higher than 0.2%.
- The cost-effectiveness of the conversion process depends heavily on those variables whose value changing up to 20% results in a disadvantage of the use of EB.

Sensitivity analysis (2)

Variables	DB TCO change	EB TCO change
Vehicle parameters		
Investment costs	0.29%	0.39%
O&M costs	0.68%	0.54%
Cost of electricity	-	0.10%
Battery cost	-	0.17%
Energy consumption	0.20%	0.10%
Charging infrastructure parameters		
Charger infrastructure costs	-	0.04%
Number of buses using charger	-	0.07%

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Switching values of variables

Variables	Benchmark value	Switching Value	
		DB	EB
Investment costs (DB)	200 000 EUR	-8%	-
Investment costs (EB)	196 700 EUR	-	6%
O&M costs per year (DB)	58 578 EUR	-3%	-
O&M costs per year (EB)	45 475 EUR	-	4%
Cost of electricity	0.11215 EUR/kWh	-	25%
Battery cost	70 000 EUR	-	14%
Energy consumption (EB)	1.2 kWh/km	-	25%
Energy consumption (DB)	29 l/100 km	-12%	-
Charger infrastructure costs	150 000 EUR	-	54%
Number of buses using charger	5 buses	-	-25%

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Conclusions

- Similar TCO results for both alternatives are achieved.
- Variations of certain input parameters for O&M costs and investment costs of conversion have significant influence on the TCO results.
- Charging infrastructure does not have significant impact on economic viability of DB conversion into EB; it can be used by number of vehicles over its lifetime thus significantly reducing the cost burden per vehicle.
- The overall results of economic analysis are in favour of converted electric bus which apart from lower O&M costs provides additional benefits to the environment and extends the life of the used diesel bus.

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Future steps

- **Development** of mathematical model to study the dynamic traction and fuel consumption characteristics of DB
- **Tests** of the dynamic traction and fuel consumption characteristics for DB on the track; **calibration** of the model
- **Development** of the bus conversion technology by using the results of the industrial research
- **Creation** of an experimental object – prototype on the basis of existing DB model by using the developed technology.
- **Tests** of the experimental object - converted EB – on the track.
- **Comparison** of test results with research results and **finalization** of the conversion technology.

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Shopping Mall Accessibility Evaluation Based on Microscopic Traffic Flow Simulation

Mihails Savrasovs, Irina Pticina and Valery Zemlynikin

Agenda

- Introduction
- Methodology
- Case-study description
- Analysis and results
- Conclusions

Shopping mall

- The International Council of Shopping Centers (ICSC) defines shopping center as "a group of retail and other commercial establishments that is planned, developed, owned and managed as a single property, typically with on-site parking provided"
- There are several factors influencing the selection of the shopping mall geographical location:
  - density of population in the area
  - distance between rest shopping malls
  - availability of main roads near location

Examples of traffic congestions in the area of shopping malls

Shopping mall "Alfa"

Shopping mall "Spice"

Shopping mall "Mols"

Shopping mall "Domina Shopping"

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"last mile problem"

- By the analogues to supply chain management known problem "last mile problem", the same term

"visitors last mile problem" in accessing the shopping mall by visitors cold be proposed

- it could be quite easy to reach the geographical location of shopping mall using main roads of the city
- but it could be quite complicated and time consuming:
  - to get into parking area of the shopping mall
  - to get out from the shopping mall area
  - to find the parking lot in the parking area

Goal

- The current paper goal is to demonstrate the usage of the traffic microscopic simulation to measure the accessibility of the shopping mall, based on proposed methodology

Methodology

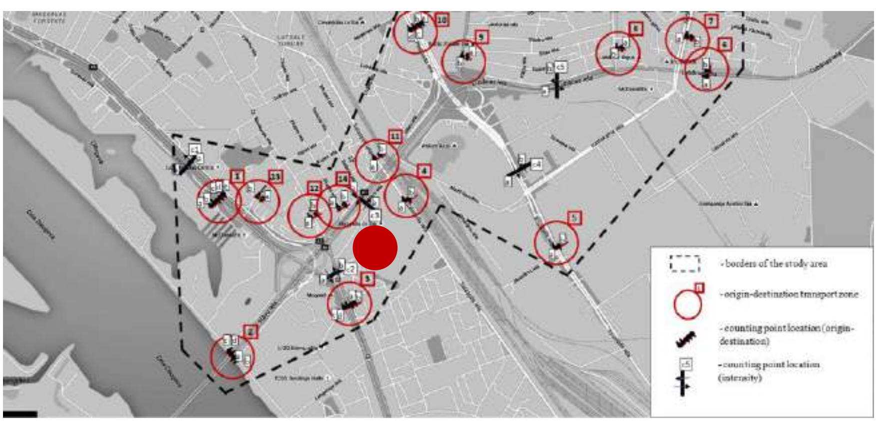
Development, validation and calibration of the microscopic traffic flow model for the area affected by the shopping mall

Simulation of the traffic flows based on the developed model, with recording in file or database the tracking data (trajectory data of the individual vehicle)

Analysis of the tracking data, by: selecting the data about specific vehicles

Statistical processing of the aggregated data

Study object



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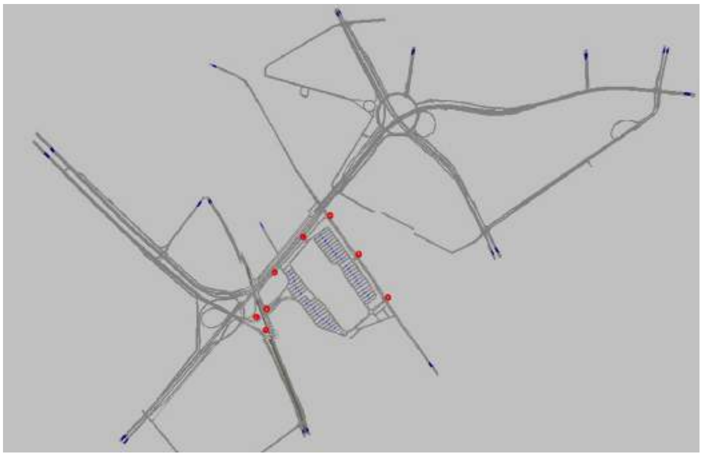
General input data for model development

- **Geometrical data:** Images from Google Maps were used as background
- **Controlling devices and signs data:** The data for defining the traffic light operation were obtained from Riga City Traffic Department. In total, there are 19 signalling control points in the transport network and up to 38 none-signalized intersections
- **Demand data.** The demand was obtained as OD matrix, which includes the travel patterns for 14 zones indicated in the study area plus additional zone, which represents the shopping mall. The OD matrix was obtained based on a license plate survey
- **Validation data.** The data for validation were obtained during the traffic counting (consist of traffic volume data for 5 counting points)

Coded network

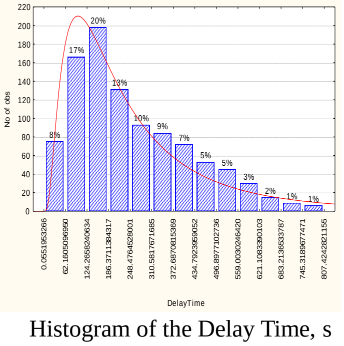


Simulation

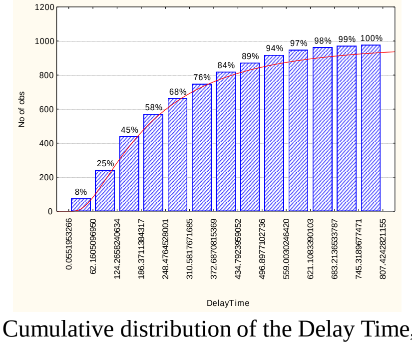
- PTV VISSIM simulation software
  - Coded network
  - OD matrices for regular trips (cars, cargo vehicles, busses)
  - Trip chain-files for targeted trips and pass-by trips
  - Simulated time: 17:00 – 18:30
  - 15m – model warming-up period
  - Data collection tools: build-in functionality
  - Data store tool: MS SQL DBMS

Descriptive statistics of the data

Measure	Mean	Conf.limits for means (95%)	Std.Dev.	Median	Min.	Max.
Value, s	253.79	(243.26;264.32)	167.66	204.68	0.055	807.42



Histogram of the Delay Time, s



Cumulative distribution of the Delay Time, s

Analysis results: To Shopping Mall

From Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14
To Shopping Mall	Average Delay Time (rounded values), s													
	58	56	81	25	180	160	290	380	127	211	99	-	68	-
	Distance (rounded values), km													
	1.6	2.1	0.54	0.29	3.57	3.00	3.89	3.8	2.9	3.4	1.6	4.8	4.7	1.8
	Average Delay time per 1km (rounded values), s													
	36	27	150	86	50	53	75	100	44	62	62	-	14	-

Analysis results: From Shopping Mall

To Zone	1	2	3	4	5	6	7	8	9	10	11	12	13	14
From Shopping Mall	Average Delay Time (rounded values), s													
	207	368	345	27	330	282	457	234	387	227	169	-	165	-
	Distance (rounded values), km													
	1.6	2.1	0.54	0.29	3.57	3.00	3.89	3.8	2.9	3.4	1.6	4.8	4.7	1.8
	Average Delay time per 1km (rounded values), s													
	129	175	638	93	92	94	117	62	133	67	106	-	35	-

Discussion

- As a disadvantage of the proposed approach, the following points could be mentioned:
  - the simulation model of the study area should be developed, calibrated and validated
  - the simulation software should be able to produce trajectory data to external data store, which should be able to store significant amount of the collected data (in this example > 3GB)
- Opposite, the disadvantages:
  - usually by planning new attraction point in the urban area, the developers are pushed to do the simulation
  - most of the modern traffic simulation software is able to produce the individual vehicle trajectory data

Conclusions

- The paper demonstrates the case-study of applying microscopic traffic flow simulation to evaluate the shopping mall accessibility, by calculating the delay time (lost time) to reach and get out from the shopping mall
- The proposed approach is based on idea, that shopping malls usually are in places, which are congested much by the traffic, therefor evaluation of shopping mall area accessibility is the important the critical issues for developers and transport planners

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Conclusions cont.

- The paper introduces the idea of the "visitors last mile problem" for the visitors of the shopping mall with analogue of last mile delivery in logistics
- Combining the proposed approach with the existing accessibility models, which considers, the travel time from residential areas to shopping mall, could give a positive result
- The proposed approach could be adopted and used in practice to evaluate accessibility of any attraction point (not only shopping mall), if it is requested

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Theoretical View on the Designing of Prototype of Business Model for a Transport Company

Dr.oec, Prof., Irina Kuzmina-Merlino

MSc, PhD student, Oksana Skorobogatova

Transport and Telecommunication Institute, Riga, Latvia

Sponsors: ATTIKI ODOS, Marathon Data Systems

Media Sponsor: SKIATHOS life

With the support of: alliance, novelog

Actuality of the research

- Finding another way to succeed

- Changing existent one to win competitors.

Actuality of the research

*The U.S. Census Bureau reports that **400,000 new businesses are started** every year in the USA, but **470,000 are dying**.*

Example of a failed business model – Kodak

Source:
https://www.successharbor.com/percentage-businesses-fail-09092015/

Research subject and object

- Research subject is a prototype of business model of a passenger transport company.
- Research object is a set of literature in the fields of strategic management and corporate governance in the industry.

Research aim

The aim is to design the prototype of business model as a tool for strategic management for a company which is operating in passenger transport industry.

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Research questions

The paper focuses on studying the following issues:

- What is a successful business model?
- Strategy and business model: how they are connected?
- How to build successful business model for a passenger transport company?

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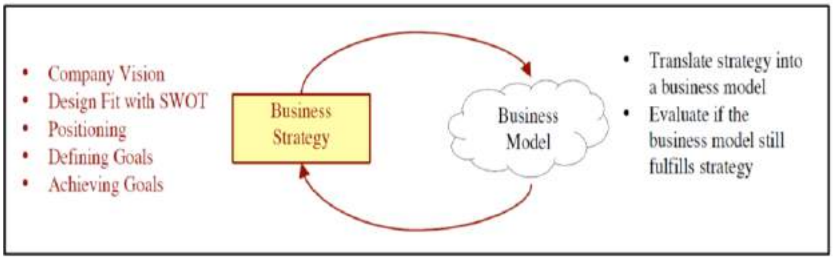
The nature of Business Model

At a simple level, the business model has been referred to as:

✓a statement (Stewart & Zhao, 2000),
✓a description (Applegate, 2000; Weill & Vitale, 2001),
✓a representation (Morris, Schindehutte, & Allen, 2005; Shafer et al., 2005),
✓an architecture (Dubosson-Torbay, Osterwalder, & Pigneur, 2002; Timmers),
✓a conceptual tool or model (George & Bock, 2009; Osterwalder, 2004; Osterwalder, Pigneur, & Tucci, 2005),
✓a structural template (Amit & Zott, 2001),
✓a method (Afuah & Tucci, 2001),
✓a framework (Afuah, 2004),
✓a pattern (Brousseau & Penard, 2006),
✓and a set (Seelos & Mair, 2007), (Christoph Z. and et al., 2011).

Business Model and Business Strategy



Source:
Alexander Osterwalder (2004) "The Business Model Ontology a Proposition in a Design Science Approach", Universite de Lausanne Ecole des Hautes Etudes Commerciales, Postgraduate diploma work, pp 4-158

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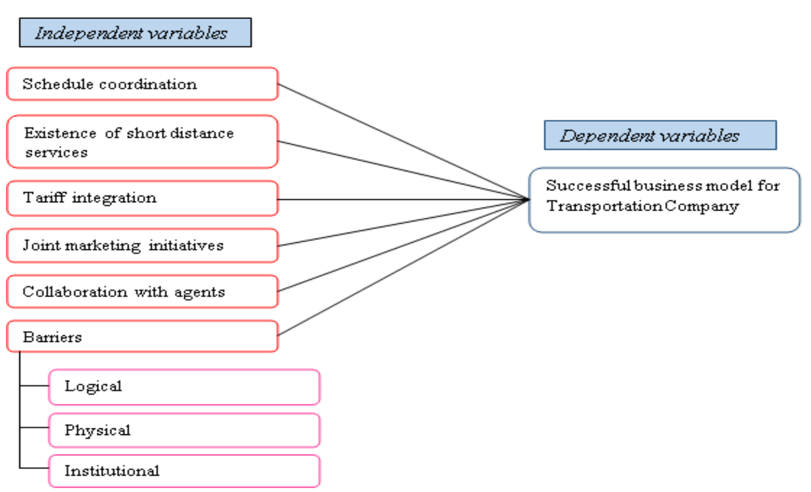
Theoretical Framework

The Theoretical framework discusses the interrelationship among the variables that are deemed to be integral to the dynamics to the situation being investigated.

Theoretical Framework



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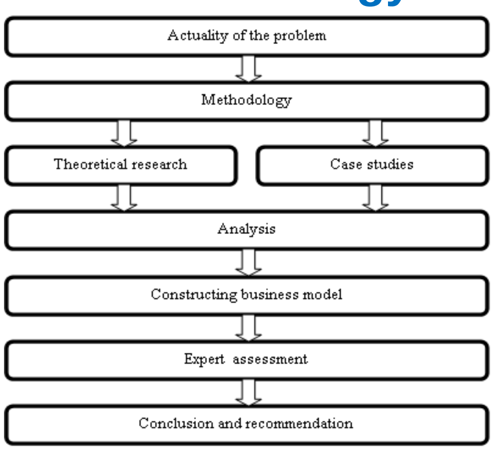
Research questions:

The paper focuses on studying the following issues:

- RQ1: What is the successful business model?
- RQ2: How to re-interpret the strategy through the lens of the business model?
- RQ3: What procedures should be done to build successful business model?

Research methodology



Flow chart of the research work

Designed based on writings by Saunders et al. 2011, Mingers et al., Jefferies, 2011, Greener, 2008.

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Assessment of Developed BM Prototype

Experts' opinions has been collected and analytical hierarchy process (AHP) has been chosen as the best method of assessing the business model. This stage consists of:

- ✓ The procedure of expert screening based on application which they fill in.
- ✓ Procedures of experts survey based on survey question about model which has been built by authors.
- ✓ Experts' evaluation.

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TSI TRANSPORTA UN SAKARU INSTITŪTS

Map of Business Model

<table>
<tr>
<td rowspan="2">Key partners:
-commercial agreements with partners, or make joint venture.
-agreement with transport operators, terminal management, local authorities</td>
<td>Key activities:
-improving comfort level of the terminal.
-special tariff for routes.
-coordination of schedules
-reduction of transfer distance.</td>
<td rowspan="2">Value proposition:
-improving the quality of transportation services for passengers by making intermodality of transportation for the service and reducing price.</td>
<td>Customer relationship:
-discounts.
-rewarding system.
-restructuring spaces in the terminal.</td>
<td rowspan="2">Customer segment:
-All.</td>
</tr>
<tr>
<td>Key resources:
-infrastructure of the terminal.
-knowledge of market split.</td>
<td>Channels:
-Information and sales desk in the terminal.
-Internet based service and communication channels.</td>
</tr>
<tr>
<td colspan="3">Cost structure:
-related with restructuring the terminal
-related with integration of new services</td>
<td colspan="2">Revenue streams:
-advertisement
-tickets
-renting facilities
-parking place
-subsidies</td>
</tr>
</table>

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Expert Assessment

Building blocks	R1	R2	R3	Average score
Key partners	4	3	4	3.7
Key activities	5	5	5	5.0
Key resources	4	4	4	4.0
Value proposition	4	5	4	4.3
Customer relationship	5	5	5	5.0
Channels	4	4	4	4.0
Customer segments	3	4	3	3.3
Cost structure	5	4	5	4.7
Revenue stream	5	5	4	4.7

Conclusions

RQ1: What is the successful business model?

✓A successful business model shows *more attractive and successful way than the existing alternatives*.

✓It can *make more value* for the discrete group of customers.

✓Or can be the alternative which *destroys existing* and will be the *standard for the future* generation of entrepreneurs to beat

(the authors' conclusion based on literature review).

Conclusions

- ***RQ2: How to re-interpret the strategy through the lens of the business model?***

✓Business strategy should always reflect in business model, as they interlinked with each other.

✓The strategy should be translated into a business model and be evaluated whether the business model still fulfills strategy. However, by business strategy it is chosen company vision, positioning, defining goals and achieving them are the main ones.

✓To get better understanding of business model "design space", it is suggested roughly mapping *four main areas* of a company's environment (market force, industry force, key trends and macroeconomic forces). These all external factors influence on business model.

Conclusions

RQ3: How to build successful business model for a passenger transport company?

What are criteria's for building successful business model for a passenger transport company?

Criteria:

- schedule coordination;
- existence of short distance services;
- tariff integration;
- joint marketing initiatives;
- collaboration with transport service agents;
- possible barriers: logical, physical and institutional.

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Recommendations

(1) In order to build successful business model, it should be chosen the way from which building blocks start interlinking. These way can be: Resource-driven, Offer-driven, Customer-driven, and Finance driven.

(2) Building business model canvas using nine building blocks.

(3) Criteria for a passenger transport company could be:
- ✓ schedule coordination;
- ✓ existence of short distance services;
- ✓ tariff integration;
- ✓ joint marketing initiatives;
- ✓ collaboration with transport service agents;
- ✓ and barriers: logical, physical and institutional.

Summary: Building the own business model a company creates an effective tool for sustainable corporate strategic management.

Ευχαριστώ πολύ!

Thank you for your attention!

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

DEVELOPMENT OF A SMART PICKING SYSTEM IN THE WAREHOUSE

Transport and Telecommunication Institute
Transport and Logistics Faculty
Transport and Logistics Department
Mg. oec, lecturer, Raitis Apsalons
Asoc.prof.sc.ing. Gennady Gromov
LATVIA

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Current events of topic

The most popular problems in realization of customer orders' picking process:

1) Availability of stock in picking process at the picking locations
2) Not ensured the ODP – orders' dividing principle
3) Not correct conditions for replenishment
4) Variants of allocation of storage and picking areas are not considered
5) Not correct picking technology is appropriated

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Current events of topic

A smart picking system is a set of different elements of a picking process which facilitate the order picking process through using the WMS.

Current events of topic

The smart order picking system comprises:

1) the way of organizing goods flow,
2) order dividing principle,
3) several allocations variants for the storing area and picking area,
4) routing methods of picking,
5) replenishment methods,
6) approaches of goods layout: one picking location for each item or various picking locations for each single item, etc.

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Current events of topic

Practical problem: Collecting of customer orders very often are not realised in efficient way – warehousing companies have to consider implementing of the smart picking system

Scientific problem: to develop a model of the smart picking system.

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The aim of topic

The main purpose is to figure out the elements for the development of a smart picking system in a warehouse.

The development of a smart picking system for foodstuffs is showed as example.

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The object and subject of the research

The object of the research addresses the interconnection of a replenishment process with the picking process.

The subject of the research concerns the elements of a smart picking system.

Restrictions of the research

1) One row rack storing system available in the warehouse.
2) Each item is placed on separate pallet. Let it be physical picking system: pick and walk (Tomkins, 2003). For this purpose picking area (PA) is established in this warehouse.
3) Picking process will be realized by picking handling units (HU) and customer units (CU). Therefore ground level and first level of pallet racks are used as PA. The one picking location of each item consists of 2 pallets: 1 pallet on ground level and second one on the first level of rack.

Restrictions of the research

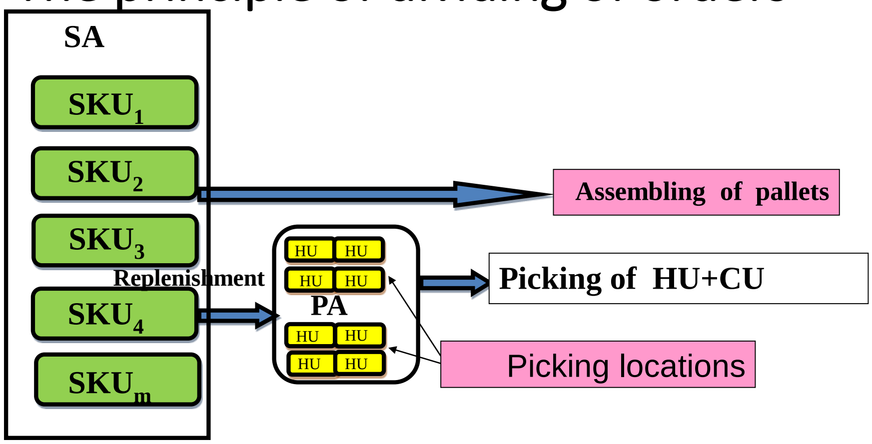
4) It is defined that replenishment – moving the item from storing area (SA) to PA - will occur if stock of definite item in picking location will achieve critical level. This approach is called as Red Card principle (RCP) of picking system.

The principle of dividing of orders

The principle of dividing of orders (PDO) states that quantities for definite SKU of each order are divided into 2 parts:

- For picking full pallets (FPLL) from SA – for single order usually expressed in customer units from SA.
- For picking handling units (HU) and customer units (CU) from PA – for single order usually expressed in customer units from PA.

The principle of dividing of orders



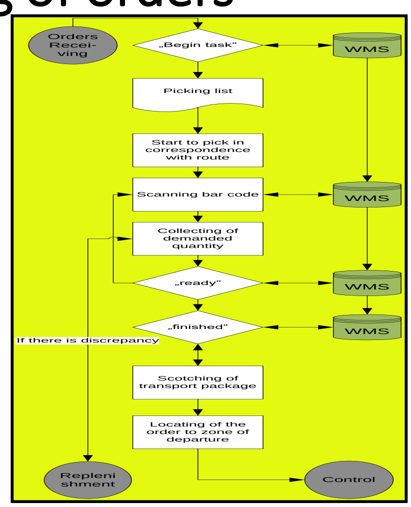
1. Universal picking of orders

Step 1: The picker activates the scanner by entering his password; he presses the button "Begin task" to start picking.

Step 2: The picker receives the picking list in his scanner according to the fixed list of priorities.

Step 3: The picker begins picking in accordance with the given picking route.

Step 4: When the picking starts, the picker goes to the designated picking location, scans the required barcode of products and collects the necessary quantity of products.



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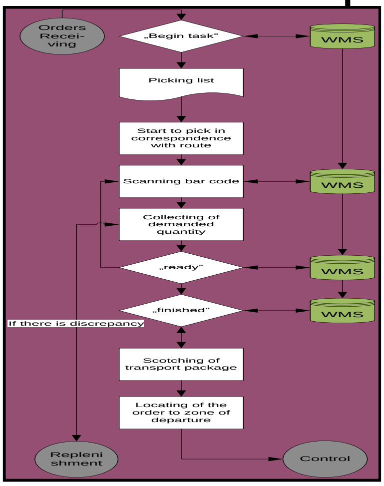
1. Universal picking of orders



Step 5: the picker goes to the next picking locations and performs Step 4 until the picking list is fulfilled, then he presses "Finished".

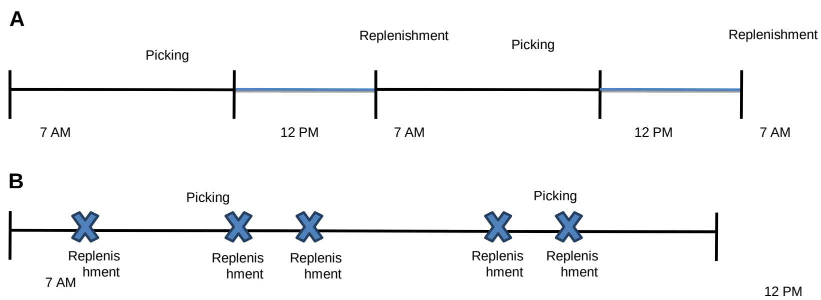
Step 6: If after the picking of an order there is a necessity to combine several items in transport package, the warehouse needs to ensure additional packing process.

Step 7: The picker moves the complete (picked) order to the departure zone designated by warehouse clerk or scanner.

2. Approaches of the layout of items in PA

A) various picking locations for each single SKU

B) one single picking location for each single SKU



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3.The development of a smart picking system

Step1: Considering the choice of products flow: goods to man (G2M) or man to goods (M2G).

Step 2: Choosing the variants of layout of SA and PA. This issue was analysed and the methodology of evaluation of its impact on the total costs of a warehouse was developed by authors in the previous research.

Step 3: Creating replenishment conditions in order to replace stock from SA to PA. The Red Card Principle (RCP) has to be considered. It stands for determining a critical stock level in a single picking address when replenishment automatically starts. The authors offer to use the Min/Max method for solving this problem.

Step 4: Routing shapes and methods of picking.

3.The development of a smart picking system

Step 5: Determining the proper sequence of SKU locations. It is very important to obtain a general parameter or a group of parameters for the right allocation of SKU in a picking area. This issue was also earlier developed by the authors.

Step 6: Launching the picking process. At first, clever algorithms and counting formulas have to be verified by logistics data analysts, using data structure, developing counting models, conducting experiments or making simulations, and then results have to be consolidated

Step 7: Make a data structure analysis for enhancing the work of the smart picking system.

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4. Example of a smart picking system for foodstuffs

In the warehouse of logistics centre are stored a lot of positions of foodstuffs.

1. Usually these stock keeping units characterized by high-speed turnover.
2. If there is decision of replenishment for these positions, for example, once a day then appears additional need to calculate number of picking locations for each item in condition that there will not be interruption of picking process.
3. There is necessary to develop a plan of picking face - located products of picking locations.
4. The smart picking system must be responsible for correct results of calculation and allocations.
5. However it is possible only by using correct algorithms.

4. Example of a smart picking system for foodstuffs

Mathematical algorithms must aware:

1) number of items;

2) the principles of picking route planning and items locations;

3) the mass of handling unit or, seldom, customer unit;

4) the number of orders;

5) the amount of pallet for each product;

6) the reasonable interval between replenishment;

7) picking – storing system from technical point of view (types of racks, forklifts);

8) picking amounts and from hence items ABC classification;

9) period of validity of each item, etc.

Start database for calculation of number of picking locations for each SKU

Stock Keeping Unit	Name of stock	Package, litres	Number of orders	Picked quantity from PA, CU	Pallets' quantity, CU/pall	Coefficient of forecast	Coefficient of picking flow fluctuation
SKU_1	Apple juice	1.0	12261	46159	720	1.09	1.1
SKU_2	Carrot juice	1.0	10732	42616	720	1.18	1.6
SKU_3	Poegranates drink	2.0	14764	63393	336	1.25	1.5
SKU_4	Cherries drink	2.0	10397	62365	336	1.22	1.4
SKU_5	Black currant juice	1.0	11833	83495	720	1.16	1.7
SKU_6	Lemon lemonade	1.5	8262	33327	504	1.21	1.6
SKU_7	Pear lemonade	1.5	8751	102925	504	1.04	1.3
SKU_8	Mineral water "Belindo"	1.5	10050	99415	504	1.18	1.3
SKU_9	Mineral water "Sarema"	1.5	6528	65839	504	1.05	1.2
SKU_10	Table water "Lendi"	0.5	7719	42652	1080	1.17	1.2
SKU_11	Kids lemonade	1.5	8689	42386	720	1.07	1.3
SKU_12	Kvass "The old one"	1.5	9931	58855	720	1.28	1.4
SKU_13	Kvass "Mini"	0.5	8991	66554	1080	1.01	1.3
SKU_14	Pear drink	1.0	11386	72505	720	0.95	1.5
SKU_15	Maple lemonade	1.0	5655	46623	720	0.99	1.4
SKU_16	Cranberry fruit drink	0.5	6444	95532	1080	1.11	1.4
SKU_17	Aloe tee	1.5	7211	41517	540	1.31	1.3

Calculation of the number of picking locations

The number of picking locations for each existing SKU (N_{SKUi}) in the warehouse is calculated as follows:

$$N_{SKUi} = \frac{Q_{p.s.i} \bullet K_{FORECATSTi} \bullet K_{Fi}}{n_d \bullet A_{pll.i} \bullet N_{li} \bullet N_{di} \bullet R_{ABCxi}}$$

$Q_{p.s.i.}$ is the picking quantity from PA for each SKU in the previous season or previous corresponding season (CU/quarter);
$K_{FORECASTi}$ is the coefficient of estimates for each SKU in the next season; n_d is the number of working days in the quarter (days/quarter)
$A_{pll.i.}$ is the quantity of pallet for each SKU (CU/pll);
N_{di} - means the number of pallets in depth of the rack (depends on the type of racks) for each SKU;
R_{ABCxi} is the number of replenishments a day for each SKU depending on the inventory turns in the picking process

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Total number of picking locations for each SKU after calculation

Stock Keeping Unit	Name of stock	Package, litres	Number of orders	Picked pallets in a day	Rxi	Nskui calculated	Nskui accepted
SKU_3	Pomegranates drink	2.0	14764	3.63	1	2.72	3
SKU_4	Cherries drink	2.0	10397	3.48	1	2.44	3
SKU_8	Mineral water "Belindo"	1.5	10050	3.58	1	2.33	3
SKU_12	Kvass "The old one"	1.5	9931	1.61	1	1.13	2
SKU_7	Pear lemonade	1.5	8751	3.27	1	2.12	3
SKU_11	Kids lemonade	1.5	8689	0.97	1	0.63	1
SKU_6	Lemon lemonade	1.5	8262	1.23	1	0.98	1
SKU_17	Aloe tee	1.5	7211	1.55	1	1.01	2
SKU_9	Mineral water "Sarema"	1.5	6528	2.11	1	1.27	2
SKU_1	Apple juice	1.0	12261	1.08	1	0.59	1
SKU_5	Black currant juice	1.0	11833	2.07	1	1.76	2
SKU_14	Pear drink	1.0	11386	1.47	1	1.10	2
SKU_2	Carrot juice	1.0	10732	1.07	1	0.86	1
SKU_15	Maple lemonade	1.0	5655	0.99	1	0.69	1
SKU_13	Kvass "Mini"	0.5	8991	0.96	1	0.62	1
SKU_10	Table water "Lendi"	0.5	7719	0.71	1	0.43	1
SKU_16	Cranberry fruit drink	0.5	6444	1.51	1	1.06	2
		XYZ	ABC			Total	**31**

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Plan of picking locations in the warehouse (upward, first 2 levels of 1 row racks)

		Aisle			
SKU_16	Cranberry fruit drink	A_16	B_16		
SKU_10	Table water "Lendi"	A_15	B_15	SKU_16	Cranberry fruit drink
SKU_15	Maple lemonade	A_14	B_14	SKU_13	Kvass "Mini"
SKU_14	Pear drink	A_13	B_13	SKU_2	Curettes juice
SKU_5	Black currant juice	A_12	B_12	SKU_14	Pear drink
SKU_1	Apple juice	A_11	B_11	SKU_5	Black currant juice
SKU_9	Mineral water "Sarema"	A_10	B_10	SKU_9	Mineral water "Sarema"
SKU_17	Aloe tee	A_09	B_09	SKU_17	Aloe tee
SKU_11	Kids lemonade	A_08	B_08	SKU_6	Lemon lemonade
SKU_7	Pear lemonade	A_07	B_07	SKU_7	Pear lemonade
SKU_12	Kvass "The old one"	A_06	B_06	SKU_7	Pear lemonade
SKU_8	Mineral water "Belindo"	A_05	B_05	SKU_12	Kvass "The old one"
SKU_8	Mineral water "Belindo"	A_04	B_04	SKU_8	Mineral water "Belindo"
SKU_4	Cherries drink	A_03	B_03	SKU_4	Cherries drink
SKU_3	Pomegranates drink	A_02	B_02	SKU_4	Cherries drink
SKU_3	Pomegranates drink	A_01	B_01	SKU_3	Pomegranates drink

Rack A **Rack B**

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Conclusion

1) By implementing proper algorithms, a smart picking system becomes a critical part of WMS.

2) In order to avoid a range of warehouse problems, especially those that occur in the stock picking process, a model of the smart picking system has to be elaborated and thereafter introduced. It is important to be aware that the calculations of picking locations for uninterrupted picking process come as the last part of the smart picking model.

Conclusion

3) Opposite choice would mean to reject all previous calculations and to return to the variant where each SKU has a single location. Therefore, an uninterrupted picking process can ensured through a regular replenishment during the picking process. However, this process may be still attended with a problem the congestion of warehouse technique movement - pickers and reach trucks working alongside.

Conclusion

The total number of engaged picking locations has reached 31 picking locations when the replenishment of picking locations for each SKU runs once a day.

If the replenishment is performed twice a day, the result equals 21 picking locations.

For three replenishments a day, the result equals 17 picking locations – one picking location for each SKU.

To highlight once again, a suitable number of replenishments can be obtained by minimising the total picking costs or total picking time.

Thank you for attention!

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

A conceptual framework for planning transhipment facilities for cargo bikes in last mile logistics

Tom Assmann (M.Sc.) & Evelyn Fischer (M.A.)

Sponsors: Marathon Data Systems

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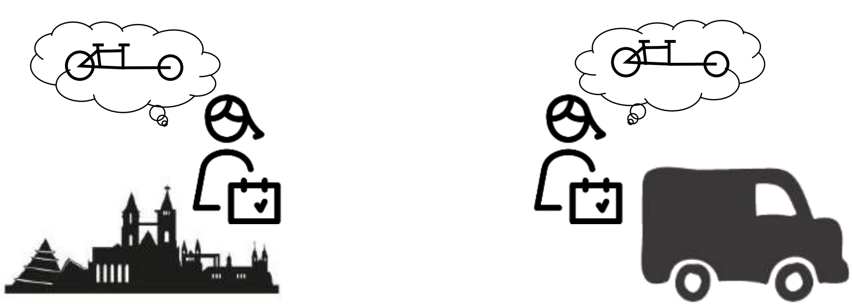
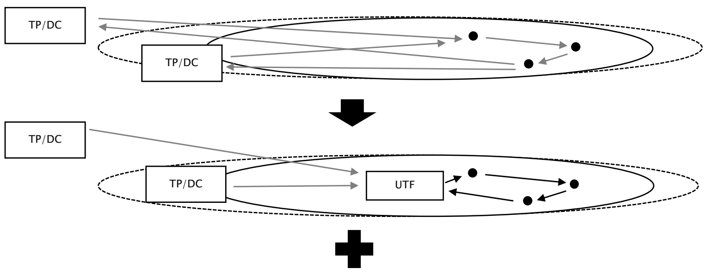
With the support of: alliance, novelog

Urban logistics

- Urbanization and agglomeration (Batty 2013)
- Increasing e-commerce and traffic volumes
- Air pollution, GHG-emissions, congestion and noise exposure
- Demand for green and walkable neighborhoods (Newman & Kenworthy 2015)
- Strive towards cities following the human scale (Gehl 2010)



Transforming the last mile



Complexity of cities / urban fabric

heterogeneity

Social life styles

Multiple stakeholder

Multiple functions and requirements

Car-centric infrastructure

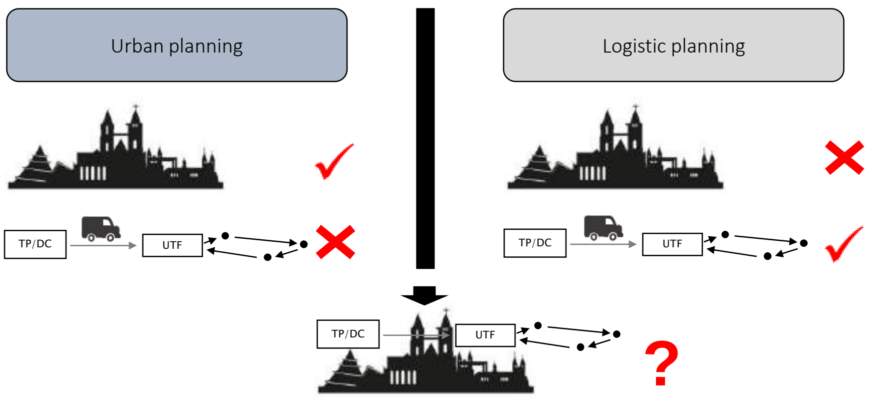
High density

Scares space

Planning principles

Urban planning

Logistic planning

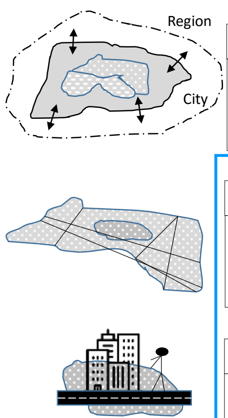


Literature review

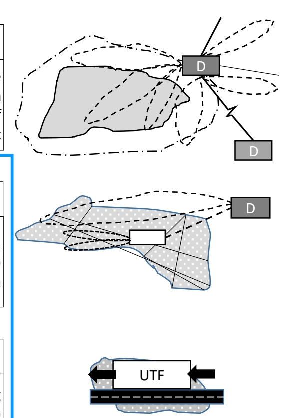
Results:

- The methodologies are predominantly static in relation to urban dynamics and technically superimpose the network on the urban fabric. The literature regarding holistic planning of UTFs in dense urban areas is weak. They do not consider the aspects of urban quality, liveability and effects on urban fabric.
- The literature gives close to zero guidance for municipalities and logistic planners on how to strategically include UTFs and cargo bikes in urban planning.
- BUT: both domains use hierarchical orders for giving structure to the system

The combined planning framework



City	Logistic
Large-area planning scale	
Regional-/city level	Meso-level
Spatial-planning preparatory land use plan Infrastructure plan	General network Service plan Standards and modes of transport
Subarea planning scale	
District-/quarter level	Meso-level
District planning District development Mobility plans public spaces	Sub-network plan (layout, UTF, transport) Sub-contractor plan
Micro planning scale	
Block-/building level	Micro-level
Street design Design principles Binding land-use plan	Facility planning (internal/external) Accessibility



Application on urban fabric

- Interdisciplinary workshop on “How to deploy a cargo bike UTF” on subarea and micro scale
- Focus: Consolidation UTFs and Transhipment UTFs (Assmann & Behrendt 2017)

1. Communication-friendly design

- **Subarea scale: Enhancing contact in public space**

- UTFs slow down speed in district
- Open design of the UTF e.g. semi-public spaces

- **Micro scale: Early involvement of stakeholders in design process**

- Gather informal knowledge of employees and later customers
- Mutual development for broader acceptance and belonging to the quarter

Application on urban fabric

2. Enhanced functionalities

- **Subarea scale: Accelerating diffusion of cargo bikes**

- Increasing visibility of cargo bikes
- UTF as an instrument to develop parts of a district

- **Micro scale: Enlarging the functions of an UTF**

- Integration of a parcel shop
- Integration of cargo bike rentals or workshops
- Integration of missing or underdeveloped functions

Traffic Transportation and Logistics Laboratory

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Assessing traffic and environmental impacts of smart lockers logistics measure in a medium-sized municipality of Athens

Presenter: Ioannis Karakikes

Department of Civil Engineering, University of Thessaly, Greece

Co-authors: Vasileios Kiousis, Eftihia Nathanail

Goals and outline

Goals

❖Impact assessment of City Lockers in urban areas

❖Applicability of such systems

❖Methodological framework for impact assessment

❖Application of framework

Steps

✓ Step 1: Problem statement
✓ Step 2: Methodology
✓ Step 3: Model development
✓ Step 4: Scenarios development & configuration
✓ Step 5: Results
✓ Step 6: Conclusions

Step 1: Problem statement

Home deliveries – E-commerce

ICT → ↑ B2C sales → ↑ parcels → ↑ last-mile deliveries

Many small orders
+
Demand for short time delivery

} Many routes with low load factor
+
↑ veh-kms

Aggravating factors
- Failed deliveries (12%)
- Returns of goods (22%)

Solution: Alternative delivery systems

✓ Pickup points
✓ Smart lockers

Key feature:
→ De-synchronizing the delivery process

Advantages:
- Consumers → Flexibility, cost, speed, satisfaction
- Logistics companies → resource needs, operating costs
- E-commerce companies → transportation costs, time, service competitiveness
- Cities → traffic and environmental impacts, improving quality of life

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Step 2: Methodology, Data collection & Analysis

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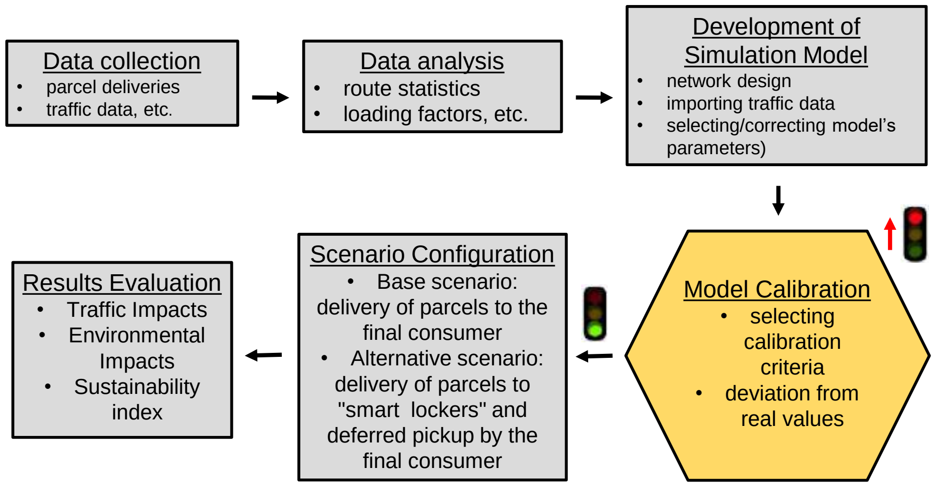
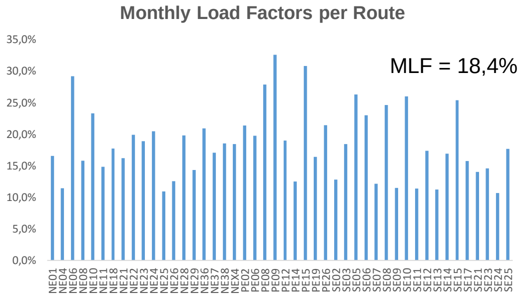
Flowchart of methodological approach



Parcel Delivery Data – March 2017

- 65000 stops
- 1850 trips
- 94 routes

- Total Load at Distr. Centre → Load Factor (Excel, Oracle)
- Load delivered per destination (QGIS, Excel)



Region (Municipality)	Deliveries (%)
Athens	16.7
Maroussi	5.2
Piraeus	4.7
Kifissia	4.4
Glifada	4.1
Halandri	3.8
Kalithea	2.7
Aspropirgos	2.4
Peristeri	2.3
P.Faliro	2.1
Other regions	51.5

DHL Smart Lockers

- 10 stations in Athens
- 1 in Thessaloniki

(Located in gas stations)

Map Point	Region	January	February	March
A	Halandri (Kifisias Ave.)	62	71	74
B	Halandri (Pentelis Ave.)	64	53	75
C	Nea Erithrea	100	97	139
D	Galatsi	48	71	86
E	Glifada	35	24	60
F	Ilioupoli	22	28	22
G	Kalithea	40	32	67
H	P. Faliro	19	24	37
I	Piraeus	23	23	19
J	Psihiko	53	47	48
Total deliveries per month		466	470	627

Restrictions:

- max. parcel weight: **20 kg**
- max.parcel dimensions: **40 x 40 x 60 cm**

Study Area (Municipality of Halandri)

Date	Routes												Sum
	NE 01	NE 05	NE 06	NE 10	NE 11	NE 27	NOX 4	NOX 5	SE 21	SE 24	SE 25	SUX 5	
1/3	15			37	26	8			6		2		94
2/3	24		1	40	28	4			2		1		100
3/3	10			38	26	4			4		1		83
6/3	9			43	23	4			3				82
7/3	11	1		54	27	7			10		1		111
8/3	10			37	40	9			6	8	1		111
9/3	**13**			**32**	**16**	**6**			**3**				**70**
10/3	21			42	27	5			4		2		101
13/3	18			47	25	5			1		2		98
14/3	16			43	33	9			10		1		112
15/3	19			40	29	10			5				103
16/3	11			30	30	7			7		1		86
17/3	14			46	31	8			7				106
20/3	10		1	48	25	5			6		1		96
21/3	15			34	26	6			6	1	2		90
22/3	17			41	27	9		3	4			1	102
23/3	18			40	23	2			7				90
24/3	13			31	21	9	2		6		1		83
27/3	13			43	32	7			10		2		107
28/3	13	1	1	36	34	5			8	1	1		100
29/3	23	1	1	42	23	11			6	1			108
30/3	17			39	37	10			6		2		111
31/3	19			47	29	6			3	1			105
Sum	349	3	4	930	638	156	2	3	130	12	21	1	2249

Simulation day selection criteria:

- Least number of routes
- Least number of stops

Traffic data (Traffic Management Centre of the Attica Region)

- Hourly traffic volume & speed values from 32 detectors (Thursday 9th, March 2017)
- Traffic signal programs for the 8 junctions of the model's road network

Step 3: Model development

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Configuration of the model's road network

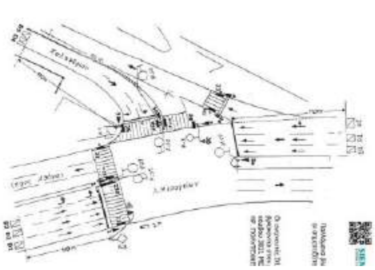
Microscopic traffic simulation (PTV Vissim)

Information on roadways (dimensions, properties):

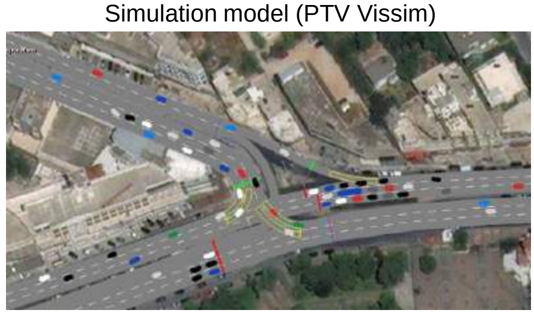
- Drawing layouts of junctions (Attika Region)
- Google Earth

Mesogeion Ave. – Halandriou Str.

Drawing layout (Attika Region)



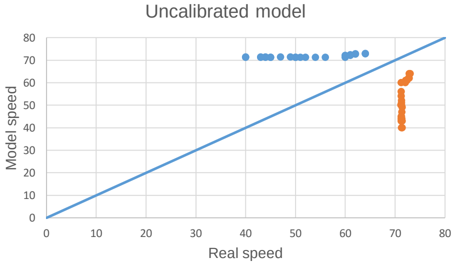
Simulation model (PTV Vissim)

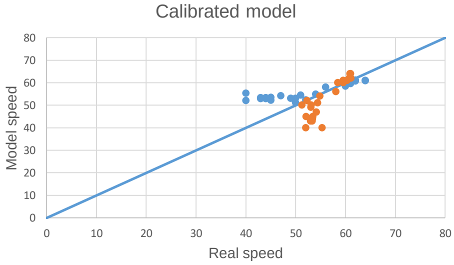


Model Calibration

Data Collection Measurement	Station ID	GEH Value	|Δ%| speed
1	280	5,7	41
2	475	8,3	36
3	459	3,2	43
4	290	3,9	46

Data Collection Measurement	Station ID	GEH Value	|Δ%| speed
1	280	3,6	11
2	475	5,0	28
3	459	1,8	12
4	290	4,0	15





Step 3: Scenarios development

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Base Scenario (1/2)

Coding of stops in the model

No	Name	Lane	Pos	Length
14	NE11_2_6_13:38	107 - 1	2.426	15.000
15	NE11_2_7_14:11	108 - 1	2.498	15.000
16	NE11_2_8_14:25	109 - 1	3.168	15.000
17	NE10_1_1_11:36	118 - 1	3.135	15.000
18	NE10_1_2_11:42	111 - 1	2.354	15.000
19	NE10_1_3_11:47	112 - 1	2.591	15.000

DHL deliveries in Halandri on March 9, 2017

Route	Network Entry	Number of Stops	Earlier Stop Time	Later Stop Time	Duration	Average Duration (stop-to-stop)
NE11	1	8	11:07	11:35	0:28	0:04:00
	2	8	12:41	14:25	1:44	0:14:51
NE10	1	6	11:36	12:02	0:26	0:05:12
	2	26	12:32	15:56	3:24	0:08:10
NE27	1	5	11:53	12:20	0:27	0:06:45
	2	1	12:58	12:58	N/A	N/A
NE01	1	3	12:15	12:46	0:31	0:15:30
	2	10	15:05	16:11	1:06	0:07:20
SE21	1	2	12:20	12:41	0:21	0:21:00
	2	1	15:05	15:05	N/A	N/A

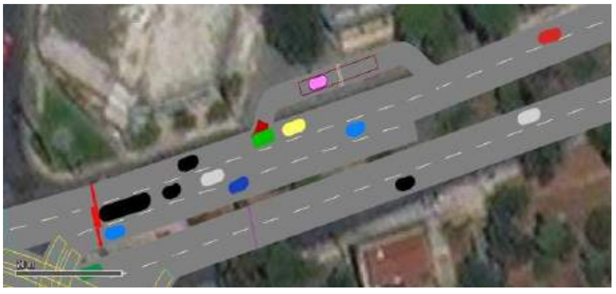
Design of stops in the model

from real positions…

…to model projections

Base Scenario (2/2)

DHL routes designed as public transport routes (necessarily in Vissim)



No	Name	EntryLink	DestLink	DestPos	VehType	DesSpeedDistr	DistinctDepTimes
1	NE11_1_11:07_11:35	92	64	3041.455	610: Vanaki	50: 50 km/h	41520.0
2	NE11_2_12:41_14:25	1	64	3051.775	610: Vanaki	50: 50 km/h	47400.0
3	NE10_1_11:36_12:02	27	64	2096.438	610: Vanaki	50: 50 km/h	41430.0
4	NE10_2_12:32_15:56	19	2	2068.391	610: Vanaki	50: 50 km/h	46840.0
5	NE27_1_11:53_12:20	4	61	4191.217	610: Vanaki	50: 50 km/h	44555.0
6	NE27_2_12:58	4	61	4187.461	610: Vanaki	50: 50 km/h	48340.0
7	NE01_1_12:15_12:46	92	14	403.286	610: Vanaki	50: 50 km/h	45800.0
8	NE01_2_15:05_16:11	92	2	2063.712	610: Vanaki	50: 50 km/h	55920.0
9	SE21_1_12:20_12:41	8	59	2242.214	610: Vanaki	50: 50 km/h	46150.0
10	SE21_2_15:05	19	59	2237.210	610: Vanaki	50: 50 km/h	56050.0

Alternative Scenario

Simulation of DHL & consumers' vehicle routes

How many DHL vehicles?
Load to Halandri = 156.6 kg
→ 1 DHL vehicle (Load capacity > 1000kg)

How many consumers' cars?
(Lemke, Iwan and Korczak, 2016)
→ 70 orders x 51% = 36 cars

Route	Total Load (kg)	Load Capacity (kg)	Load Factor (%)	Load Halandri (kg)
NE01	108.28	1240	8.7	14.26
NE10	266.695	1155	23.1	88.12
NE11	104.868	1155	9.1	40.86
NE27	246.188	1155	21.3	8.11
SE21	196.492	1155	17.0	5.222
Total				156.572

Which 36 consumers out of 70?
(Hoback, Anderson and Dutta, 2008 & 2012)
- order weight > 6 kg → (8 recipients → definitely by car)
- distance from nearest locker > 1km → (41 recipients → possibly by car)
  → selection of (36-8=) 28 of them (greater distance from locker)

Results

Simulation Results (Vissim)

Stakeholder: Logistics provider	Scenarios	
	Base	Lockers
Travel time (sec)	23085	4073 (-82%)
Travel distance (m)	58097	5265 (-91%)
Number of vehicles	5	1
Stakeholders: End consumers	**Scenarios**	
	Base	**Lockers**
Travel time (sec)	0	26662
Travel distance (m)	0	118742
Number of vehicles	0	36

Sustainability of Lockers Scenario (EnViVer and Evalog)

Scenario	CO2 (g/km)	NOx (g/km)	PM10 (mg/km)	Delays (s)
Base	271121	1393	101326	2249529
Lockers	270377 (-0.3%)	1387 (-0.4%)	101040 (-0.3%)	2205481 (-2.0%)
Logistics Sustainability Index Change: 1.1%				

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Conclusions

- Logistics provider benefits:
  - 82,4% less travel time
  - 90,9% less veh-km (80% of the fleet not necessary anymore) → downsize of direct and indirect operating costs

- Networks' overall emissions & traffic delays slightly improved
  - Benefits from avoiding home delivery trips outweigh negative impacts induced by the extra pick up trips of final recipients which are realized with motorized vehicles

- Other expected benefits from the establishment of Smart lockers:
  - Limitation of not-at-home deliveries (absent recipient), avoiding double and triple deliveries with extra costs.
  - Less veh-km for the operator → reduction of the price of the service provided.
  - Less freight vehicles on the road network
    - less unregulated parking stops,
    - less urban space engagement
    - less infrastructure usage
    - more green spaces
    - higher quality standards.
  - Flexibility, by combining individuals' pickup/delivery trips with trips for other purposes.
  - Smart lockers are mostly located in areas (commercial centers, shopping malls, city centers) served by public transport, so part of the delivery/pick up trips do not burden the road network or/and the environment at all.

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Does the Implementation of Urban Freight Transport Policies and Measures Affect Stakeholders' Behavior?

Eftihia Nathanail, Giannis Adamos, Ioannis Karakikes & Lambros Mitropoulos

Traffic, Transportation and Logistics Laboratory

University of Thessaly, Volos, Greece

Outline

- Background
- Research objectives
- Method
- Results
- Conclusions

Behavioral modeling - BM (1/2)

- Stakeholders' behavior towards adopting Urban Freight Transport (UFT) measures or complying with new policies-regulations
  - ➢ Motivations
  - ➢ Experience
  - ➢ Other behavioral factors
- Behavioral modeling is an efficient approach to
  - ➢ Reveal and assess any impacts generated by several stakeholders
  - ➢ Propose actions
  - ➢ **Affect behavioral changes**

Behavioral modeling - BM (2/2)

- Behavioral modeling allows to
  - ➢ Estimate the likelihood that operators adopt sustainable measures
  - ➢ Cross compare subjective vs. objective data
  - ➢ Capture what motivated behavioral changes
  - ➢ Assess the level of acceptance through comparison groups
- Behavioral theories use
  - ➢ Attitudes
  - ➢ Intentions
  - ➢ Behavioral beliefs
  - ➢ Norms
  - ➢ Self-reported behavior

Theory of Planned Behavior

Theory of Interpersonal Behavior

Transtheoretical Model of Change

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Research objectives

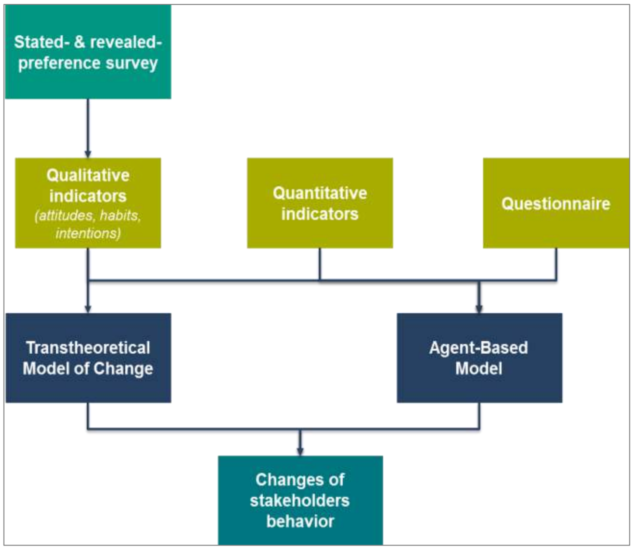
1. Investigate potential changes in stakeholders' behavior towards UFT policies and measures

2. Estimate the proportion of those stakeholders who have repudiated their previous behavior and have established the new behavior towards sustainable UFT measures

Method

1. Selection and application of "Transtheoretical Model of Change"
2. Implementation of an online questionnaire survey in 12 European cities testing UFT measures/policies
3. Before-after experimental design

Integration of BM into NOVELOG evaluation tool



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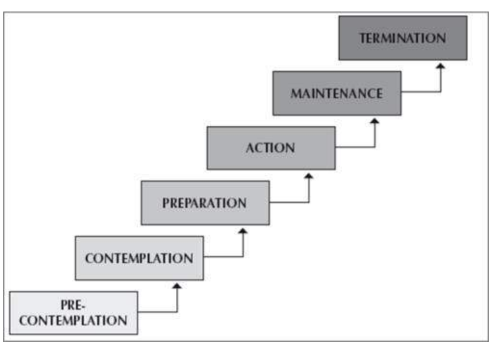
Transtheoretical Model of Change (TMC)



Source: Prochaska & DiClemente, 1983

- ***Pre-contemplation*:** In this stage, persons do not intend to take action and change their behavior.
- ***Contemplation***: Persons start to become aware of the problem, and the costs and benefits of the previous behavior are equally distributed.
- ***Preparation***: In this stage, persons start to make some steps towards their behavioral change.
- ***Action***: Although change has occurred, still there is a high risk that the person will return to his or her previous behavior.
- ***Maintenance***: The new behavior is becoming a habit.
- ***Termination*:** In this final stage, persons have repudiated their previous (unsafe/unhealthy) behavior and the new behavior is established.

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NOVELOG cities & measures/policies

City	Measure/policy
London Borough of Barking and Dagenham Riverside	Freight travel plans
Gothenburg	Consolidated deliveries to shopping centre
Athens	Sharing vehicle capacity
Graz	Home deliveries for shop visitors
Mechelen	Locker walls for last mile distribution
Turin	Multi-users lanes
Regio Emilia	Urban consolidation center
Bologna	Home deliveries system
Venice	Public transport for freight last mile deliveries
Barcelona	Super-blocks concept
Rome	Integrated decision support system
Pisa	Enforcement and intelligent transport systems adoption for control and management

Source: http://novelog.eu

Stakeholders' categories

Stakeholder Category	Stakeholders
Supply chain stakeholders	Freight Forwarders, Transport Operators, Shippers, Major Retail chains, Shop owners
Public authorities	Local Government, National Government
Other stakeholders	Industry and Commerce Associations, Consumer Associations, Research and Academia

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Behavioral indicators

No.	Indicator	Explanation	Question
1	Green reputation	Reputation of involved stakeholders towards implementing "green" measures.	How would you characterize your reputation towards implementing green measures?
2	Green concern	Degree that the involved stakeholders are oriented towards environmental preservation resulting from the measure implementation.	How much oriented you are towards environmental preservation from the measure implementation?
3	Perceived visual and audio nuisance	Degree to which people are annoyed by the visual and audio nuisance, caused by goods' deliveries in the city.	How annoyed do you feel due to the visual and audio nuisance that goods' deliveries in the city cause?
4	Diffusion of information	Public satisfaction concerning the diffusion of information and the informative channels and tools used to get the public acquainted with the modification of mobility standards due to goods' deliveries in the city.	How satisfied you are with the diffusion of information regarding potential changes in the mobility standards due to goods' deliveries in the city?
5	Perceived alternative mobility	Citizens' recording of increase in the use of environmental friendly modes and ways for goods' deliveries in the city.	How often do you choose environmentally friendly modes and ways for goods' deliveries in the city?
6	Quality of life	Evaluation of quality of level, addressed by land use optimization, e.g. detachment of UFT activity areas from city centre or isolation of them in special district, regulatory separation of UFT vehicles from the rest of traffic and other network users etc.	What's the quality of living in the city, owing to the impacts of goods' deliveries?

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Behavioral indicators

No.	Indicator	Explanation	Question
7	Awareness level	Knowledge of the goods' delivery systems that are used in the city.	Are you aware of the goods' delivery systems that are used in your city?
8	Compliance with regulations	Degree to which regulations are respected by the general public.	How much do you respect regulations that aim to facilitate goods' deliveries in the city?
9	Enforcement	Easiness of compliance with new measures, rules and regulations.	How easy would it be for you to comply with new UFT measures, rules and regulations?
10	Eco-driving practice before the journey	Professional drivers' intentions to practice eco-driving before they start the journey, e.g. vehicle proper maintenance, trip planning and use of on-board devices, "light" travel, etc.	How often do you adopt eco-friendly measures (e.g. maintain properly the vehicle, plan your trip, use on-board devices, travel "light") before the journey?
11	Eco-driving during the journey	Professional drivers' intentions to practice eco-driving during the journey, e.g. compliance with speed limits, smooth acceleration and braking, minimization of the use of heating and air-conditioning.	How often do you adopt eco-friendly measures (e.g. comply with speed limits, accelerate and brake smoothly, minimize the use of heating and air-conditioning) during the journey?
12	Motivation for eco-driving	Compliance with eco-driving practice for fuel savings, reduction of pollution emissions, and increase of road safety.	Would you comply with eco-driving practice, in order to reduce pollution emissions, save fuel and increase road safety?

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TMC statements – Example

Indicator		Statements
Eco-driving practice before the journey		Please choose one the statements cited below that describes better your attitude towards practicing eco-driving before the journey
	a.	I do not practice eco-driving before the journey, and I do not tend to change it
	b.	I do not practice eco-driving before the journey, but I start thinking of changing it
	c.	I usually practice eco-driving before the journey, and I tend to do it more often
	d.	I usually practiced eco-driving before the journey the last six months
	e.	I always practiced eco-driving before the journey the last six months
	f.	I practice eco-driving before the journey, and that’s what I tend to do in the future

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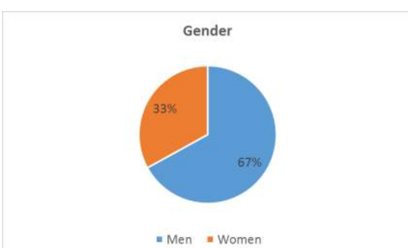
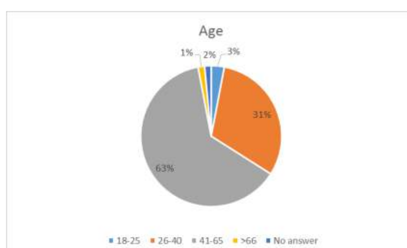
Sample characteristics

Stakeholder category	Time period		Total
	Before	After	
Supply chain stakeholders	29	29	58
Public authorities	39	130	169
Other stakeholders	40	25	65
Total	**108**	**184**	**292**





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Before-after analysis (Supply chain stakeholders)

Variable	Supply chain stakeholders						
	Before (B)		After (A)		B vs. A		
	M	SD	M	SD	z-statistic	effect size (r)	p-value
Green reputation	3.4	1.09	2.8	1.1	-2.153	-0.29	0.03*
Diffusion of information	2.7	1.0	2.8	1.19	-0.016	0	0.99
Perceived alternative mobility	2.8	1.47	3.0	1.45	-0.422	-0.06	0.67
Quality of life	2.8	1.0	2.5	1.0	-1.408	-0.19	0.16
Awareness level	3.5	1.01	3.6	1.1	-0.258	-0.03	0.79
Compliance with regulations	3.9	0.95	3.9	1.0	-0.416	-0.06	0.68
Enforcement	3.1	1.27	3.9	0.97	-2.113	-0.28	0.04*
Eco-driving practice before the journey	3.3	1.45	3.9	0.92	-1.115	-0.15	0.27
Eco-driving practice during the journey	3.1	1.18	3.8	0.76	-2.522	-0.34	0.01*
Motivation for eco-driving	3.7	1.29	4.2	0.54	-1.342	-0.18	0.19

*M: Average rating, SD: Standard Deviation, *statistically significant (p-value<0.05)*

Before-after analysis (Public authorities)

Variable	Public authorities						
	Before (B)		After (A)		B vs. A		
	M	SD	M	SD	z-statistic	effect size (r)	p-value
Green concern	4.1	0.97	4.3	0.9	-1.549	-0.12	0.12
Quality of life	2.7	0.99	2.8	1.0	-0.134	-0.01	0.89
Awareness level	4.0	0.92	3.2	1.2	-4.071	-0.31	0*

*M: Average rating, SD: Standard Deviation, *statistically significant (p-value<0.05)*

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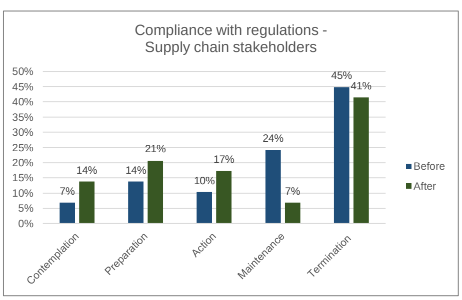
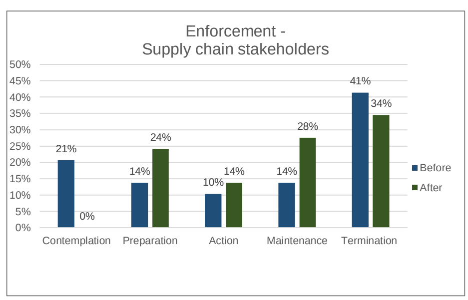
Before-after analysis (Other stakeholders)

Variable	Other stakeholders						
	Before (B)		After (A)		B vs. A		
	M	SD	M	SD	z-statistic	effect size (r)	p-value
Green concern	4.2	0.99	4.4	0.62	-0.095	-0.01	0.92
Perceived visual and audio nuisance	3.5	1.1	3.8	0.88	-2.098	-0.26	0.04*
Diffusion of information	2.9	1.05	3.3	1.1	-2.257	-0.28	0.02*
Perceived alternative mobility	2.6	1.08	2.9	1.0	-0.809	-0.1	0.42
Quality of life	2.9	0.9	3.0	0.84	-0.235	-0.03	0.81
Awareness level	3.6	1.0	3.6	1.14	-0.205	-0.03	0.84
Compliance with regulations	4.0	1.07	4.0	1.19	-0.079	0	0.94
Enforcement	3.7	1.0	4.1	0.86	-1.881	-0.23	0.06

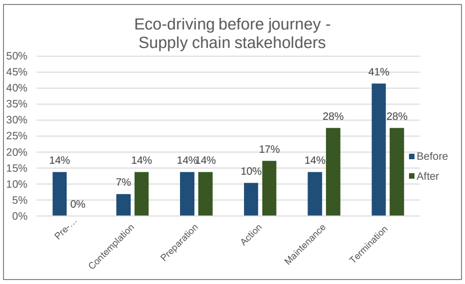
*M: Average rating, SD: Standard Deviation, *statistically significant (p-value<0.05)*

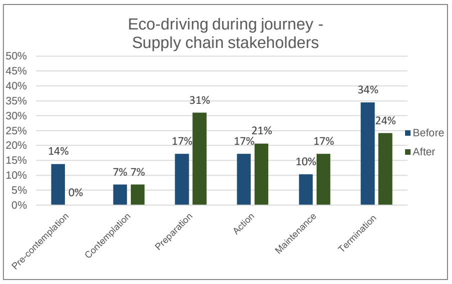
TMC testing – Supply Chain Stakeholders



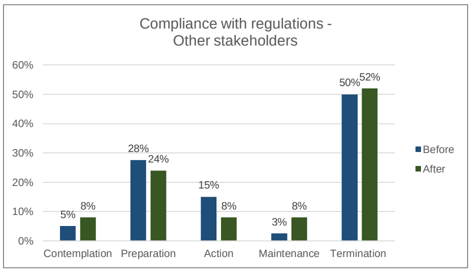


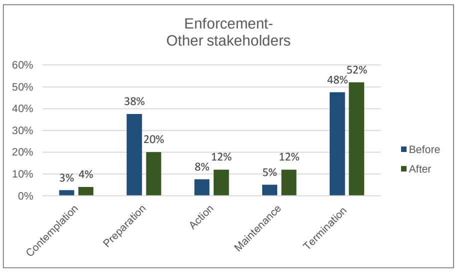
TMC testing – Supply Chain Stakeholders





TMC testing – Other stakeholders





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Conclusions

- Statistically significant increase after the measures' realization was met in the average rating of "enforcement" and "eco-driving practice during the journey" by the **supply chain stakeholders**
- For **public authorities**, it was revealed that the implementation of UFT measures, slightly affected their green concerns towards environmental preservation, and their attitudes about the level of quality of life in their cities
- A statistically significant increase after the implementation of the measures was met in the average rating of the indicators "diffusion of information" by **other stakeholders**
- The latter stakeholders believe that the quality of life in their cities was slightly improved after the measures' implementation.

Contact details

Thank you for your attention!

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Urban Traffic Management Utilizing Soft Measures: A Case Study of Volos City

Maria Karatsoli - UTH

Ioannis Karakikes - UTH

Eftihia Nathanail - UTH

Outline

- Introduction
- Soft measures
- Methodological approach
- Study area
- Evaluation Indicators
- Data Collection
- Simulation on Vissim
- Measures and Vissim scenarios
- Results
- Findings- further research
- References

Introduction

Cities' Sustainable Urban Mobility Plans (SUMPs)→strategies and actions that :

•improve accessibility
•provide high quality mobility
•deal with phenomena that result in congestion, bottlenecks and increase in delays, accidents, environmental pollution and fuel consumption

Local traffic management contributes to the alleviation of local traffic flow issues by making a more efficient use of the available network capacity

Objectives:

•the enhancement of the existing network's efficiency
•the alleviation of traffic congestion
•the reduction of environmental pollution
without implementing new hard measures

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Introduction

Combinations of several interrelated traffic control strategies →more efficient and substantial reductions in travel time and delay

A combination of traffic control strategies has been selected for the city of Volos, simulated and tested, for drawing useful conclusions on their effectiveness in improving the performance of the urban transportation network

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Soft measures

"Soft measures" refer to introducing new transport policies, modifying the operational structure of the network, and/or adopting Intelligent Transport Systems (ITS) for information provision, and traffic monitoring and control

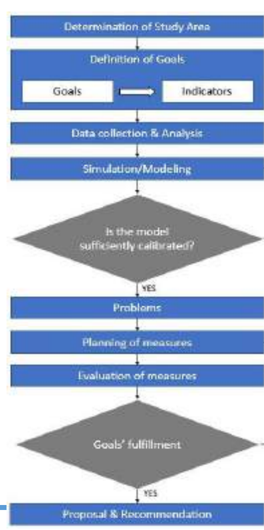
Cairns et al.
- the workplace and school travel plans
- personalized travel planning
- public transport information
- home shopping
- car sharing/ carpooling
- travel awareness campaigns

Möser and Bamberg
in their study analyze five soft measures that are the most implemented and evaluated in the last decade

MIDAS European project
examples of soft measures in case studies that include marketing campaigns for greater use of public transport, cycling and walking, carpooling, and mobility management initiatives.

Richter et al.
conducted a review research about when and where a list of soft measures can be proved effective for sustainable mobility

Methodological approach



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Study area

The city of Volos
•situated in the center of Greece
•sixth largest city of the country with 144.449 inhabitants
•the city center which is run by the commercial streets of Dimitriados and Iasonos (study area)
•is arranged based on the Hippodamian or grid plan
•serves high traffic volumes especially during the summer season
•the central district of Volos has 4583 residents that own 1380 cars, while the parking places are only 395

Study area

Problem: congestion → Aim: Reduction of private vehicle use → ? Solution: Reserved lane for buses and taxis

However, one of the two remaining lanes is illegally used for parking ⇨High delays due to long queues that are built along the two axes force a share of private vehicles to use the bus lane

The inappropriate use of the existing system mentioned above worsens the problem of congestion making imperative the need for more effective solutions

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Evaluation indicators

Name	Explanation
Delays	Sum of delays
Average Speed	Average speed of all vehicles
Intersection Delays	Average extra time to cross an intersection per vehicle
CO	total emissions of CO
NOx	total emissions of NOx
Total number of conflicts	Total number of conflicts in a specific area

Evaluation indicators

•Based on the "Intersection Delays" indicator the Level of Service (LOS) was determined for the two critical intersections of Iasonos - K. Kartali and Dimitriados - Venizelou

•To measure the number of conflicts the "Surrogate Safety Assessment Model" (SSAM) was used

Data Collection

✓**Evening peak-hour traffic data** (20:00-21:00) based on a travel survey conducted by the Traffic, Transportation and Logistics laboratory (TTLog) of the University of Thessaly
✓**Traffic conflicts and incidents** were recorded and critical intersections were identified for further analysis
✓**Travel times** were also measured to be used as a reference for the calibration of the model
✓ **Traffic lights' programs** were given by the Traffic Management Center of the city of Volos
✓All the rest **operational elements** required for the microsimulation model (VISSIM) were determined either from google maps or on-site observation.
✓For **the evaluation of emissions**, the share of light- and heavy-duty vehicles was considered based on the percentage of local sales of alternative fuel vehicles in Greece in 2016

Fuel type	Light duty vehicles	Heavy duty vehicles - Buses
Petrol	92.53%	0%
Diesel	6.41%	100%
CNG	1.05%	0%
Electric	0.01%	0%

Data Collection

Public transportation system in Volos city

•Consists of **twelve bus lines** that serve the city and the surrounding areas
•Consists of a fleet of **51 busses** and **3 mini busses**
•Average **occupancy rate of 22.9%** for all lines.
•Five public transport lines that run through the study area during the peak hours **operate every 20 minutes** and stop at **eight** public transport stops on Iasonos and Dimitriados streets.

Onsite sampling measurements of public transport within our study area during the peak hour showed the following results:
•The ridership of the buses is close to the estimated average occupancy in the survey.
•The operation of the bus lines has no significant discrepancies from the schedule (delays of max. 3 minutes were noticed).
•No problematic spots for buses in the study area (except for the lane change of busses serving the lines 2, 3 and 4, on Iasonos street between Venizelou and K. Kartali street, which causes small delays and multiple conflict points)

Simulation on Vissim

•A total number of ten hourly (3600 seconds) simulation runs with different random seeds was completed in order to guarantee representative normalized results.

• The warm-up period was set equal to 1800 seconds in order to load the network realistically before the starting collecting data to be used in the evaluation

• The model was calibrated by checking for coding errors and false insertion of input data while adjusting various parameters iteratively until results fall within certain thresholds

Measures and Vissim scenarios

Measure 1: Ban of access to UFT vehicles during shopping hours
-Modeling effort: Set to 0 the probability of vehicles to park in sparse located parking lots along the two main road axes

Measure 2: ITS adoption (surveillance systems) to prevent illegal parking and short term stops
-Modeling effort: Set the attribute "ParkRate" for all Parking Lot vehicle routes equal to 0.1%, from 3%, parking duration distribution remained the same)

Measure 3: Adjustment of the coordination time offset
-Modeling effort: Decrease time offset of signal programmes between intersections.

	Base scenario	Scenario with measures
Measure 1	Probability: 12% (arose from the calibration process)	Probability: 0%
Measure 2	ParkRate: 3%	ParkRate: 0.1%
Measure 3	-	Decrease offset time between successive intersections

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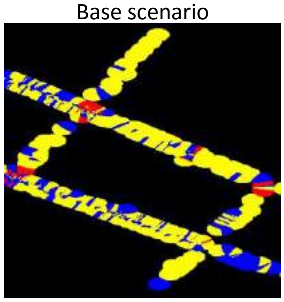
Results

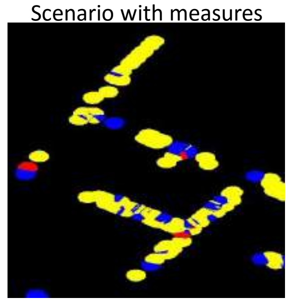
Indicators		Base scenario	Scenario with measures	Change
Traffic quality	Network's total delays (s)	609,396.6	138,464.3	-77.3%
	Network's average speed (km/h)	10.38	25.39	+144.6%
	Average delay (s/veh) and LOS at Iasonos - K. Kartali intersection	22.6 (LOS C)	15.7 (LOS B)	C to B
	Average delay (s/veh) and LOS at Dimitriados - Venizelou intersection	22.5 (LOS C)	15.9 (LOS B)	C to B
Safety	Total number of conflicts	33,550	1,226	-96.4%
Environment	CO_2 (g/km)	715,649	665,253	-7.0%
	NO_X (g/km)	5,141	4,798	-6.7%

Results

Base scenario



Scenario with measures



Mapping conflict types at the two critical intersections
Crossing conflicts
Rear End
Lane change

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Findings- further research

✓Improvement of the traffic conditions and the environmental impacts of the whole network:

- reduction of travel delays by 77.3%
- reduction of pollutant emissions by 6.8% (in average)
- reduction of conflicts by 96%, without changing or rebuilding the existing transport infrastructure

✓Implementation of better enforcement in parking activities and signalization coordination can improve traffic conditions without the need of expensive infrastructure and long-lasting development projects.

✓Positive impacts also for pedestrians and cyclists

- Pedestrian sidewalks will become wider (due to wider side clearance area) and safer
- General accessibility and visibility will be improved
- Public transportation will become more attractive (fewer accelerations/decelerations for passengers, higher comfort, punctuality, performance and credibility)
- Aesthetically pleasing mobility experience.

❑ The future steps are to consider other supporting measures, such as informative campaigns, financial incentives for usage of public transport, park and ride facilities, bike sharing systems etc. and examine their impact, to model more measures' combinations and to study the effect on other transportation network users (pedestrians, cyclists).

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Thanks for
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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Applying Unsupervised and Supervised Machine Learning Methodologies in Social Media Textual Traffic Data

Konstantinos Kokkinos
Eftihia Nathanail
Elpiniki Papageorgiou

Key points of our work

- Traffic patterns' monitoring.
- Utilize textual data analytics.
- Incorporation of methodologies for handling Big Data.
- Investigation of the feasibility of using Big Data produced by Twitter textual streams for extracting traffic related events.
- Use of machine learning models for clustering (unsupervised learning) and classification (supervised learning).
  - Clustering: KMeans on an Apache Spark
  - Classification:
    - Multi-Layer Perceptron Neural Networks, (MLP-NN),
    - Support Vector Machines, (SVM) and
    - Deep Convolutional Learning, (DCL)

State of the Art-1

- Twitter provides services where, users can post geo-tagged tweets via the GPS interface of their smart devices.

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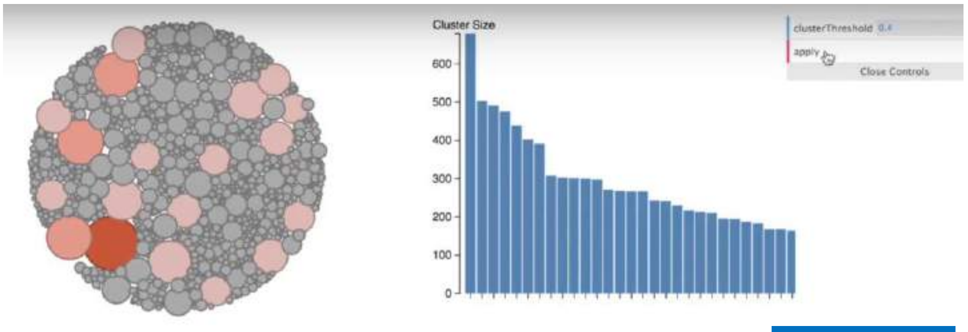
State of the Art-2

- I-TWEC utilizes Twitter data lexical and semantic similarities and provides clustering visualizations enabling users to merge them based on their similarity preferences.



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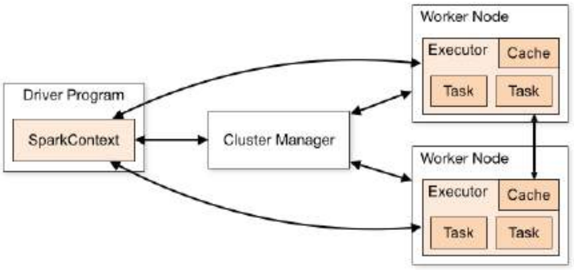
State of the Art-3

- With the improvement of big data processing technologies, we now have the ability to perform traffic sensing and learn human mobility patterns from updated location information in network interaction log data (mostly GPS and textual).



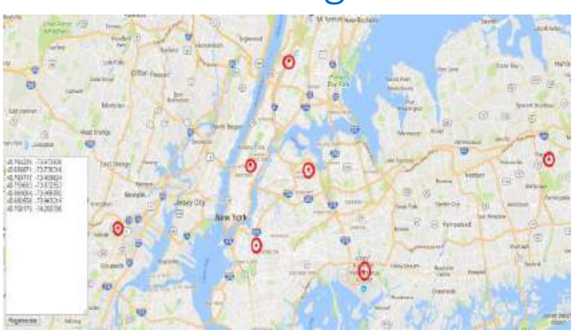
Methodologies Used

- Clustering of traffic data of numeric nature via the use of KMeans algorithm with the Euclidean distance as a cost function.
- Classification considering two cases:
  - Binary classification regarding tweets related to traffic either due to weather conditions or not and
  - Ternary classification related to heavy traffic due to accidents, seasonality affected events (for example, Christmas Eve) and external unexpected events (basketball game, strikes, demonstrations etc.).
- Gathering of tweets using the Twitter4J library. The usage of the Twitter API allows us to mine tweets using criteria based on hashtags, limited time, longitude and latitude and any keyword

Traffic Big Data clustering using unsupervised machine learning-1

- Data was gathered for the city of New York during the Christmas period of 2017 (Dec. 11th 2017 – Jan. 3rd 2018). The area of interest was chosen to be the virtual rectangle:
  - left upper corner: Hawthorne NJ Lat: 40.939825, Log: -74.160612,
  - right lower corner: Jones Beach State Park NY Lat: 40.597646, Log: -73.505552).
- Data gathered: (geolocation) + (date and time) + (searching criterion included keywords such as: congestion, traffic jam, traffic etc.)
- Initial filtering of the aforementioned tweets was performed to mine the ones originated by people riding vehicles and therefore excluding pedestrians.

Traffic Big Data clustering using unsupervised machine learning-2



- Around 2.7 million of tweets are fed to a single machine Spark ML and SQL-Context schema.
- After setting *k*=7 clusters each geo-located tweet was assigned to its nearest centroid based on the Euclidean distance metric.

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Traffic classification using supervised machine learning
a. Data Acquisition

- Same area as in the clustering use case
- Binary classifier
  - The tweets either include the weather condition in a traffic event or not.
  - The tweet structure (Date, Time, Latitude, Longitude, Keywords) where an *m*-at most keywords
  - Keywords included the words {traffic, rain, snow, sleet, accident, slowdown, congestion, stuck, thunder, crash} when investigated heavy traffic due to extreme weather conditions.
- Ternary classifier
  - Similar tweet structure
  - Keywords {game, strike, demonstration, flight, Christmas, year, accident, crash, ambulance, shopping}.

Traffic classification using supervised machine learning b. Data Set Processing-1

- Removal of tweet meta-associations
  - to discard hashtags, links, mentions and user-ids
- Tokenization
  - transformation into a larger set of syllables with the synchronous extraction of non-text characters
- Extraction of stop-words
  - Removal of conjunctions, articles, pronouns etc.
- Stemming of tokens
  - remove suffices of tokens and group words of similar semantics

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Traffic classification using supervised machine learning b. Data Set Processing-2

- For the set of calculated Inverse Frequency Index (IDF) $w_{st} = \ln(N_{tr} / N_{st})$
- we built a feature representation vector $f_j^{st} = \begin{cases} w_{st} & if \ \ stemmed \ \ token \in N_{tr} \\ 0 & if \ \ stemmed \ \ token \notin N_{tr} \end{cases}$
- Information Gain, (IG) calculation for each stemmed token STi for the class vector Cm

$$IG(ST_i) = -\sum_m P(C_m)\log P(C_m) + P(ST_i)\sum_m P(C_m / ST_i)\log P(C_m / ST_i) + P(\overline{ST_i})\sum_m P(C_m / \overline{ST_i})\log P(C_m / \overline{ST_i})$$

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Traffic classification using supervised machine learning: c. Classification using MLP-NN-1

- Use of the binary classifier from the April-ANN toolkit.
- All-to-all connection between the hidden layers of the NN concentrating on (positive negative classifier)
- Investigation of the:
  - True Positive (TP),
  - True Negative (TN),
  - False Positive (FP) and
  - False Negative (FN) instances

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Traffic classification using supervised machine learning:

c. Classification using MLP-NN-2

- Calculation of the performance metrics:
- Accuracy $Acc = (TP + TN)/(TP + FP + FN + TN)$
- Precision $Prec = Tp/(TP + FP)$
- Recall $Rec = TP/(TP + FN)$
- F-Score $F = (1 + \beta^2)\frac{Prec\,.Rec}{(\beta^2.\,Prec)+Rec}$

Traffic classification using supervised machine learning:

c. Classification using SVM

- Use of a SVM noting that the optimization problem under concern makes use of kernels, which map input features into a different space.
- Finding the derivative of the cost function and using gradient descent does not work
- Instead, the SVM only weights are close to the decision boundary.

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Comparison of the two methods

Classifier	Accuracy (%)	Precision (%) by class		Recall (%) by class		F-Score (%) by class	
		Weather caused	Not Weather caused	Weather caused	Not Weather caused	Weather caused	Not Weather caused
MLP-ANN	89.6	90.7	88.9	88.54	90.63	89.22	89.91
SVM	92.73	92.06	93.4	92.80	92.66	93.02	92.44

Traffic classification using supervised machine learning:

c. Classification using DCL network-1

- Use of the Deep Convolutional Neural Network for the 3-class classifier
- The training of the network was done by stochastic gradient descent via the use of a backpropagation algorithm to compute the gradients.
- 70-30 proportion of trained and test datasets.
- The tendency of the network to over fit in the learning process of the decision function was confronted by augmenting the cost function.

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Traffic classification using supervised machine learning:

c. Classification using DCL network-2

	Due to Accidents	Seasonality affected	External events
Accuracy (%)		81.76	
Precision (%) by class	79.65	80.92	84.72
Recall (%) by class	82.34	82.18	80.49
F-Score (%) by class	82.21	81.28	81.79

Conclusions

- The increase of vehicular traffic creates the need to obtain information on traffic flow based on new sources.
- The incorporation of machine learning methodologies is shown to be beneficial in identifying traffic hot-spot centroids for the case of traffic clustering using data generated by social media.
- For the classification process in discovering the reasons of occurrence of congestion events, the MLP-NN and SVM methods outperformed the Deep Learning models.

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4th Conference on Sustainable Urban Mobility – CSUM2018

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A thorough review and analysis of journey planners

Sourlas Dimitrios, Eftihia Nathanail

Introduction

- What is a Journey Planner?
- What do users want?
- Connecting Planners' attributes with user preference

The Steps

- ➢Review some planners to define main and other attributes
- ➢Based on review → creation of template
- ➢Thorough search of Journey planners

  ↓

  Creation of list

The Template (1)

- ❖Designed for a complete picture of each Journey Planner
- ❖Filled by:
  - Testing the website
  - Nibbler tool
  - Mystery Shopper method

The Template (2)

❖Testing the website (Apparent features)

- Input options
- Geographical coverage
- Optimization options
- Route results
- Services provided

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The Template (3)

❖Nibbler tool (Specific attributes)

- Popularity
- Mobile app
- Latest website update
- Server behaviour

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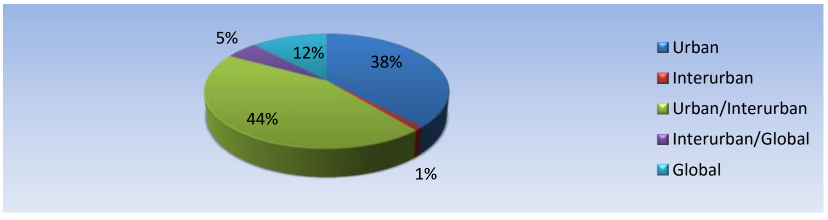
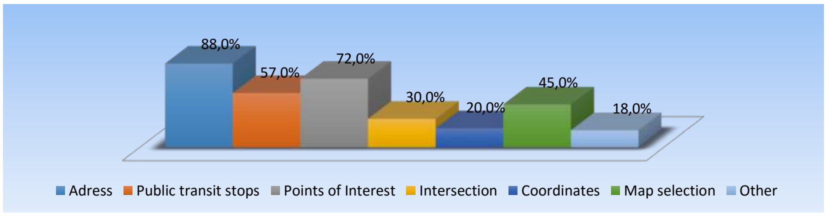
The Template (4)

❖Mystery Shopper Method

- Visually attractive, map clarity (introduction)
- Easy operation, explicit terminology (recognition of customer's needs)
- Intructions (offer)

Results – Descriptive Statistics (1)



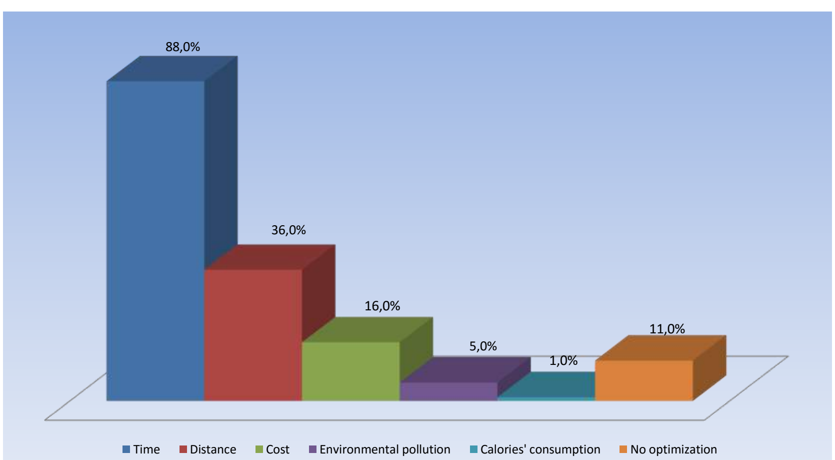


Results – Descriptive Statistics (2)

	Private Vehicle	Bus	Tram	Metro	Trolley	Pedestrian	Bicycle	Taxi	Carpooling
Urban	28,9%	94,7%	50,0%	47,4%	23,7%	63,2%	36,8%	5,3%	0,0%
Interurban	100%	100%	0%	0%	0%	100%	0%	0%	0%
Urban-Interurban	34,1%	90,9%	65,9%	65,9%	15,9%	88,6%	27,3%	13,6%	0,0%
Inter-urban-Global	80,0%	60,0%	20,0%	20,0%	20,0%	20,0%	0,0%	0,0%	0,0%
Global	100,0%	41,7%	25,0%	25,0%	16,7%	66,7%	33,3%	0,0%	8,3%

	Car sharing	Bike sharing	Ship	Riverboat	Bike	Train	Truck	Combination
Urban	2,6%	5,3%	10,5%	7,9%	2,6%	60,5%	0,0%	76,3%
Interurban	0%	0%	0%	0%	0%	100%	0%	100%
Urban-Interurban	6,8%	0,0%	40,9%	2,3%	0,0%	72,7%	2,3%	90,9%
Inter-urban-Global	0,0%	0,0%	60,0%	0,0%	0,0%	40,0%	0,0%	60,0%
Global	0,0%	8,3%	33,3%	0,0%	16,7%	25,0%	25,0%	41,7%

Results – Descriptive Statistics (3)



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Results – Attributes Significance (1)

❖The Important Five

- Input options
- Route duration
- Alternate routes
- Real time information
- Weather forecast

Results – Attributes Significance (2)

❖Another seven important attributes

- Visual attractiveness
- Operational ease
- Map clarity
- Explicit terminology
- Comprehensibility
- Rationality
- Adequacy

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Results – Attributes' Correlation

Correlations

			comprehensibility	rationality	adequacy_of_instructions	visual_attractiveness	operational_ease	explicit_terminology	map_clarity
Spearman's rho	comprehensibility	Correlation Coefficient	1.000	.357**	.600**	.458**	.354**	.565**	.373**
		Sig. (2-tailed)	.	.000	.000	.000	.000	.000	.000
		N	100	100	100	100	100	100	100
	rationality	Correlation Coefficient	.357**	1.000	.397**	.251*	.174	.393**	.046
		Sig. (2-tailed)	.000	.	.000	.012	.083	.000	.648
		N	100	100	100	100	100	100	100
	adequacy_of_instructions	Correlation Coefficient	.600**	.397**	1.000	.396**	.359**	.492**	.122
		Sig. (2-tailed)	.000	.000	.	.000	.000	.000	.225
		N	100	100	100	100	100	100	100
	visual_attractiveness	Correlation Coefficient	.458**	.251*	.396**	1.000	.547**	.475**	.325**
		Sig. (2-tailed)	.000	.012	.000	.	.000	.000	.001
		N	100	100	100	100	100	100	100
	operational_ease	Correlation Coefficient	.354**	.174	.359**	.547**	1.000	.470**	.327**
		Sig. (2-tailed)	.000	.083	.000	.000	.	.000	.001
		N	100	100	100	100	100	100	100
	explicit_terminology	Correlation Coefficient	.565**	.393**	.492**	.475**	.470**	1.000	.266**
		Sig. (2-tailed)	.000	.000	.000	.000	.000	.	.007
		N	100	100	100	100	100	100	100
	map_clarity	Correlation Coefficient	.373**	.046	.122	.325**	.327**	.266**	1.000
		Sig. (2-tailed)	.000	.648	.225	.001	.001	.007	.
		N	100	100	100	100	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

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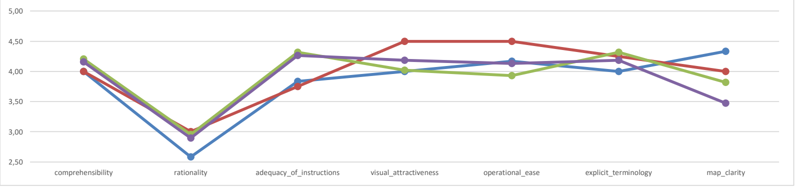
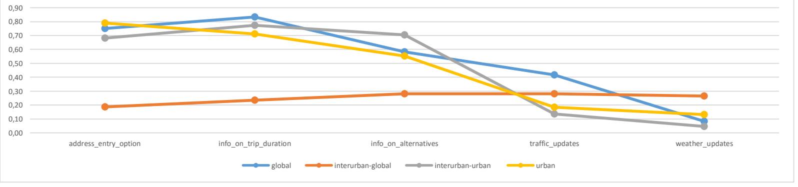
Results – Cluster Analysis





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Conclusions

- Consistency in the quality of Journey Planners
- No significant differences in attributes' performance
- Interurban – urban planners provide less information

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THANK YOU!

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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

The contribution of Open Big Data Sources and Analytics Tools to Sustainable Urban Mobility

Samaras-Kamilarakis Stavros, Vogiatzakis Petros-Angelos, Nathanail Eftihia, Mitropoulos Lampros

Sponsors: Marathon Data Systems

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With the support of: alliance, novelog

Introduction

- What is Big Data? → The information asset characterized by such a high volume, velocity and variety to require specific technology and analytical methods for its transformation into value.
- By 2020, the number of internet connected devices is expected to be almost 50 billion. All these data will result in 40 zettabytes (40 trillion gigabytes) of digital information which can be processed with different tools.
- Two types of data sources → open and private.
- People are able to contribute in the elaboration of large datasets in order to extract desirable results in open big data sources.

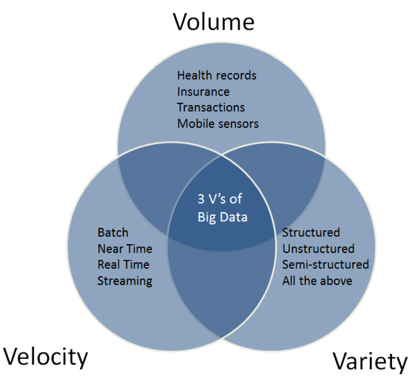

Figure 1. The 3 V's of Big Data. Volume, variety and velocity

Literature Review - Methodology

Research question: How and to what extent could the available open big data sources and tools be of asset to sustainable urban mobility?

Sources → academic and scholarly: including electronic (cross-disciplinary) databases and tools, university libraries, Science Direct, Google Scholar as well as public and private sector's websites, international journals and conference proceedings.

Quality of literature sources → authenticity, credibility, representation, and meaning.

Backward literature search and forward literature search used to enhance the review.

From 1000 case studies conducted during 2016 and 2018 → 20 were chosen which addressed topics related to: mobility-as-a-Service (MaaS), logistics, traffic operation and management, transportation planning and prediction, assessment and decision making.

Literature Review - Analysis and Classification (1/2)

- The identified studies were classified based on used datasets and their applications. For example, mobility pattern datasets, created from GPS devices and vehicles, aim to inspire smart policies for green automobiles.
- The manager of each dataset (i.e. public or private sector or both) and the means of collecting data (i.e. detectors, mobile phones, smart card data, social media, etc.) were identified.
- All case studies addressed the issues of smart transport in general and most of them focus in particular in smart cities giving more emphasis also on issues such as pollution, congestion and energy savings.

Literature Review - Analysis and Classification (2/2)

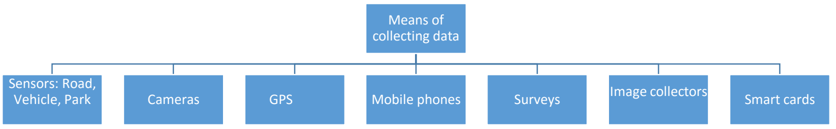

Diagram 1. Means of collecting data

In order to analyze and process these datasets, to understand and export solutions, advanced tools have been developed. The most common tools used for processing big data datasets in the reviewed studies was Hadoop, Spark, MATLAB and programming model MapReduce.

Table 1. Big data sets and application per study

	Reference	Datasets	Application
1	(Babar & Arif, 2017)[6]	Traffic data, parking lot data and pollution data	Smart decision supervision and control
2	(Rathore, et al., 2017) [7]	Daily water usage, smart parking, pollution, city traffic, weather	Smart system to make municipalities smarter and digital.
3	(Nathali Sylva, Khan, & Han, 2017) [8]	Water consumption, city traffic, parking lot	Smart city architecture.
4	(Paul, et al., 2017) [9]	Smart cities generated datasets	Real-time smart city security system (communication security protocol).
5	(Suma, Mehmood, Albugami, Katib, & Albeshri, 2017) [10]	London Tweets	Use of social media for the detection of spatio-temporal events related to logistics and planning.
6	(De Gennaro, Paffumi, & Martini, 2016) [5]	Driving and Mobility pattern	Promotion of green vehicles.
7	(Mehmood & Graham, 2015) [11]	Capacity Sharing, Smart City Transport, Logistics	Illustrates how sharing transport load in a smart city can improve efficiencies in meeting demand for city services.

Table 2. Big data sets and application per study

	Reference	Datasets	Application
8	(Zhong, et al., 2015) [12]	Warehouses, Shopfloors	Uses of RFID for advanced decision-makings.
9	(Kaur & Prakash Singh, 2017) [13]	Logistics (Mileage, procuring items, Carrying load, Holding inventory, Distance)	Sustainable procurement and transportation decision.
10	(Zuojian, et al., 2016) [14]	GPS coordinates, traces	Recommend the shortest and feasible path for passengers to reach their destination.
11	(Li, et al., 2018) [15]	Geographic location (GPS)	Commuting patterns in Beijing in 2015.
12	(Ankit, Deepak, Ishant, Jishnu, & Saurabh, 2017) [16]	Speed, engine monitoring, mileage, number of stops, miles per gallon, safety aspects, etc.	Better organization in supply chain management and further solving the remaining issues of supply chain.
13	(Adithya, Diego, & Uday, 2015) [17]	Railroad and rail traffic	Predicting the behavior of the assets in operation and maintenance
14	(Bao Rong, Hsiu-Fen, & Po-Hao, 2017) [18]	Data traffic parameters	Carry out rapid big data retrieval and analytics to serve as part of business intelligence.
15	(Liye, Qiang, & Tien Fang, 2017) [19]	Ship traffic	Port safety management
16	(Qi & Mohamed, 2015) [20]	Real-Time Traffic	Real-time congestion and operation warning strategy for improvement
17	(Yingjie, Jinlong, Xindai, Chunhui, & Chao, 2016) [21]	Vehicle Traffic	Solve problems of traffic data distribution storage and processing
18	(Jameson, et al., 2015) [22]	Call detail records, census data, road networks, surveys	Travel demand estimation
19	(Chao, Xi, Xuehai, Aili, & Nadia, 2016) [23]	Traffic flow	Adjust the waiting time for the traffic lights.
20	(Jiang, Yu, Zhou, Chen, & Liu, 2017) [24]	Trajectory data	Dynamic modeling for ITS.

Available Big Datasets in Transport – Open Source Big Data

- Open source datasets are available online in almost every country in the world and they are categorized according to field of their collection and the region which have been obtained.

Governmental	Global Data	Academic	Science and Health	Marketing and social media	Journalism and media

Diagram 2. Categories of collected open source datasets

- Some open source services that currently exist, as well as companies and tools that cooperate with this idea are framework (Hadoop MapReduce, Spark), coordination (Apache Zookeeper), visualization (Rodeo), collaboration (Anaconda) and security (Sentry, Apache Ranger).

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Available Big Datasets in Transport – Transport Data Typology

- In order to explore what open big dataset are available and their connection to these transport topics a thorough search has been deployed containing over 100 open datasets → 15 have been selected which obtained mainly through the Kaggle website and they were most relevant for the research and have been grouped into 5 groups.

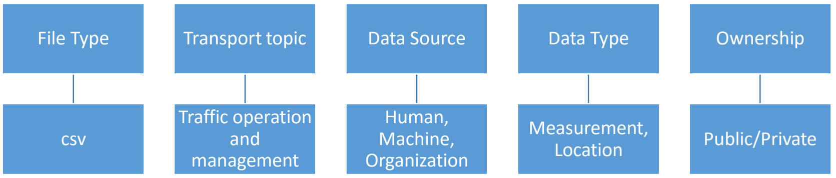

Diagram 3. Classification of selected open source big data datasets.

Table 3. Typology of datasets referring to transport sector

Dataset	File Type	Transport Topic	Data Source	Data Type	Ownership
Cargo 2000	Csv	Logistics	Machine	Track	Private
Human Mobility during Natural Disasters	Csv	Mobility as a service	Social Media	Location	Private
1.6 million UK traffic accidents	Csv	Traffic planning and prediction	Human	Measurement	Public
US Traffic Fatality Records	Bigquery	Traffic planning and prediction	Human	Measurement	Public
UK Traffic Counts	Csv	Traffic operation and management	Human/Organization	Sensor	Public
US Traffic, 2015	Csv	Traffic operation and management	Machine/Organization	Sensor	Public & Private
US open policing projects	Csv	Transportation planning and prediction	Human	Measurement	Public
NYC Transport Statistics	Csv	Traffic operation and management	Machine	GPS	Public
NYC Taxi with OSRM	Csv	Traffic operation and management	Human	Sensor	Private
Uber Pickups in NYC	Csv	Traffic operation and management	Machine	Location/measurement	Private
Traffic Violations in USA	Csv	Traffic operation and management	Human	Measurement	Public
2016 NYC Real Time Traffic Speed Data Feed	Csv	Traffic operation and management	Machine	Sensor	Public
NYC Taxi trip durations	Csv	Traffic operation and management	Machine	Measurement/location	Private
NYC Bike trip duration 2016	Csv	Traffic operation and management	Machine	Measurement/location	Public
Historical Air Quality	Bigquery	Transportation planning and prediction	Machine	Measurement/location	Public

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Discussion and conclusions (1/2)

- We attempted to create a roadmap and reveal trends regarding open source big data and related applications in sustainable urban mobility.
- The most state-of-the-art tools that make big data processing feasible are Apache Hadoop and Spark.
- The main transport field that most case studies papers refer to is traffic operation and management, as accident data, environmental data, traffic data etc. and the least used one is logistics and assessment and decision making.
- Implications → stakeholders are cautious about involving in transport and the possible threats that may occur. This is, privacy issues especially in logistics and assessment and decision making because the management and operation of the companies are private.

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Discussion and conclusions (2/2)

- Open source dataset is less likely to contain quality data compared to those who are constructed and operated by private sector companies → anyone can share and manage open source datasets.
- This field has many aspects that academics, researchers, transport engineers and industry could focus → achieve richer legacy for transport and urban mobility.
- Future research: process and classification of unstructured data or deployment of tools for artificial intelligence to take place into real time decision making.
- Opportunities → sustainable urban mobility aims to promote green cities and people look adaptive to this shift. Big data can help in reduction of costs in the transport field and it can promote employment in companies.

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Connected and Autonomous Vehicles – Legal issues in Europe, the USA and Greece

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Pantelis Kopelias
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4th CONFERENCE
ON SUSTAINABLE URBAN MOBILITY

Contents

(The paper presents existing Legislation & Regulation Issues, in Europe, the USA and Greece, up to February 2018)

Tort Liability (1/2)

- State tort law & state financial responsibility laws in case of a crush
- Three theories of tort liability for drivers:
  - (a) traditional negligence
  - (b) no-fault liability
  - (c) strict liability
- Liability due to:
  - (a) negligence,
  - (b) strict liability
  - (c) breach of warranty (involves product defects) → (i) manufacturing defect; (ii) inadequate information to the buyer; (iii) design defect

Tort Liability (2/2)

- Three parameters are examined in order to determine who is responsible for the accident:
  - (a) driver's liability,
  - (b) vehicle's liability
  - (c) other factors that cannot be predicted
- Driver behind the wheel = Driver considered responsible
- Responsibility for an accident when an Autonomous/Connected vehicle is involved : Depends on the level of automation
- Fully Autonomous vehicle: current laws cannot be applied
- Partially Autonomous vehicle: Difficulty in defining liability

Data Sharing & Data Security (1/1)

- Data Sharing: GSM, DSRC, Bluetooth, Wi-Fi
- Sending & Receiving of data through the internet: Risk of exposure of data in case of security failure
- Definition/standarization of:
  - (a) the kind of data transmitted and the kind of systems receiving it
  - (b) who is collecting the data, the purpose of data processing and data collection
  - (c) possible use of the collected data
  - (d) the security systems that are used as to protect personal data.
- Need for proper legal framework to secure data privacy

European Legislation & Regulation (1/4)

- European countries are obliged to conform to all regulations and standards set by UNECE
- Drivers' behavior in most European Countries:
  - traffic rules
  - criminal and civil law
  - regulations of the 1968 Vienna Convention
  - Directive 2006/126/EC
- The 1968 Vienna Convention treaty: establishment of standard traffic rules to increase road safety (ratified by all European Union Members apart from Spain and the UK)
  - **Article 8:** "Every moving vehicle or combination of vehicles shall have a driver"
  - **Article 13:** "Every driver of a vehicle shall in all circumstances have his vehicle under control…"
  - **2014 Amendment** : vehicles equipped with automation systems are considered to be in accordance with the Vienna Convention treaty as long as a driver is sitting behind the wheel at all times and is capable of taking charge of the vehicle and overriding these systems.

European Legislation & Regulation (2/4)

- UNECE Agreements of 1958 and 1998 : standards and regulations on how vehicles are registered and manufactured
- Ratification of 118 Standards of the 1958 Agreement and 16 Standards of the 1998 Agreement (2014) → **aim**: the modernization of its legal framework affecting new cars → still no free technological evolution or deployment
- **EU's Projects since 2008:** L3 Pilot Driving Automation, DRIVE C2X, HAVEit, CITYMOBIL 1 & 2, ADAPTIVE, COMPANION and HORIZON 2020
- Three new directives on the way on testing of roadworthiness, road inspection and vehicle registration

European Legislation & Regulation (3/4)

- Similar acts by some European countries like France, Sweden, the Netherlands and Spain
- UK's "Automated and Electric Vehicles Bill 2017-19" (2017):
  - defines insurance issues when automated or self-driving cars are involved in car accidents
  - Includes the human "driver" as a person that should be compensated in case of an accident when the vehicle is driving itself
- Germany's "Automated and Connected Driving" Report:
  - Aim: the development of necessary ethical guidelines for automated and connected driving
  - Conclusion: Eleven issues (dilemma situation, equality, subjugation to technical systems, liability and utilization of collected data, etc.)

European Legislation & Regulation (4/4)

- **Data privacy and sharing**:
  - European Union's Directives: 95/46/EC, 2005/58/EC, 2006/24/EC, 2009/136/EC, 2016/680/EE & 2016/681/EE
  - EE Convention for the "Protection of Human Rights and Fundamental Freedoms"
  - Regulation 2016/679 on the "protection of natural persons with regard to the processing of personal data and on the free movement of such data"
  - European Commision Organisations: DG MOVE, DG JUST, DG CNECT & DG GROW → towards an easy, safe and more effective way of universal data.
  - European's Commision report : "the protection of personal data and privacy is a determining factor for the successful deployment of cooperative, connected and automated vehicles".

USA Legislation & Regulation (1/3)

- As of 2011: Amendments to existing legislation or new legislation concerning CAVs by 21 U.S. states → **aim**: Introduction of definitions, regulations concerning on-road testing and deployment & liability issues
- Biggest Problem: each state adopts and enacts its own laws → different standards → need of a common legal framework
- NHTSA: Federal Automated Vehicles Policy (2016) → guidance rather than rulemaking → up to manufacturer to comply or not with its content
  - Vehicles compatible with Federal Motor Vehicle Safety Standards (FMVSS) are allowed to travel on public roads → applies to Highly Automated Vehicles (HAVs) → no legal obstacles if a HAV is compatible
  - Description of ways for training autonomous vehicles' drivers, for registration and certification, post-crash behavior, data recording and sharing as well as privacy maintenance

USA Legislation & Regulation (2/3)

- State Legislation: Nevada, California and Michigan first three states

STATE / CONTENT	Definitions / Committee on CAVs	Testing	Platooning	Public Operation	Liability Issues	Bill, Year
Alabama	X					SJR 81, 2016
Arkansas	X	X	X	X		HB 1754, 2017
California	X	X	X		X	SB 1298, 2012 / AB 1592, 2016 / AB 669, 2017 / AB 1444, 2017 / SB 145, 2017
Colorado	X	X			X	SB 213, 2017
Connecticut	X	X		X		SB 260, 2017
Florida	X	X	X	X	X	HB 1207, 2012 / HB 599, 2012 / HB 7027, 2016 / HB 7061, 2016
Georgia	X			X	X	HB 472, 2017 / SB 219, 2017
Illinois	X					HB 791, 2017
Louisiana	X					HB 1143, 2016
Michigan	X	X	X	X	X	SB 996, 2016 / SB 997, 2016 / SB 998, 2016 / SB 169, 2013 / SB 663,2013
Nevada	X	X	X	X	X	AB 511, 2011 / SB 140, 2011 / SB 313, 2013 / AB 69, 2017
New York	X	X				SB 2005, 2017
North Carolina	X		X	X		HB 469, 2017 / HB 716, 2017
North Dakota	X					HB 1065, 2015 / HB 1202, 2017
South Carolina	X		X			HB 3289, 2017
Tennessee	X	X	X	X	X	SB 598, 2015 / SB 2333, 2016 / SB 1561, 2016 / SB 676, 2017 / SB 151, 2017
Texas	X	X		X	X	HB 1791, 2017 / SB 2205, 2017
Utah	X	X				HB 373, 2015 / HB 280, 2016
Vermont	X					HB 494, 2017
Washington, D.C.				X	X	DC B 19-0931, 2012

USA Legislation & Regulation (3/3)

- **Data privacy and sharing: 3 Categories of legislation**
  - **Constitutional protections:** 4th Amendment of the U.S. Constitution guarantees the "*right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures*".
  - **Federal laws:** regulation of the collection, use and disclosure of data in the finance and health sectors *(Privacy Act of 1974, Electronic Communications Privacy Act (ECPA), Computer Fraud and Abuse Act (CFAA))*
    - Federal Trade Commission : FTC Act on "*unfair or deceptive acts or practices in or affecting Commerce*"
  - **State laws:** Focus on privacy-related issues, such as data disposal, privacy policies and security breach notification

Greek Legislation & Regulation (1/3)

- Driver behavior, driver liability and vehicle registration → traffic rules, civil and criminal laws
- Road Traffic Regulation: Amended in 2012
  - Part one : definitions and general behavioral directions & rules on road infrastructure (e.g. road marking)
  - Part two : Technical requirements of vehicles and necessary skills of drivers → legally licensed
  - Part three: Penalties imposed to rule violators
  - Part four: Annex of all signs used in the Greek road network.
- Governmental law *"On Vehicle Criminal responsibility and Liability"* established in 1911.

Greek Legislation & Regulation (2/3)

- The 2012 Road Traffic Regulation sets a huge obstacle for AV implementation → According to paragraph 1 of article 13 *"All moving vehicles or combination of vehicles must have a driver"*.
- **Exception** : Established in 2014 (Government law No 4313), to allow registration of a self-driving bus, in the city of Trikala, integrated with city Mobil 2 EU's project.
  - Bus was monitored through cameras and a licensed driver was responsible to remotely stop the vehicle in case of an emergency → Driver was considered **liable** in case of an accident as if he was actually driving the vehicle

Greek Legislation & Regulation (3/3)

- **Data privacy and sharing: EU Directives & Government Laws & Hellenic Data Protection Authority's (HDPA) decisions**
  - **Law 2472/1997:** *"Protection of people from processing of personal data"* → Processing of personal data is legal if: ***(a)*** Collected in legally defined ways, ***(b)*** Under specified purposes , ***(c)*** On the amount that is absolutely necessary in order to serve these purposes , ***(d)*** After authorization is granted
  - **Law 3471/2006:** Amendment of the 2472/1997 law → involves electronic communications & embodies Directive 2002/58/EC of the European Union to Greek legislation → regulations on position and travelling data that is collected and processed

Greek Legislation & Regulation (3/3)

- **Data privacy and sharing: EU Directives & Government Laws & Hellenic Data Protection Authority's (HDPA) decisions**
  - **Law 3783 /2009:** Management of the way mobile phone users and service providers are identified.
  - **Law 3917/2011**: Embodies Directive 2006/254/EC of the European Union to Greek legislation → Determination of how data is stored after processing
  - **Hellenic Data Protection Authority's (HDPA) Acts:**
    - on Traffic Management Cameras (Decision 58/2005)
    - on the operation of CCTV systems in public areas (Opinion 1/2009)
    - Directive for the secure destruction of personal data after the end of the period that is required for the accomplishment of the processing purpose (Directive 1/2005) and Decision 91/2009

Conclusions

- Liability in case of an accident is an important issue, originating from the fact that current legislation requires a driver to be sitting behind the wheel
- Data privacy and security are under investigation
- USA States and EU have introduced new legislation → still lot of work to be done

Thank you for your attention

Traffic, Transportation and Logistics Laboratory

4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Investigating the role and potential impact of social media on mobility behavior

Maria Karatsoli - UTH

Eftihia Nathanail - UTH

Sponsors:

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With the support of:

Outline

- Big Data
  - Qualitative big data sources
- Social Media
- Social media survey
  - ✓ Social media survey results
- Findings- further research
- References

Big Data

Big data refers to all those data whose scale, diversity and complexity require new analysis techniques and algorithms (Chandrasekar, 2015).

Source: Google image

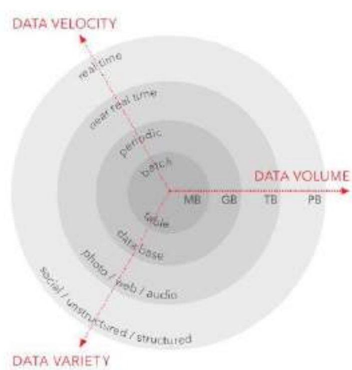
Big Data

"3 Vs"

- High Volume
- Velocity
- Variety

✓ Value

✓ Veracity



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Qualitative big data sources

- Social media
- Points Of Interest
- Community driven navigation apps
- Tourism related social websites

Source: Google images

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Social Media

- Large sample of qualitative data i.e. social-economic, demographic, and social network information
- Exact location of user
- Highly active data
- Useful data for evaluation stages
- Low cost

Source: Google images

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Social media survey

- 55 questions
- Three main parts: Before- During – After an activity/(trip)

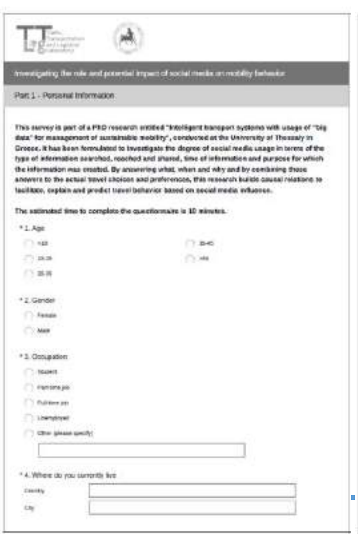
✓ Investigate the role and potential impact of social media on mobility behavior

✓ Campaigns and awareness- raising strategies

✓ Social media data

Source: SurveyMonkey

Social media survey- Personal Information


Investigating the role and potential impact of social media on mobility behavior

Part 1 - Personal Information

This survey is part of a PhD research entitled "Intelligent transport systems with usage of "big data" for management of sustainable mobility", conducted at the University of Thessaly in Greece. It has been formulated to investigate the degree of social media usage in terms of the type of information searched, reached and shared, time of information and purpose for which the information was created. By answering what, when and why and by combining these answers to the actual travel choices and preferences, this research builds causal relations to facilitate, explain and predict travel behavior based on social media influence.

The estimated time to complete the questionnaire is 10 minutes.

* 1. Age

* 2. Gender

Female

Male

* 3. Occupation

Other (please specify)

* 4. Where do you currently live

Country

City


* 5. Do you own a drivers' license?

Yes

No

* 6. Which transport mode do you use mainly during an activity?

Car

Bike

Public transport

Walking

Other (please specify)

* 7. How often do you use public transport?

Often

Sometimes

Never

* 8. Which electronic devices do you use?

Desktop

Laptop

Tablet

Smartphone

Cell phone

Other (please specify)

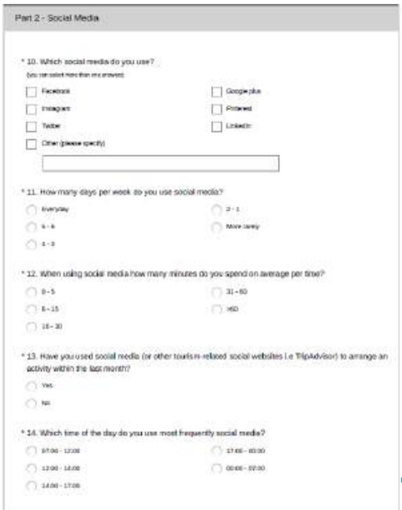
* 9. Do you use social media?

Yes

No

Source: SurveyMonkey

Social media survey: Use of social media



Source: SurveyMonkey

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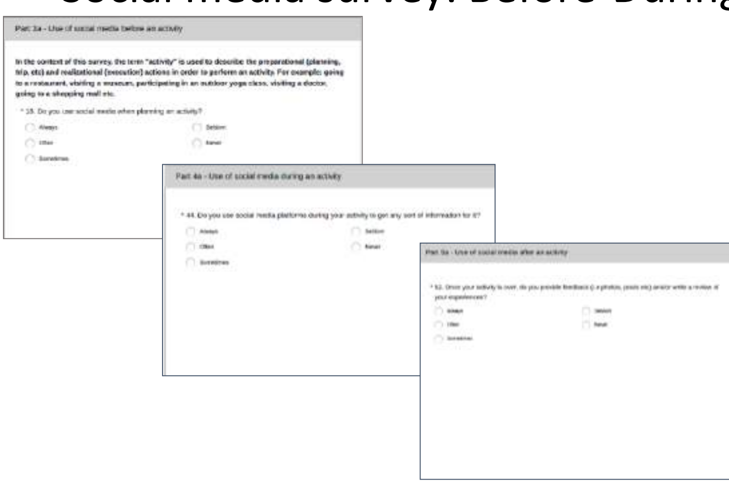
Social media survey: Before-During-After



Source: SurveyMonkey

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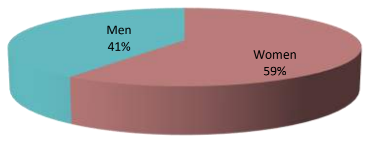
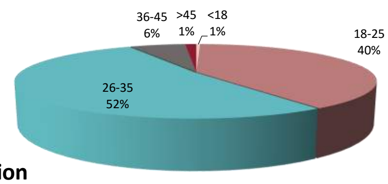
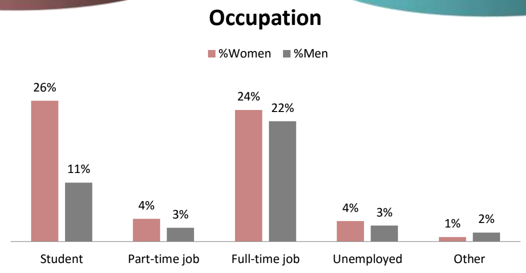
Social media survey

- 237 participants



Age of participants





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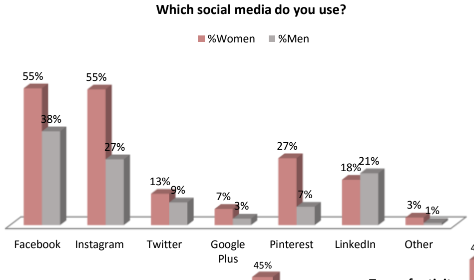
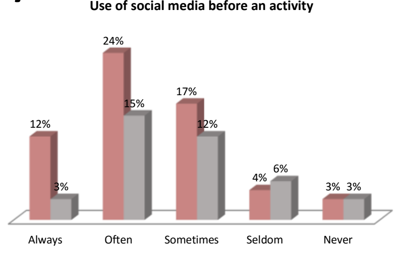
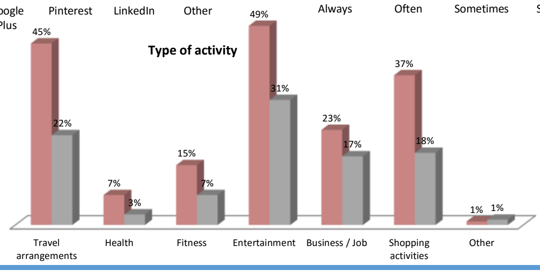
Social media survey- Results







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Social media survey - Results (Women - Men)

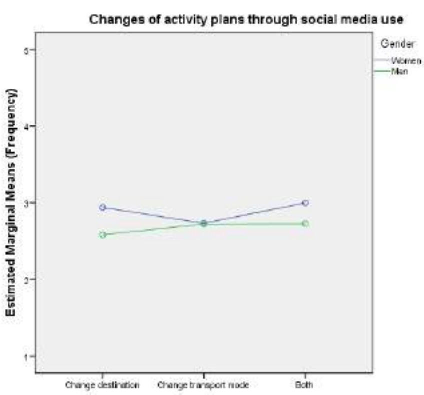
- **10% of the respondents** answered that they never use public transport while **53% of them** responded that they always use it. Women (M=3.61, SD=1.11) use more often public transport than men (M=3.13, SD=1.27), with statistically significant differences between them (p-value<0.05).
- **66% of the respondents** never share fake information both women (M=1.24, SD=0.54) and men (M=1.22, SD=0.56) rarely share fake information with the difference between them not being statistically significant (r=-0.04, p-value>0.05)
- **38% of the respondents** are often affected by photos/videos shared on social media regarding a place visit/activity, both women (M=3.93, SD=0.81) and men (M=3.58, SD=0.87) are often affected, the differences between the two groups of comparison were statistically significant (p-value<0.05).

*Scale: 1 Never, 2 Seldom, 3 Sometimes, 4 Often, 5 Always

Parameters	Groups						
	Women		Men		W vs. M		
	M	SD	M	SD	z-statistic	Effect size (r)	p-value
Use of public transport	3.61	1.11	3.13	1.27	-2.67	-0.18	0.008*
Share of fake information	1.24	0.54	1.22	0.56	-0.65	-0.04	0.515
Purchase of products seen on social media	2.56	0.87	2.19	0.8	-3.08	-0.21	0.002*
Impact of reviews on buying decisions	3.69	0.91	3.53	1.11	-0.85	-0.06	0.395
Visit of a place seen on social media	3.01	0.69	2.86	0.81	-1.69	-0.11	0.09
Impacts of reviews on a place visit	3.64	0.87	3.42	0.87	-1.83	-0.12	0.067
Impact of photos/videos shared on social media on a place visit	3.93	0.81	3.58	0.87	-2.94	-0.20	0.003*
Importance of the proposed transport mode on final decision	2.9	0.97	2.93	1.05	-0.31	-0.02	0.76
Impact of social media use on activity plans	2.71	0.79	2.57	0.9	-0.94	-0.06	0.35
Share of activity's information on social media before its occurrence	2.22	0.74	2.3	0.8	-0.56	-0.04	0.59
Help of social media in activity planning	3.4	0.99	3.27	0.91	-1.34	-0.09	0.22

M: average rating, SD: Standard Deviation, *statistically significant (p-value< 0.05)

Social media survey- Results



•Both women and men change transport mode after use of social media with the same frequency.

•Women change both destination and transport mode more frequently than men.

• A change in activity plans is not relatively significant either with the gender (p-value=0.197) and the type of change (destination/mode or both) (p-value=0.690) or the combination of them (p-value=0.538).

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Findings- further research

- Facebook and Instagram are the two most used social media
- 94% of the participants use social media before an activity
- 67% of the participants use social media for travel arrangements
- A negative review affect more the activity planning of both men and women
- Both women and men visit often a place seen on social media
- The proposed transport mode affects often the final decision regarding activity planning
- According to participants the use of social media often helps the activity planning.

✓ Investigate the role of social media during and after the activity
✓ Types of big data on social media
✓ Investigate the role of quantitative big data on ITS

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Thanks for
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4th Conference on Sustainable Urban Mobility – CSUM2018

24-25 May, 2018, Skiathos Island, Greece

Campaigns and Awareness-Raising Strategies on Sustainable Urban Mobility

Vissarion Magginas, Maria Karatsoli, Giannis Adamos, Eftihia Nathanail

Presentation Structure

- Introduction
- Methodology
- Awareness-Raising Strategies and Campaigns
- Survey Sample
- Survey Results
- Conclusions

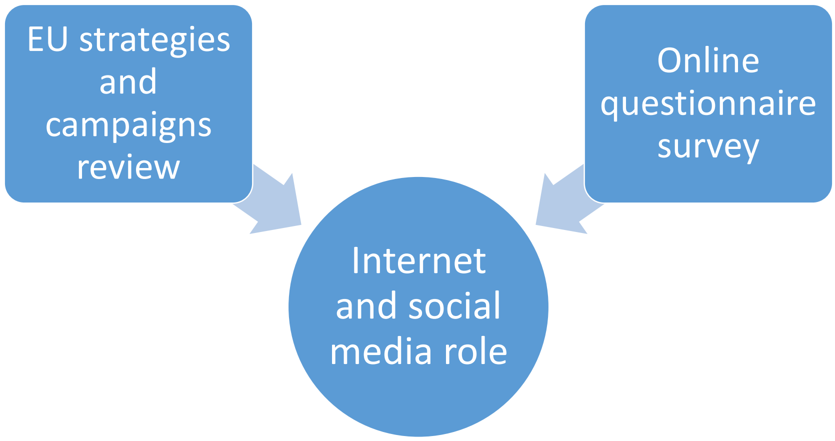
Introduction

- Cities accommodate over 70% of world population
- Urbanization is constantly increasing
- Urban mobility is becoming unsustainable
- Need for Sustainable Urban Mobility Plans (SUMPs)

Introduction

- Citizens need to be informed and involved
- Use of awareness-raising strategies and formulation of promotional campaigns
- Study purpose:
  1. Awareness-raising strategies and campaigns in the digital era
  2. How can social media and the internet support awareness-raising strategies and campaigns?

Methodology



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Awareness-Raising Strategies and Campaigns

- **Ten** cases implemented in the EU
- All of the cases were **part of a larger sustainable mobility project**
- Data collected for **country of implementation, main objective, media plan, evaluation method, theme and target group**

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Awareness-Raising Strategies and Campaigns

Table 1. Overview of European Union campaigns and strategies

Campaign/strategy	Country	Objective	Media plan	Evaluation	Theme	Target group
ASTUTE	Several	Overcoming organizational barriers	Internet, brochures, local events	Longitudinal study	Cycling, walking	City inhabitants
Today and Tomorrow	Cyprus, Portugal, Italy	University mobility impacts reduction	Internet	Questionnaires, interviews	Carpooling, bike-sharing	Students and faculty
The Traffic Snake Game Network	18 EU countries	Travel behavior change	Internet, local events, posters	Before-after analysis, longitudinal study	Cycling, walking, car-sharing, public transport	Primary school children and parents
MOBI	Several	Travel behavior change	Internet	Longitudinal study, after analysis	Cycling, walking, car-sharing, gamification	23,400 employers of 117 companies
AENEAS	Several	Alternatives to car use	Internet, brochures, newsletters	Questionnaires	Walking, cycling, public transport	Senior citizens
SWITCH	Several	Soft modes promotion for short trips	Internet, local media	Before-after analysis	Walking, cycling	City inhabitants
MoMa.BIZ	Several	Business & industrial zones mobility issues	Internet, local events	Before analysis	Mobility issues	Business & industrial zones commuters
PRO.MOTION	12 EU countries	Influencing travel decisions at home	Several	SUMO evaluation method, Before-after behavioral analysis	Public transport, car-sharing, walking	City inhabitants
Casteddu Mobility Styles	Italy	Light metro service promotion	Internet	Before-after analysis	Metro service	Car users
CIVITAS	Portugal	Sustainable transport behavior	Internet, local events, posters, flyers, local press	Questionnaires, interviews	Eco-driving, school mobility, public transport	Residents, students

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Awareness-Raising Strategies and Campaigns

- Always part of a larger project
- Significant financial and political support by the EU
- Organized by multiple organizations
- Scope mostly local

solutions

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Awareness-Raising Strategies and Campaigns

- Varying target groups
- Main objective was the promotion and adoption of the sustainable urban mobility concept
- Theme was the promotion of a combination of public transport and “soft” modes
- Informative and positive approach adopted

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Awareness-Raising Strategies and Campaigns

- Many media outlets and promotion material used
- Very limited use of social media
- Final evaluation using performance indicators
- CO_2 emission reduction and alternative modes use increase were the most commonly used performance indicators

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Survey Sample

- 237 participants
- 56% female and 44% male
- 40% 18-25 years old, 52% 26-35 and 6% 36-45
- 47% employed full-time, 7% employed part-time, 7% unemployed and 37% students
- 80% live in Greece

Survey Results

- Sample grouped based on gender and employment status
- 97% of the respondents use social media
- Facebook and Instagram most commonly used
- Male participants also use professional themed social media
- Female participants use image-based social media

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Survey Results

- Time a social media post is uploaded of significant importance
- Majority of users motivated by a designated transport social media account post
- Majority of users prefer humorous and/or informative message

Survey Results

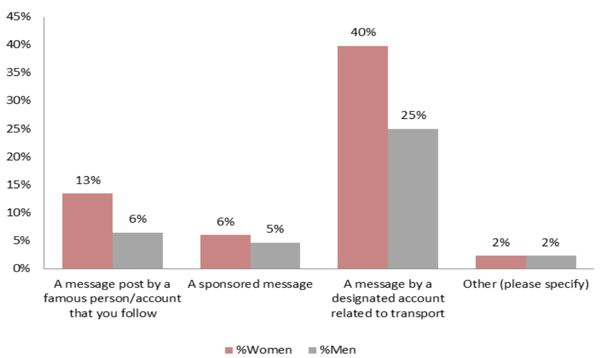

Fig. 1. Preferences on the approach of raising awareness on traveling possibilities depending on gender

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Survey Results

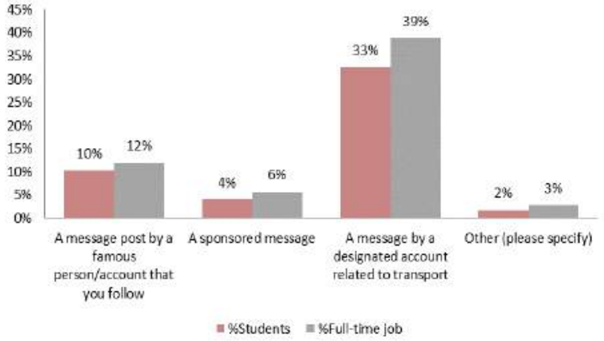

Fig. 2. Preferences on the approach of raising awareness on traveling possibilities based on employment status

Survey Results

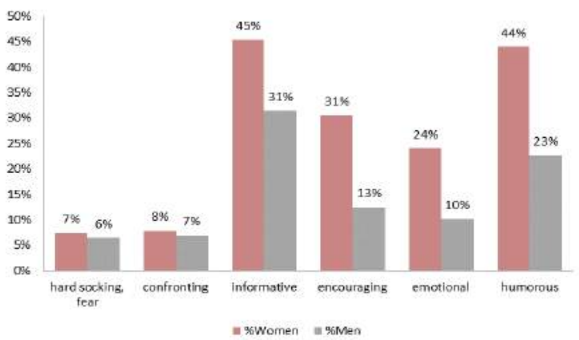

Fig. 3. Preferences on message appeal based on gender

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Survey Results

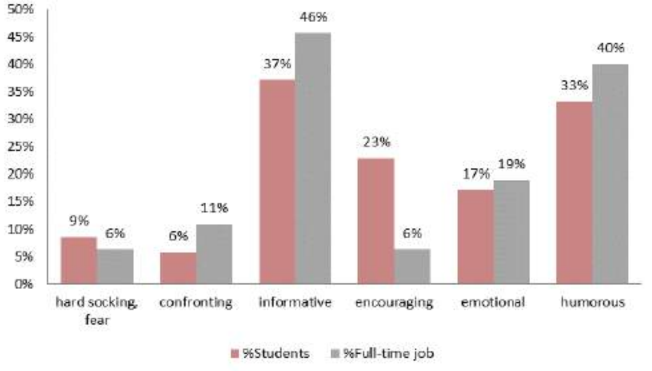

Fig. 4. Preferences on message appeal (students, full-time job)

Conclusions

- **Social media** have the potential to reach a wide range of audiences
- A **humorous message** promoted through **social media** by a **designated transport account** could help communicate the concept of sustainable urban mobility
- The formulation of a **framework** supporting the creation of **digital campaigns** is an important step towards the popularization of **sustainable mobility awareness campaigns**
- Need for further investigation regarding the **interaction** between **social media users** and the **content of a digital campaign**

THANK YOU FOR YOUR ATTENTION!

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