Book of Abstracts

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PLENARY SESSION

RESPONSIBLE PRODUCTION LIFE CYCLE, LOGISTICS AND BIG DATA: JOURNEY FROM SINGLE INNOVATIONS TO SCALABLE SOLUTIONS

Professor Esa Hämäläinen, University of Turku (Finland) - Director Brahea Centre

Abstract: The Intergovernmental Panel on Climate Change (IPCC) has stated that climate change is a major ongoing process requiring strict restrictive actions on a global level. Also, other environmental challenges like “plasticification” of the world sea water is a huge and global thread, which should be mitigated. In every fields of human activities actions like recycling, zero CO2 production and responsible operations are expected. However, systems and functions in industries and public sectors have become extremely complicated, which are difficult to make emissions free. Also there are huge differences between countries how responsible production should be understood and organized. Logistics, transportation and supply chain processes in many industries are producing large amounts of emissions. Even if maritime logistics respond only fraction of total global CO2 emissions (round 2.6 %), locally, like in port areas, ships are producing heavily various polluting substances. In large process industries there are plenty of different activities, long and complicated supply chains, large volumes of chemical usage and some of them are not really environmentally friendly. To make this kind of manufacturing sectors and logistics chains responsible need a plenty of time series data (big data) for deeper analysis before making right correcting decisions from sustainable view. When making sustainable environmental investments these should be, when it is possible, scalable-type of solutions, which means that environmental improvements (output) grow much faster than the investment figures (input) grow. Also, when making for example maritime vessels environmentally good, there are plenty of usable options in different operational areas in ships. Together these solutions could make maritime sector to become even totally green and zero-emission. Without valid and reliable continuously collected data and internationally binding legislation responsible and zero-emission society is really difficult to achieve.
**OPTIMIZATION AND MODELING IN LOGISTICS AND TRANSPORTATION**

**FORECASTING FUTURE TRENDS IN FREIGHT TRANSPORT IN SLOVENIA UNTIL THE YEAR 2030**

Dejan Dragan, Vlado Popović, Abolfazl Keshavarz, Borut Jereb, Tomaž Kramberger

Abstract: Slovenia regarding the freight traffic belongs at the very top of the EU, while every sixth truck is excessively overloaded. The main aim of the present study is to accurately forecast future freight traffic on the highways until the year 2030. For this purpose, the adequate Box-Jenkins time series model has been identified. In order to obtain the best possible structure and parameters of a final model, a unique heuristic modeling framework containing an entire composition of different rigorous statistical criteria has been applied. For making predictions of future freight transport, a Monte Carlo scenario-playing framework has been conducted. The results show that an interval forecast (16458, 20671) million Tkm with a 95% likelihood is expected at the beginning of 2030. Regarding the practical point of view, this study has contributed to a decision-making process while studying different planning approaches about adequate fees’ systems for trucks on the highways.

Keywords: Transport Planning, Forecasting Models, Monte Carlo Procedure, Road Freight Transport in Slovenia.

**MODELING ALLOCATION OF HIVES**

Juraj Pekár, Marian Reiff, Ivan Brezina

Abstract: The contribution of insect pollinators to the economic output is obvious. Several alternative bee species have been identified to be capable of replacing or at least supplementing decreasing number of honey bees. Our research aim to deal with location of nesting aids for solitary bees in orchards using mathematical programming models for determining the optimal location of nesting aids and thus can be used to optimize the management of solitary bees.

Keywords: hive location, pollination management, crop pollination, Osmia cornuta.

**BENEFITS FROM COOPERATION BEHAVIOUR IN VEHICLE ROUTING PROBLEM**

Zuzana Čičková, Dana Figurová

Abstract: In transport systems, there are usually more distribution companies that must serve their customers. Obviously, if companies could cooperate with each other this kind of cooperation can lead to some additional benefits for them. In this paper, we focus on the situation where we anticipate the existence of multiple companies. Each of these companies owns one central depot whereby their customers are served by different types of vehicles. In the case of non-cooperation behavior, each of the companies act independently. However, if we allow the coalition formation between the companies and consider joint customer service, there may be a reduction in the shipping costs resulting from a better customer allocation to the depot. Other benefits may accrue from the simultaneous use of the depots which means that the vehicle can be repeatedly reloaded at another depot (not the starting one). In this paper, we will introduce the new mathematical models to describe these situation. We will also focus on the possible ways of the redistribution these benefits in terms of Game Theory.

Keywords: Cooperative Game Theory, Game Theory, Vehicle Routing Problem, redistribution.
A TWO-STAGE APPROACH BASED ON DEA FOR DESIGNING EFFICIENT MATERIAL HANDLING SYSTEMS

Amar Oukil

Abstract: The process of selecting material handling (MH) models as well as evaluating related MH systems is a milestone for the design of manufacturing and logistics facilities. In order to support managers towards this process, we propose a new methodology, based on data envelopment analysis (DEA), and deploying over two stages. In the first stage, the best MH models are selected on the ground of the MH manufacturer’s technical specifications and market prices. In the second stage, alternative MH systems are produced through combinations of best MH models picked in preset numbers, from different category pools, according to a set of criteria. For both stages, we develop a DEA cross-evaluation framework that exploits the voting system embedded under the cross-efficiency matrix and integrates the manager’s subjective judgment as an essential component of the decision making process. The proposed procedure is illustrated using a sample of MH equipment collected from catalogues of MH manufacturers and vendors.

Keywords: Material handling equipment, Data envelopment analysis, Design evaluation, Modelling.

A FUZZY-AHP APPROACH TO EVALUATE THE CRITERIA OF THIRD-PARTY LOGISTICS SERVICE (3PL) PROVIDERS

Stefan Jovčić, Petr Průša, Josef Samson, Dragan Lazarević

Abstract: This paper deals with the criteria that should be taken into consideration when making a decision about Third-Party Logistics (3PL) service providers and their evaluation. Not all the criteria is equally important, so it is necessary to evaluate them in order to determine the priority and help the company to make a decision. The criteria for 3PL assessment were defined by consulting several experts in the field of logistics. It is very important to analyze and evaluate 3PL providers because there are a very large number of providers in the market and for the company it is very important to choose the right one, based on the relevant criteria. The methodology used for evaluation of the criteria is based on Fuzzy-AHP (Analytic Hierarchy Process) approach. This approach combines the Saaty’s scale (which gives the value of most importance in the statements-criteria) and fuzzy logic (which deals with the linguistic statements). The main result of the paper is to rank the criteria by importance and direct it for the further research in the field of 3PL.

Keywords: Third-Party Logistics (3PL) Service Provider, Fuzzy-AHP approach, 3PL evaluation criteria.

FUZZY LOGIC APPLICATION IN GREEN TRANSPORT - PREDICTION OF FREIGHT TRAIN ENERGY CONSUMPTION

Jovana Ćalić, Milica Šelmić, Dragana Macura, Miloš Nikolić

Abstract: Rail freight transport is one of the most preferred modes of green transport since it emits three times less CO2 and particulates per ton-mile than road transport. Train energy consumption is the biggest issue related to rail traction costs. Data about freight trains energy consumption per year are not possible to define precisely, so it is convenient to use fuzzy logic as a tool for data prediction. In order to predict it, we provide Wang - Mendel method for combining both numerical and linguistic information into a common framework – a fuzzy rule base. Relevant input variables are: freight train kilometers, average freight trains weight and non-productive kilometers. The output variable from the defined fuzzy logic system is average energy consumption per year for rail freight transport. The proposed model is applied and tested on real data collected in the Republic of Serbia.

Keywords: Train energy consumption, Rail freight transport, Prediction model, Wang-Mendel method, Fuzzy rules.
AN APPLICATION OF DATA ENVELOPMENT ANALYSIS (DEA) TO MEASURE THE EFFICIENCY OF LEADING CARGO AIRLINES

Danica Babić, Slavica Dožić, Milica Kalić

* from the monography Quantitative Methods in Logistics

Abstract: The air cargo industry is very important in the global economy, due to the fact that it is recognized as the main mode of transport for perishable goods, luxury goods, and other high value products. In order to survive in highly competitive market, cargo airlines must identify the needs of their customers and provide the appropriate services. The common measure that implies how much a firm can meet its predetermined goals is the efficiency. This paper provides the efficiency analysis of the 18 world leading cargo airlines in 2017. A Data Envelopment Analysis (DEA) models with three inputs and two outputs are created to assess and optimize the cargo airline productivity. In these models the efficiency indicators such as number of employee, number of aircraft and offered capacity are defined as inputs, while realized traffic and revenue are defined as outputs. The basic model was used to evaluate the efficiency of the selected cargo airlines and it provides satisfactory results. However, in order to improve these results and to evaluate the operation indicators which affect cargo airline efficiency and which are not in the same order of magnitude, the weighted DEA is proposed. The weights are derived by using Analytic Hierarchy Process (AHP). The results of the models include a benchmark and cargo airlines ranking, as well as the directions for improving the efficiency of inefficient airlines. Moreover, it is shown that the weighted DEA provides more logical results, since the relationship between the indicators is defined in accordance with their real significance. It should be noted that this is the first research where integrated AHP and DEA are used for assessing the efficiency in cargo airline industry. The high flexibility of the proposed models enables its application on different markets as well as on all types of airlines.

Keywords: Cargo Airline Efficiency, Data Envelopment Analysis (DEA), Analytic Hierarchy Process (AHP).

A BI-OBJECTIVE APPROACH FOR DESIGNING END-OF-LIFE LITHIUM-ION BATTERIES LOGISTICS NETWORK

Branislava Ratković

Abstract: This paper presents a bi-objective approach for designing logistics network for end-of-life lithium-ion batteries from electric vehicles. The first objective determines the optimal locations of collection points and treatment facilities, for collecting and processing of end-of-life lithium-ion batteries, with aim of minimizing total costs of the system. The second objective minimizes risk associated with transport of end-of-life lithium-ion batteries for end users located along the routes of transportation vehicles. Proposed model was tested on illustrative example.

Keywords: electric vehicles, lithium-ion batteries, logistics network design.
A MIQP MODEL FOR SOLVING THE VEHICLE ROUTING PROBLEM WITH DRONES

Dražen Popović, Milovan Kovač, Nenad Bjelić

Abstract: The presence of drones in everyday life expands on a daily basis. In the last couple of years, the usage of aerial drones (UAV-Unmanned Aerial Vehicles) in last-mile parcel delivery attracts more and more attention. Some companies (mainly in the USA and Australia) have already tested and applied the usage of drones in the parcel delivery. There are many papers describing a two-phase approach for routing the drone-ground vehicle tandem. Most of the previous work in this domain propose different heuristics, metaheuristics and optimization approaches for the transformation of a given truck route to a truck-drone route. Considering the simultaneous approach for solving the routing problem with drones, the literature is very scarce. The purpose of this paper is to present a novel MIQP (Mixed Integer Quadratic Programming) model of a simultaneous approach to solving the VRPDTW (Vehicle Routing Problem with Drones and Time Windows).

Keywords: MIQP, VRP, Unmanned Aerial Vehicles, Last-mile parcel delivery.

FRAMEWORK FOR SIMULATION ANALYSIS OF PRIORITY QUEUES STRATEGIES IN DETERIORATING GOODS SUPPLY

Milorad Vidović, Dragana Drenovac

Abstract: The Queuing theory has been considered as one of the most important methods which has very wide application in making different improvements of the system performances, which are very often related to decreasing waiting times in queues. In order to reduce waiting time, many different techniques have been studied while the priority queuing models appear to be the most popular. Waiting times are of particular importance in case of deteriorating goods which lose its quality during a time, decreasing its economic value. Therefore, in this paper we propose concept of the simulation model which can analyse effects of priority queues strategies, on the waiting times in deteriorating goods supply. The analysis is based on simulation model implemented in ARENA 15.1. Simulation experiments were realized on numerical examples based on deteriorating goods supply chain.

APPLICATION OF THE METHODOLOGY FOR CALCULATING CARGO HANDLING TARIFFS AT RIVER PORTS

Ivana Vukićević Biševac, Nataša Milešić, Katarina Prskalo, Nataša Vidić, Katarina Vukadinović

Abstract: In this paper, we will discuss several methodologies for calculating cargo handling tariffs at river ports. We will present port tariffs calculations based on the Principle of total costs and present the methodology. We will apply described methodology on one case study: Port “Danube” Pancevo.

Keywords: River ports, Cargo handling, Port tariffs.
LOGISTICS CONCEPTS AND STRATEGIES

COMPETENCE REQUIREMENTS FOR LOGISTICS MANAGERS IN SERBIA: A LONGITUDINAL ASSESSMENT
Biljana Cvetić, Dragan Vasiljević, Miloš Danilović, Nemanja Milenković

Abstract: Today, logistics and supply chain management is attractive and very demanding field for a professional career. The competences that the employers in this field require from employees continue to evolve and change. This paper aims to provide a longitudinal assessment of two studies of online ads of logistics and supply chain management jobs conducted in the Republic of Serbia. Both these studies used the same methodology of collected, coded and analysed job ads. The ads were analysed by deductive content analysis and related quantitative indicators. The aim is to reinforce the results of these studies by searching statistical similarities in professional and fundamental competences of logistics and supply chain managers. Also, several studies done in the US, the UK, Germany, Brazil, etc. will be used for drawing conclusions. The outcomes of this paper can be valuable to educators, to educational and professional institutions, and to other interested parties.

Keywords: logistics and supply chain professionals, competence, longitudinal study, the Republic of Serbia.

SPATIAL COMPETITION WITH REGULATORY INTERVENTION
Zuzana Čičková, Allan Jose Sequeira Lopez

Abstract: In transport systems, there are usually more distribution companies that must serve their customers. Obviously, if companies could cooperate with each other this kind of cooperation can lead to some additional benefits for them. In this paper, we focus on the situation where we anticipate the existence of multiple companies. Each of these companies owns one central depot whereby their customers are served by different types of vehicles. In the case of non-cooperation behavior, each of the companies act independently. However, if we allow the coalition formation between the companies and consider joint customer service, there may be a reduction in the shipping costs resulting from a better customer allocation to the depot. Other benefits may accrue from the simultaneous use of the depots which means that the vehicle can be repeatedly reloaded at another depot (not the starting one). In this paper, we will introduce the new mathematical models to describe these situation. We will also focus on the possible ways of the redistribution these benefits in terms of Game Theory.

Keywords: Cooperative Game Theory, Game Theory, Vehicle Routing Problem, redistribution.

MODELING A HUMANITARIAN LOGISTIICS INFORMATION SYSTEM’S PROCESSES AND INFORMATION NEEDS
Dimitris Folinas, Dimitris Aidonis, Charis Achillas

Abstract: The purpose of this paper is to model the user requirements for an information system for the management of logistics processes of a humanitarian supply chain. The modeling procedure includes the development of the physical architecture as well as UML Diagrams. UML (Unified Modeling Language) is a standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems.

Keywords: Humanitarian Supply Chain, Relief Logistics, Logistics Information Management Systems, Information systems modelling.
ECONOMIC IMPACTS OF SECA REGULATION ON MARITIME COMPANIES IN THE BALTIC SEA REGION – LITERATURE REVIEW AND LOW EMISSIONS RECOMMENDATIONS: PART 1

Esa Hämäläinen, Tommi Inkinen

Abstract: The Intergovernmental Panel on Climate Change (IPCC) has stated that climate change is a major ongoing process requiring strict restrictive actions on a global level. This paper focuses on literature covering the impacts of the Sulphur Emission Control Area (SECA) based on academic papers published in 2017–2018. In numerous studies conducted before 2015, it was predicted that regulation would have serious impacts on maritime businesses. This is the first part of our research introducing the topic. The paper continuous in Part 2.

Keywords: Literature, SECA, Impacts.

ECONOMIC IMPACTS OF SECA REGULATION ON MARITIME COMPANIES IN THE BALTIC SEA REGION – LITERATURE REVIEW AND LOW EMISSIONS RECOMMENDATIONS: PART 2

Esa Hämäläinen, Tommi Inkinen

Abstract: This is the second part of our research. Two publication databases were queried: Science Direct (SD) and Web of Science (WoS). The search query in these channels was performed using keywords “SECA, economic impacts” to investigate how SECA implications were studied for clean business development. Two main topic groups were discovered. The first group includes topics that focus on solving negative impacts (economy of maritime businesses); and the second group consists of topics that focus on the positive impacts on health and the environment, particularly in SECA port regions. After the screening process, the data included 21 papers that matched the query specifications. The decision was made to only use the most recent studies that were completed after 2015. The results indicate that ship owners and fuel producers can use various methods simultaneously to adapt to the SECA regulation.

Keywords: Literature, SECA, Impacts.

CONCEPT AND TECHNIQUES OF SUPPLY CHAIN FINANCE

Jelica Petrović Vujačić, Marko Miljković

Abstract: The paper addresses the relatively new concept of supply chain finance (SCF) and techniques of SCF. The flow of financial resources in supply chains is increasingly becoming the focus of attention. As a consequence, new tasks at the intersection of finance and logistics/supply chain management open new business areas for banks as well as financial and logistics service providers. Supply Chain Finance is defined as the use of financing and risk mitigation practices and techniques for optimizing the management of working capital and liquidity invested in supply chain processes. The concept of SCF covers a wide range of products, programs and solutions in the financing of commerce, including international trade, and has been used to refer to a single product, or a comprehensive range of products and programs of solutions aimed at addressing the needs of buyers and sellers.

Keywords: supply-chain finance, SCF techniques, finance, logistics.
FREIGHT FORWARDING INDUSTRY - THE CONTEMPORARY ROLE AND DEVELOPMENT TRENDS IN SERBIA

Đurđica Stojanović, Marko Veličković

Abstract: The freight forwarding industry has been changed and developed through the history, as a result of the development in trade, transportation, other related industry sectors, logistics and information technologies, laws, and other social, economic and political changes. By using the available literature and analysing the statistical data of EU and Serbia, we examined briefly the current role and development trends in the freight forwarding industry, following the NACE industrial classification of economic activities. The results confirmed that this subsector has a crucial importance within the logistics sector and, consequently, in the national economy on a whole. In the same time, it is highly diversified on the market, "hidden" and underestimated in the classification of activities, and not precisely recognized by current NACE classification. Further, the freight forwarding industry in Serbia shows some specificities comparing to the EU experience.

Keywords: Freight forwarding industry, Development trends, Sectors classification, EU, Serbia.

HUMAN RESOURCES IN LOGISTICS AND SUPPLY CHAINS: CURRENT STATE AND TRENDS

Milorad Kilibarda, Vukašin Pajić, Milan Andrejić

Abstract: This paper presents the results of the research of human resources in logistics and supply chains. The analysis covered different researches in developed and developing countries. The needs and problems with labor shortage, required logistics competencies and skills, as well as problems and solutions related to employment and retention of the labor are considered in detail. The results of the research conducted by authors in the Serbian market are presented. Also results showed that there is a large fluctuation caused by salaries, inability to progress and lack of vision of the company. The research was carried out on a sample of 314 respondents of mainly highly trained logistics specialists in different positions and in different industries. The results of all researches have shown that there is an evident lack of logistics experts in all positions and in all countries and regions. The situation is similar in the Serbian market.

Keywords: human resources, logistics, supply chains, recruitment, retention.

COST OF QUALITY IN DISTRIBUTION LOGISTICS

Vukašin Pajić, Milorad Kilibarda

Abstract: The task of logistics in the field of sales and distribution of the products is to achieve the highest quality of service with as lowest cost as possible. These are two conflicting goals that need to be explored and tackled together with the tendency to come up with an optimal solution. The quality of logistics services is directly linked to costs through two key perspectives. The first refers to the good quality costs, which involve investing in preventive solutions, such as implementation of quality standards, planning, management, control and quality assessment. The second perspective refers to the bad quality costs, which are the consequence of nonconformance, internal and external errors. This paper provides a review of different approaches and models for determining the cost of quality, such as: PAF model, opportunity cost model, process cost model, ABC model and Taguchi’s loss function. The procedure for determining costs in the area of distribution and delivery of the products from the distribution center to the stores is presented. The methodology in this paper includes: mapping and process analysis, identification, quantification and analysis of the quality costs.

Keywords: Cost of Quality, distribution, logistics, PAF model.
BARRIERS TO IMPLEMENTATION OF AUTOMATED COMMERCIAL VEHICLES IN GOODS DISTRIBUTION

Marko Stokić, Vladimir Momčilović, Davor Vujanović

Abstract: Development of automated vehicles (AV) has gained additional impetus due to a significant lack of professional drivers throughout Europe and America in recent years. Other latent problems are vehicle overloading, whose responsibility is the proper/inadequate cargo distribution and securing in the AV cargo compartment and its access control, how the freight loading/unloading/reloading will be carried out, as well as legal and financial liability in case of vehicle stability loss due to improperly distributed and secured cargo. There is a problem of allocating responsibility in case of AV malfunction or breakdown in operation, as well as who will generate requirements for vibration or noise related AV maintenance. Will it be necessary to change existing Incoterms rules or introduce new ones? Potential AV implementation barriers will be identified and reviewed in this paper, questions raised and suggested possible solutions to those issues, as well as defined potential supply chain actors’ liability when involving automated vehicles.

Keywords: automated commercial vehicles, logistics chain, barriers, responsibility, road safety.

CROWD LOGISTICS - A NEW CONCEPT IN REALIZATION OF LOGISTICS SERVICES

Milena Jeremić, Milan Andrejić

Abstract: Crowd logistics is based on the idea of a network of connected members that realize the transport of goods in order to improve the efficiency and sustainability of the physical movement of goods, as well as their storage, delivery and use around the world. Crowd logistics relies on individuals who are connected with mobile technologies and focus is on small operations. The essence of crowd logistics is to create a connection between people who have certain logistics resources and those with logistics needs. The aim is to minimize inefficient use of resources and use free capacities. In this paper the solutions applied in practice have been explored. Among other things, a detailed overview of different types has been given. In this research 73 active services were identified and divided in three new groups defined in this paper. An increase in the number of new services on an annual level of about 10% was observed.

Keywords: crowdsourcing, crowd logistics, delivery, network.
INTERMODAL TRANSPORT AND LOGISTICS TERMINALS

INITIATIVES AND ACTIVITIES FOR THE DEVELOPMENT OF INTERMODAL FREIGHT TRANSPORT IN SLOVENIA

Marina Zanne, Bojan Beškovnik

Abstract: European Union (EU) has a strong focus on developing intermodal transport as a solution to slow down the growth of unimodal road freight transport. Different strategies and approaches have been undertaken by the EU, where the modernization of railway infrastructure and service standardization step out. At the same time, also the national governments have a significant role in promoting and encouraging the use of intermodal transport. In this paper, the authors provide an overview of intermodal transport development in Slovenia. They assess different national measures and programmes that can be applied, in order to support the intermodal transport, and investigate the application of these measures. To conclude, they create a list of suggestions on future activities for promotion of intermodal transport in Slovenia, in order to support EU and primarily central European region’s expectations for the use of southern maritime European transport route and the two core network corridors.

Keywords: intermodal freight transport, intermodal corridors, intermodal connectivity, EU initiatives, national measures.

LOGISTICS CHARACTERISTICS OF GOODS AND CONTAINERIZATION LEVEL

Marinko Maslarić, Svetlana Nikoličić, Sanja Bojić, Borna Debelić, Siniša Vilke

Abstract: The phenomenon of containerization is a well-researched theme. However, these researches are mainly in the context of new technical and technological issues and challenges, necessary for realization of such an transport technology, as well as dynamics of containerization and contemporary business models. The investigation of cargo being carried by containers appears to be underrepresented, which can be result of thinking that container represent the transport unit (box) that replaces a large number of smaller packages so it is primarily intended for general cargo. Containers could be used for transport of a large number of different types of goods, and types of packages, whether the level of containerization of particular goods depends on several factors. This paper aims at analyzing these factors in containerized level. It also looks at developing of special diagram showing the compatibility between the particular freight and container types. This paper will demonstrate how this diagram could be used on simple way in finding which types of container is suitable for specific types of commodity.

Keywords: commodity, freight density, containerization, diagram.
THE INFLUENCE OF CHINA TO THE CONTAINER MARKET IN EUROPE

Elen Twrdy, Milan Batista

Abstract: European economy, which has been one of the most important ones for centuries, greatly depends on maritime transhipment. After the European Commission’s data, 74 % of cargo, which arrives or departs from Europe, does so by sea and therefore, we can clearly see the importance of ports for economic growth. Over the past decades, container throughput (TEU) has become one of the most important means of transporting cargo, so ports have quickly adapted themselves – with the new equipment and better capacities. Thus, in 2000, the container handling in EU ports represented as much as 21 % of all transhipped containers in the world, meanwhile, this percentage was only 18 % in Chinese ports. Today, China has become a leading country in the container throughput, with an increase of 28 %, while the EU has fallen to 15 %.

Keywords: containers ports, container throughput, port competition.

ELEMENTS FOR DEFINING THE INTERMODAL TERMINALS STRUCTURE

Mladen Krstić, Snežana Tadić, Slobodan Zečević

Abstract: In order to meet increasingly complex requirements in the fields of logistics and transport, intensive development of intermodal transport networks is necessary in which intermodal terminals (IT), as nodes in these networks, play a key role. ITs are dynamic and complex systems that can differ in terms of various elements (functions, services, subsystems, users, applied technologies, etc.) that define the different terminal structures. The subject of the paper is the comprehensive identification and classification of these elements in order to create the preconditions for defining IT typical structures and their further analysis, evaluation, comparison, etc. The paper identifies and describes 13 elements classified into four levels: organizational, operational, physical/spatial and technological.

Keywords: intermodal terminal, structure, element.

MODELING THE STRUCTURE OF THE LOGISTICS CENTERS

Snežana Tadić, Mladen Krstić, Slobodan Zečević

Abstract: Growing competition in the global market imposes the need for proper planning of logistics processes and development of logistics networks, where logistics centers (LCs) as nodes in these network play a key role. LCs can have different structures defined by various elements characteristics, and accordingly different efficiencies. In order to identify those that would represent benchmarks for other LCs it is necessary to define the broadest set of possible structures. However, in practice a number of structures is limited, which doesn’t mean there might not be some which would be competitive or more efficient than the existing ones. Therefore the goal of this paper is the modeling of potential LC structures, based on the identified dependencies between the elements characteristics and the existing structures’ efficiencies. The model is tested in a case study of modeling a potential intermodal terminal structure as one of the possible LC forms.

Keywords: modeling, structure, logistics center, intermodal terminal, efficiency.
SUPPLY CHAINS MANAGEMENT AND REVERSE LOGISTICS

TOWARDS MORE EFFICIENT LOGISTIC SOLUTIONS: SUPPLY CHAIN ANALYTICS
Svetlana Nikoličić, Marinko Maslarić, Dejan Mirčetić, Alin Emanuel Artene

Abstract: If something cannot be measured, it cannot be managed. This principle can be directly applied in the logistics and supply chains. Establishing and determining the logistical performance and supply chain performance represents the first step towards effective management of these systems. The second step is to use the set of contemporary analytical tools to enhance the effectiveness of logistics and supply chain processes. This is exactly the topic of this paper, since in the era of digitalization, due to the enormous amount of data generated on a daily basis, traditional knowledge and approaches cannot be used to manage logistics and supply chains. In response to technological changes and changes in business processes, the Big Data value is being increasingly studied along with the application of various analytical techniques to support the efficient flow of materials along the supply chain, that is, to effectively plan and manage the supply chain. The aim of this paper is to summarize and describe the existing knowledge about supply chain analytics and to explore how much this issue is being studied at faculties.

Keywords: logistics performances, big data, supply chain analytics.

INFLUENCE OF PRODUCT AND BUSINESS ENVIRONMENT CHARACTERISTICS ON MANAGING SUPPLY CHAIN VULNERABILITY
Jelena V. Vlajić, Jack G.A.J. van der Vorst, Dragan Djudjević

Abstract: Increased changes of trading rules in a global economy, more frequent adverse weather events due to climate change, and other unexpected events add more uncertainty to the ever-present logistics challenges for companies to manage their supply chains. Thus, there is increased theoretical and practical interest to prevent disturbances of logistics operations, as well as to manage disturbances when they occur and avoid supply chain vulnerability. Decreased vulnerability of supply chains is desired as it leads to robust and resilient supply chains. The objective of this paper is to understand how contextual factors, i.e., product and business environment related factors affect relationship between redesign strategies and vulnerabilities in the supply chain. We consider typical redesign strategies, such as the adoption of assurance systems, the use of proactive control, use of redundancy, or enhancing flexibility in supply chains. Seen from the lens of contingency theory, the findings from our literature review suggest that contextual factors affect the link between redesign strategies and vulnerabilities in the supply chain, but further research is needed to examine how each of the contextual factors affect selection and implementation of each redesign strategies used to manage supply chain vulnerabilities.

Keywords: Contingency theory, Prevention of disturbances, Impact reduction.
END-OF-LIFE VEHICLE MANAGEMENT: A SURVEY OF LOGISTICS NETWORK DESIGN MODELS
Vladimir Simić, Branka Dimitrijević

Abstract: End-of-life vehicles are classified as hazardous waste and may cause serious environmental pollution and transportation safety problems with improper management. The end-of-life vehicle management is of vital importance for environment conservation, circular economy and sustainable development. This process is not only profit-oriented, but also dependent on legislations and aimed at reducing health hazards. This paper investigates the current research within the area of end-of-life vehicle management through a brief survey of logistics network design models. The purpose of this paper is to provide a content analysis overview of exclusively peer-reviewed international journal papers published in the period 2013-2019. The distribution list is created to identify primary publication outlets. Finally, on the basis of the performed review, several important avenues for future research are highlighted. This review could provide a source of references for researchers interested toward the optimization modeling of green logistics systems and inspire their additional attention.

Keywords: End-of-life vehicle, Network design, Logistics, Content analysis.

WALKABILITY AND USABILITY OF STREET AFTER RECONSTRUCTION - POTENTIALS FOR REVERSE LOGISTICS
Svetlana Čičević, Magdalena Dragović, Slobodan Mitrović

Abstract: This paper considers the relationship between Walkability and Usability in order to understand the perceptions of residents’ accessibility to community facilities provided after the street reconstruction. To address this goal the assessment framework that includes two corresponding measurement tools has been proposed. The results show that the certain level of walkability has been achieved by the street reconstruction. However, the relationship of usability score with some of the walkability dimensions shows that land mix accessibility is not at the satisfactory level indicating the necessity for the intervention within the examined City area, in terms of the street facilities service efficiency transformation to enhance overall sustainability.

Keywords: neighborhood walkability, system usability, street reconstruction, perception.

OPTIMIZATION METHODS AND HEURISTICS AND THEIR ROLE IN SUPPLY CHAINS AND LOGISTICS
Dejan Dragan, Tomaž Kramberger, Vlado Popović

* from the monography Quantitative Methods in Logistics

Abstract: In the past decades, our capability to solve hard and large optimization problems has improved intensely. The paper addresses a review of optimization methods, heuristics, and metaheuristics. Their role in supply chain management, logistics, and transportation is also discussed. The main goal is to update interested readers about an enormous class of prevailing optimization methods and heuristics that have been designed for solving of numerous types of optimization problems. It is assumed that comprehensiveness of the overview of these methods is one of the main contributions of this paper. In the perspective of actual practice, it is also briefly stressed how and where optimization methods can be effectively applied in the field of supply chains and logistics.

Keywords: Optimization Methods, Heuristics, Metaheuristics, Supply Chain Management, Transportation, Logistics.
WAREHOUSING AND INFORMATION TECHNOLOGIES IN LOGISTICS

PIECE PICKING TECHNOLOGY SELECTION

Dragan B. Đurđević, Momčilo D. Miljuš

Abstract: Order picking is a process that is realized in warehouses of unitize goods and includes all the activities that follow picking of demanded assortment of goods according to its kind and quantity in order to fulfill customers’ demands. Order picking is known to be the most labor-intensive and also one of the most costly functions among all the warehouse functions. Depending on the types of retrieval units, types of order picking can be classified into pallet picking, case picking and piece (broken-case) picking. We focus our research on piece picking technologies. In order picking area piece order picking process could be realized on different and nowadays numerous technical solutions. During warehouse design process, selection and involvement those technologies for defined requirements, limits and functions is hard task. In this paper one approach of solving this problem is presented.

Keywords: piece picking, order picking, warehouse.

BIG DATA ANALYTICS IN LOGISTICS

Slađana Janković, Milorad Kilibarda, Ana Uzelac

* from the monography Quantitative Methods in Logistics

Abstract: The aim of the Big Data analytics is to make data-driven decisions. In this paper will be explored how Big Data analytics could help logistics companies to become data-driven. The main goal of this research was to explore the possibility to predict volume and structure of import and export in the food industry of the Republic of Serbia using supervised machine learning methods. In the first phase, in order to better perceive characteristics of available dataset and calculate the basic quantitative indicators of foreign trade in the food industry of the Republic of Serbia, the dataset is analyzed using standard methods of descriptive statistics. In the second phase, the initial dataset is used to build machine learning models based on different machine learning algorithms. The goals of the models were to predict volume of import or export of food products for different set of independent variables, such as: month, quarter, clearance procedure, import/export country, buyer/seller country, import/export company, customs tariff, etc. Some of the developed machine learning models have shown satisfying performance; therefore, the most important goal of this research has been achieved: the prediction analysis methodology has been defined and verified. All the stages that exist in the process of machine learning: data preprocessing, model building, model evaluating, model testing, and model deployment are thoroughly described in the paper. Only few of the results obtained through descriptive and predictive analysis are presented graphically and tabularly in the paper. The research has shown that Big Data analytics based on machine learning techniques can be successfully applied to predict volume and structure of the foreign trade of a country or company. Models based on the following machine learning algorithms have shown the best performance: Random Forest, k-Nearest Neighbors and Random Tree.

Keywords: Machine learning, Predictive analytics, Logistics, Big Data, Foreign trade.
FOG COMPUTING IN LOGISTICS SYSTEMS

Branka Mikavica, Aleksandra Kostić-Ljubisavljević

Abstract: The extension of cloud computing to the edge of the network through fog computing provides efficient resource utilization and higher performance regarding the delay, bandwidth and energy consumption. Fog computing is not a substitute for cloud computing. It enables data storage and processing at the edge of the network, with the possibility of interaction with the cloud data centers. Therefore, these technologies are adequate complements. Due to numerous advantages, fog computing is a promising technology for many applications, especially latency-sensitive applications requiring real-time processing. This paper analyzes the possibility of fog computing deployment in logistics systems. The benefits of fog computing deployment in an intelligent logistics center are observed. The architecture of a fog computing model in supply chain management is also addressed.

Keywords: fog computing, cloud computing, end devices, logistics systems.

THE CONCEPT OF LOGISTICS 4.0

Gordana Rađivojević, Luka Milosavljević

Abstract: The concept of Logistics 4.0 was created as a consequence of Industry 4.0, emergence of new technological solutions and the use of Internet in business systems. The aim of this paper is to present modern logistics trends, digitization of logistics and description of the concept of Logistics 4.0. The basic components of that concept are: automatic identification, real-time localization, automatic data collection, connectivity and integration, data processing and analysis and business services. The paper presents and describes some of the most important Logistics 4.0 technologies: Internet of Things, wireless sensor network, Cloud Computing, Blockchain, Big Data, robotics and automation, augmented reality, drones, 3D printing and automatic guided vehicles.

Keywords: Logistics 4.0, Industry 4.0, Internet, Digitization, Business.

LOGISTICS INDUSTRY 4.0: CHALLENGES AND OPPORTUNITIES

Vladimir Ilin, Dragan Simić, Nenad Saulić

Abstract: The frequently emerged question between logistics practitioners and theoreticians is how much technology can be leveraged to address the challenges and opportunities that arise in the logistics industry? The recently coined term - Industry 4.0 is the paradigm that explains the possibility of information and communication technologies to digitally transform processes in all industry sectors, including logistics. In this paper we are introducing a new term – Logistics Industry 4.0. Logistics Industry 4.0 refers to several emerging technologies, such as internet of things, big data, cloud computing, artificial intelligence, robotics and blockchain and their implementation in three key aspects of typical supply chain: supply of raw materials, production, and wholesale/retail and two logistics activities: transportation and warehousing. We will present the most promising technologies that will transform logistics processes in the near future and the associated challenges and opportunities.

Keywords: Industry 4.0, transformation of logistics processes, digitalization, Logistics Industry 4.0.