WSL FORUM 2019
VIII Międzynarodowa Naukowa Konferencja Logistyczna
VIII International Scientific Conference on Logistics
BOOK OF ABSTRACTS
DAY 1 (18.11.2019 - MONDAY)

PLENARY SESSION

CHAIRMAN: dr hab. Arkadiusz Kawa

- Norbert Wagener, Bernard Aritua Ceng, and Tong Zhu
  THE NEW SILK ROAD EUROPE- CHINA: OPPORTUNITIES FOR GLOBAL SUPPLY CHAINS AND CHALLENGES FOR ITS FURTHER DEVELOPMENT

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Norbert Wagener, Bernard Aritua Ceng, and Tong Zhu

THE NEW SILK ROAD EUROPE- CHINA: OPPORTUNITIES FOR GLOBAL SUPPLY CHAINS AND CHALLENGES FOR ITS FURTHER DEVELOPMENT

ABSTRACT

Background: Efforts to revive the New Silk Route from Europe to Asia have been on-going since the late 1970's. However, the launch of the Belt and Road Initiative (BRI) of the PR China in 2013 has given new impetus to Europe-Asia connectivity. Between 2014 and 2018 the number of block trains between China and Europe (including Russia) increased from 298 to 4,982 per year. Will this trend continue? Which bottlenecks and challenges appear? What are opportunities for respective countries, policy makers, shippers and logistics operators? The paper contributes to the scientific question of further and sustainable segmentation of intermodal transport markets in the context of global supply chains.

Methods: Based on a literature review and interviews with logistics operators and shippers the authors analyze the present design and operational parameters of the intermodal land bridge traffic system, major challenges and bottlenecks and propose measure how to enable further growth and to improve the sustainability of this traffic.

Results: Main issues of the further development of the New Silk Road Europe China are technological innovations, digitalization of supply chains, optimizing of intermodal transport and gateway concepts, corridor management and new trading patterns with e-commerce.

Conclusions: Although this intermodal land bridge connection will likely continue to be a niche market, it offers considerable transit time and cost savings for specific types of freight for which air freight is too expensive and maritime logistics is too slow. At higher freight costs compared with the sea freight and lower fares than air cargo this is especially interesting for high value cargo and the Northern provinces of China; also for opportunities in Central Asia, and the Caucasus. The new transport route promotes not only investments into production sites for export at locations the Northern provinces but opens also new opportunities for European exports of industrial goods and FMCG for the growing middle class in China. The total logistics costs from the viewpoint of a shipper can be more competitive via land bridge than via sea. Both production and distribution networks of large companies (e.g. BASF, HP, BMW) and small and medium sized companies (here especially through e-commerce) can benefit from a further integration of markets and globalization of supply chains.

Keywords: New Silk Road, Belt and Road Initiative, Global Supply Chains, Intermodal Transport, Digitalization, Corridor Management
Dagmar Čámská and Jiří Klečka

COST DEVELOPMENT IN LOGISTICS DUE TO INDUSTRY 4.0

ABSTRACT

Background: This paper is focused on the development of costs and their structure in logistics companies. Industry 4.0 should trigger significant changes in technologies, business or society where logistics as an area of entrepreneur activity is no exception. Some areas of logistics as storage and warehousing should be even pioneers. It is supposed that human labor has been/will be substituted by other production factors. This substitution should influence economic variables of companies and their overall performance. Challenges of Industry 4.0 will not only be exposed to companies but also to government. It is necessary to monitor the environment and describe changes.

Methods: Using published corporate financial statements the analysis is based on ratio analysis which describes cost structure and time series which show cost development on the level of individual companies operating in logistics. There are analyzed especially analytical indicators of selected cost items in terms of ratios, indicators of total costs and profitability.

Results: The computed cost structure and development were summarized and evaluated by descriptive statistics.

Conclusions: The obtained results show if and how significant there have been any changes in the level and structure of costs and profitability of logistics companies. Coming Industry 4.0 will have serious impact on business, government and individuals. This paper proves if the initiative Industry 4.0 can be already visible on the corporate data and results.

Keywords: operating cost, cost structure, Czech Republic, CZ-NACE H, Industry 4.0
THE IMPACT OF CHANGES IN THE ECONOMY ON THE COMPETENCES OF LOGISTICS

ABSTRACT

Background: The purpose of the articles is to show the impact of changes in the economy in the field of sustainable environment, digitization and supply chain resilience on the development of logistics competences. The article is based on the author's personal experience as a member of the research team developing a new qualification framework for the logistics profession in the European Union. Cognitive research goal - identification of key areas of changes in the economy over the last 6 years and learning about their impact on the recruitment and management process of logistics employees (junior, senior and strategic management), based on the opinion of experts (CEOs and directors of companies). Three areas were selected: sustainable environment, digitization and supply chain resilience.

Methodological purpose of the research - revision of the currently binding qualifications framework (ELA QF). The goal was achieved thanks to two workshops, attended by over 30 top-level managers, and individual interviews carried out by the author with the management staff of logistics companies and manufacturing companies in Poland.

Results: under development; partial results: verification should be carried out in Business Principles, Core Management Skills and Supply and Logistics Design. Practical aspects: revision of the ELA QF in 2020, add new competences that will take into account new trends. Conclusions: Level 4 competences should be higher than before in the above areas. There is a large variation in the meaning of the three areas mentioned in relation to business. This may indicate some immaturity of the above concepts.

Keywords: revision ELA QF, resilience in logistics, sustainability in logistics, digitization in logistics, competences of logistics.
SESSION 1A: NEW CONCEPTS IN SUPPLY CHAINS

CHAIRMAN: PhD Eng. Michał Adamczak

- Joanna Oleśków Szłapka and Natalia Pawlak
  LOGISTICS 4.0 MATURITY LEVELS IN SELECTED LOGISTICS COMPANIES- ACTUAL STATE AND L4MM ROADMAP

- Paweł Romanow
  PROSPECTS FOR THE DEVELOPMENT OF AUTONOMOUS TRANSPORT IN THE CONTEXT OF LEGAL, ORGANIZATIONAL, INFRASTRUCTURAL AND ETHICAL CONSTRAINTS

- Hubert Wojciechowski and Łukasz Hadaś
  RANKING UP OPPORTUNITIES FOR IMPLEMENTATION THE OMNICHANNEL CONCEPT

- Burcu Güven and Ayşegül Nuriye Bayraktar
ABSTRACT

Background: Logistics 4.0 is a concept that strives for improvement of performance of logistics processes. It encompasses many solutions dedicated for both, isolated logistics functions (such as warehousing, transport etc.), and integrated physical and information flows. Their implementation usually requires some investments (purchasing technology and/or infrastructure), as well as organizational changes. Since there is always risk emerging from implementation of new solutions, companies, especially SMEs, due to their limited resources, are cautious when it comes to the decision on introduction of changes to their structure or processes. On the other hand however, SMEs are believed to be flexible and opportunity-oriented seeking for chances to improve and increase their competitive edge and implementation of state-of-the-art solutions are undoubtedly such a chance. Nevertheless, they need support to increase their will and strengthen their need to implement contemporary innovative solutions.

Methods: Authors designed survey consisting of 25 questions. An invitation to participate in a survey was sent to randomly selected transport and logistics companies in Września county. The study was conducted on a very small random sample, so the accuracy of the test results is limited. The study covered randomly selected enterprises due to the scope of the study. The survey has been conducted in August and September 2019.

Results: 19 enterprises located in Września county participated in the survey. Paper presents preliminary research that has been done within logistics companies and based on conducted survey it was possible to assess what is actual knowledge and implementation of Logistics 4.0 tools. The preliminary results contributes that selected polish micro and medium transport enterprises are not yet fully ready for the revolution of transport through Logistics 4.0. They focus on traditional methods of contact and conducting business, claiming that they are developing their business properly and do not need to make changes. Only a few have knowledge about Industry and Logistics 4.0.

Conclusions: The problem with the implementation of the 4.0 logistics concept appears in many enterprises and results from the lack of clear information about what "thinking in category 4.0" can actually mean for the company in terms of real benefits. Research proved that there is a huge cognitive gap in transport and logistics companies in the scope of Logistics 4.0. Lack of knowledge can be eliminated by developing appropriate guidelines, roadmap and Logistics 4.0 maturity levels.

Keywords: Logistics 4.0, transport and logistics sector
PAWEŁ ROMANOW

PROSPECTS FOR THE DEVELOPMENT OF AUTONOMOUS TRANSPORT IN THE CONTEXT OF LEGAL, ORGANIZATIONAL, INFRASTRUCTURAL AND ETHICAL CONSTRAINTS

ABSTRACT

Introduction: Over the past several years, we have seen an unprecedented development of technologies related to autonomous vehicles. Various techniques of perception of the environment are combined here using popular sensors and algorithms. Global technological trends in the automotive industry clearly indicate that in the coming years it will be the most important direction of development of road transport - both passenger and freight, with an indication of the increase in the quantitative share of vehicles powered by electricity. The main goal of the paper is to organize and systematize the current knowledge in the field of the current state and development prospects and limitations of autonomous vehicles in interaction with the dynamically changing environment.

Methods: An analysis of scientific sources resulting from the adopted goal and assumed results.

Results: Description, systematization and conclusions resulting from the analysis of both the facts covered by the subject of the paper and forecasts concerning autonomous transport, covering the perspective of several or several dozen years.

Conclusions: The legal, organizational, technical and ethical standards regarding the operation of autonomous vehicles must meet the expectations of users, entrepreneurs and manufacturers, while devoting the utmost attention to physical and digital security issues.

Key words: autonomous transport, algorithms, limitations, development, telematics
Hubert Wojciechowski and Łukasz Hadaś

RANKING UP OPPORTUNITIES FOR IMPLEMENTATION THE OMNICHANNEL CONCEPT

ABSTRACT

Background: The main aim of this paper is to show, ranking of opportunities for implementation the omnichannel concept with its methodology of analysis. Opportunities were obtained from SWOT/TOWS analysis. Method used to rank up is Thurstone’s method. The SWOT/TOWS analysis it is one of the most basic analytic methods. The result of this analysis points out only a general strategy. Based upon previous authors’ experiences in using SWOT/TOWS we can conclude that analysis is commonly not sufficient for deciding. It lacks information on what factors should be used in priority to others in implementing the chosen strategy. It needs further analysis to confirm, what should the next steps be in implementing corporate strategy. Further analyses are performed using different methods.

Methods: Authors of this paper would like to show how making decisions in logistics can be more efficient using Thurstone’s method in addition to SWOT/TOWS analysis. Thurstone’s method is used to sort all factors in implementation the omnichannel concept.

Results: The results of this paper will be a sorted list of opportunities from most critical to the least crucial. Using Thurstone’s method with SWOT/TOWS analysis will result in more complete set of data to use in decision making process in implementing the omnichannel concept. Combining previously mentioned results will create a methodology of determining the ranking of opportunities for implementation the omnichannel concept.

Conclusions: The presented method for making a decision in implementing the omnichannel concept gives more information for managers than using each of the analysis separately. The main advantage of using both analyses is the reduction of risk during implementation and getting list of factors that can be used in the following decisions.

Keywords: omnichannel; e-commerce; decision-making; SWOT; TOWS
ABSTRACT

Background: The paper is devoted to the descriptive analysis on blockchain and supply chain management with a qualitative analysis of the literature. Blockchain technology is all about the science of keeping track of things. Blockchain is a distributed database that holds records of digital data or events in a way that makes them tamper-resistant. While many users may access, inspect, or add to the data, they can’t change or delete it. The original information stays put, leaving a permanent and public information trail, or chain, of transactions. If blockchain technology allows us to more securely and transparently track all types of transactions, imagine the possibilities it presents across the supply chain. In traditional systems, a combination of human and computing assets keeps track of goods as they flow through the supply chain from producer to customer. Every time a product changes hands, the transaction could be documented, creating a permanent history of a product, from manufacture to sale. This could dramatically reduce time delays, added costs, and human error that plague transactions today. PwC’s 2018 Global Blockchain Survey, which included 600 executives from 15 territories presented that 84 percent of executives surveyed said their companies are “actively involved” with the technology. This survey is one that presents the importance of blockchain in business. But there are many researches and articles about blockchain and supply chain management in literature. With our study, we’ll find the tendency and the perspectives of the studies about blockchain and SCM.

Method: In this study, our aim is to find out the descriptive characteristics of the articles linked with blockchain in supply chain management. Within this scope, journals abstracted and indexed on EBSCOhost® database is examined. In order to examine the articles, a qualitative research software named Nvivo12 was used. Thus, analysis results reflected in the results and conclusion section.

Results: Results obtained from the studies on EBSCOhost® database is analysed and determined the general tendency in relation between blockchain and supply chain management studies published in the period of 2015-2019.

Conclusion: The qualitative analysis of the literature on blockchain and supply chain management shows that there are lots of studies on blockchain and supply chain management. In the qualitative analysis of the literature on blockchain for supply chain management shows that the news publications are more than the periodicals and the most of the publications are released in 2018. More publications are needed this emerging area reflecting the blockchain for supply chain management. Researchers can study on smart manufacturing, transparency and immutability and studies including different sectors will be valuable for this field.

Keywords: supply chain management, blockchain, logistics, logistics management
SESSION 1B: INDUSTRY 4.0 IN LOGISTICS

CHAIRMAN: prof. Piotr Cyplik

- **Anna E. Wolnowska and Lech Kasyk**
  STUDY ON THE DEVELOPMENT OF TRANSVERSAL COMPETENCES OF STUDENTS OF LOGISTIC

- **Michał Fertsch**
  SUPPLY CHAIN IN INDUSTRY 4.0

- **Bernd Hentschel, Karol Górski and Marek Matuewski**
  SPECIALISED CONTAINER FOR THE SAFE TRANSPORT OF ELECTRICALLY POWERED PASSENGER CARS AFTER COLLISIONS

- **Piotr Cyplik, Mikołaj Dramowicz and Filip Marciniak**
  APPLICATION OF THE AUTOMATION READINESS CHECK (ARC) - METHOD OF QUICK ASSESSMENT OF THE ENTERPRISE’S READINESS FOR AUTOMATION – CASE STUDY
ABSTRACT

Background: In the dynamically developing enterprises of the TFL industry, the demand for educated and competent employees is still growing. The educational process at the academic level should not only broaden the level of knowledge in this field but should also promote the development of transversal skills, such as entrepreneurship, communicativeness, creativity, and cooperation in the group.

The article aims to examine the effectiveness of using three selected heuristic methods to develop transversal skills in the field of Logistics at the Maritime University of Szczecin. The research also pertains to the pace of growth of these competences during the implementation of educational processes using the indicated methods.

Method: The method of accelerating the development of transversal competences in the process of students' practical education was used to test models of cross-functional skills development processes. The competence growth assessment was carried out in three stages, with the use of brainstorming, meta-plan and psychodrama. The competence level test was taken into account before the evaluation of the learning process models and after their completion. Nonparametric tests of multiple comparisons were used to analyze the results obtained. A matrix for the dependence increase in the applied case was based on the applied heuristic method.

Results: The considerations are illustrated by the results of calculations regarding the development of transversal competences of students, as well as the effectiveness of using selected heuristic methods used to raise them.

Conclusions: It was pointed out that after applying the proposed methods to students, the level of examined competences in most cases increased. The level of students' awareness of the knowledge of their transversal competences has also increased. Despite the complexity of the research, the method applied proved to be useful in studying the change in the level of transversal skills of students. There were no significant differences between the methods used and the rate of increase in competences depending on the specialty. Women, in most cases, develop their transversal skills better than men regardless of the mode of study.

Keywords: transversal competences, higher education, brainstorming, meta plan, psychodrama
Michał Fertsch

SUPPLY CHAIN IN INDUSTRY 4.0

ABSTRACT

Background: The changes taking place in enterprises under the influence of the Industry 4.0 concept place new requirements not only for enterprises but also for supply chains. We can assume that as time passes, more and more enterprises will undergo changes consisting in adapting their operation to the requirements of this concept. However, these changes will not occur at the same pace in all enterprises nor will they have a uniform character. Therefore, there will be a problem of cooperation in supply chains of enterprises with various levels of advancement in the implementation of the industry 4.0 concept.

Methods: The aim of this article is to identify and present possible ways to solve this problem. In the considered conditions, the importance of coordinating the activities of individual partners in the supply chains is growing. The effectiveness of coordination will depend on communication between partners.

Results: The article presents two possible scenarios of improving communication in supply chains. The first of these is to leave the problem of improving communication at the level of individual enterprises. Observing the current operations of supply chains, it can be concluded that two scenarios are possible within this scenario: creating common data sets and using agent technologies. The second possible scenario is the attempt to create a central communication mechanism at the level of the chain and in the field of communication between the chain and the environment. The analysis will examine the advantages and disadvantages of individual scenarios and current results as part of their implementation.

Keywords: supply chain, industry4.0, communication in the supply chain
SPECIALISED CONTAINER FOR THE SAFE TRANSPORT OF ELECTRICALLY POWERED PASSENGER CARS AFTER COLLISIONS

ABSTRACT

The premise for the creation of this study are changes in the scope of new structural solutions, aiming at the implementation of alternative types of propulsion in the automotive industry. More and more electric vehicles are available on the world markets. This trend also applies to passenger cars, the production of which is increasingly abandoning the power units based on internal combustion engines, both diesel and petrol. With an increase in the number of vehicles equipped with alternative propulsion systems, there will certainly be road accidents involving cars equipped with battery electric propulsion systems. This phenomenon will lead to fire hazards and environmental problems in removing the aftermath of such accidents. Due to the fact that relatively large lithium batteries are particularly exposed to the risk of fire as a result of road accidents, it is necessary to develop solutions for the safe removal of electric cars from places of accidents and collisions, both for the environment and for other road users. Because even after effective fire extinguishing at the scene of the accident there is a high risk of self-ignition after the accident, there is a need to develop solutions that will minimize this type of risk.

Methods: Such solutions include a special container for the safe transport of electric passenger cars after an accident. This type of container will have a closed structure, equipped with the ability to automatically extinguish fires, occurring in its interior. This article presents two possible to implement concepts for the operation of a specialized container with a postulated profile of functionality. One of the concepts would consist in the use of a mobile pallet on which a post-crash vehicle would be placed, and which would enable the introduction of a damaged car into the interior of the container. The second concept would be to place the damaged electric car in the container by means of a special crane.

Results and research findings: Both functional concepts of this type of container are submitted for scientific discussion after a thorough analysis of the European directives and regulations in this field and after consultation with fire prevention authorities. The optimal solution, according to the authors of the study, is to use the front loading of the container using a mobile loading platform, which is used to place an accident-electric motor vehicle in the structural space of the container.

Keywords: Container, Sicherheitscontainer, Transport, e-Mobile, Feuergefahr, Brandbekämpfung, Feuerlöschung [Container, safety container, transport, e-mobile, fire hazard, fire fighting, fire extinguishing]
ABSTRACT

Background: The turbulent environment in which production companies operate today has forced them to constantly improve processes. Fast-paced technological advancement bring new and strong wave of disruption. New business models emerges, customization of products is increasing and the supply chain is getting shorter. Taking into account lack of human workforce, to successfully compete in such environment, production companies are investing in the industrial automation. Implementation of such solutions require knowledge not only in the technological and IT areas, but it also require a broader insight into the management, finance and human resources. Based on company’s study, authors of the article show the rapid and repeatable method of assessment all of the indicated areas.

Method: Authors built audit method based on lean management, six-sigma, change management and theory of constraints problem identification, using interviews and observation mixed with data gathering and analysis from the ERP class system.

Result: Audit report which indicates main areas that need to be improved before implementing industrial automation solutions with the sequence of these improvements.

Conclusion: Considering quickness and repeatability of the Automation Readiness Check method in data gathering and analytical areas it brings clear view of constraints and risks that are shown to the enterprise in such a manner, which gives a clear direction of the process and management improvement efforts. Usage of proposed method gives the enterprise capability of assessing the business benefits and risks associated with industrial automation on a multithreaded basis.

Keywords: industrial automation, automation, audit, process improvement, Industry 4.0, change management
SESSION 1C: SOCIAL AND SAFETY ASPECTS IN TRANSPORTATION

CHAIRMAN: PhD Eng. Łukasz Brzeziński

- Tomasz Pisula and Katarzyna Chudy-Laskowska
  AN ANALYSIS OF ACTIVITIES AND DEVELOPMENT OF AIRPORTS IN SELECTED CENTRAL AND EASTERN EUROPEAN COUNTRIES

- Maciej Tórz, Michał Adamczak, Rebeka Kovačič Lukman, Piotr Cyplik and Adrianna Toboła
  GUIDELINES FOR A ECO-DRIVING BUSINESS MODEL IN THE CASE OF SHORT-TERM RENTAL CARS

- Łukasz Brzeziński
  TECHNOLOGIES IN THE CHAINS OF SUPPLY OF INTERNATIONAL ENTERPRISES

- Wojciech Kamiński
  DETERMINATION THE IMPACT OF SOCIO-ECONOMIC FACTORS ON THE VOLUME OF PASSENGER TRANSPORT ON SELECTED RAILWAY LINES IN POLAND
AN ANALYSIS OF ACTIVITIES AND DEVELOPMENT OF AIRPORTS IN SELECTED CENTRAL AND EASTERN EUROPEAN COUNTRIES

ABSTRACT

Background: Recent years have seen a substantial growth in passenger traffic in airports globally. Consequently, airports should constantly endeavour to meet customers’ needs. For these reasons, analysis of the activities and development of airports appears to be of great significance, since it may help us determine whether airports are able to meet travellers’ expectations and customise their offer to passengers’ requirements.

Methods: This study uses statistical and taxonomic methods (cluster analysis, ranking) as well as selected non-parametric tests to evaluate the clusters created on the basis of designed diagnostic variables describing the operational efficiency and development of airports.

Results: The airports subjected to analysis were characterised in terms of selected financial and economic ratios describing airport management efficiency, as well as aviation infrastructure ratios, the number of passengers served and the availability and types of services provided to passengers. Airports were grouped with regard to similarity of selected ratios by means of cluster analysis. The analysis was performed on latest available statistical data for the year 2018. The groups of airports obtained were subjected to statistical analysis with the use of non-parametric tests for selected ratios. An airport ranking (a synthetic measure) was created through linear ordering in order to determine most efficiently managed and fastest-developing airports.

Conclusions: Taxonomic analysis and ranking enable identification of airports with the greatest development potential and those which fall behind. The tools can also be successfully applied to compare the level of development of Polish airports in relation to other countries of East-Central Europe.

Keywords: airports, taxonomic analysis, ranking, level of development
Maciej Tórz, Michał Adamczak, Rebeka Kovačič Lukman, Piotr Cyplik and Adrianna Toboła

GUIDELINES FOR A ECO-DRIVING BUSINESS MODEL IN THE CASE OF SHORT-TERM RENTAL CARS

ABSTRACT

Background: Short-term car renting is becoming an increasingly common form of realizing the need to move. It is especially popular in large urban agglomerations. As shown by the observations, drivers often drive in a dangerous way: exceeding the speed limit and using more fuel. The aim of the paper is to identify factors which has an influence of driving style of a people who rent a car for a short time period.

Methods: To analysis of the collected telematics data statistical methods was used: correlation analysis, regression analysis and testing of statistical hypothesis using the ANOVA method.

Results: The analysis of the collected telematics data allowed to indicate the relationship between: difference between real fuel usage and declared by producer and capacity and power of engine; exceeding the speed limit and capacity and power of the engine

Conclusions: The conducted research allows to set guidelines for building a business model that encourages renters to drive in economic and ecological style. Thanks to the identified dependency, it is possible to build a more efficient business model, the offer of which will be targeted at those drivers who currently drive in the most dangerous way.

Keywords: eco-driving, business model, short-term rental
Łukasz Brzeziński

TECHNOLOGIES IN THE CHAINS OF SUPPLY OF INTERNATIONAL ENTERPRISES

ABSTRACT

Background: Dynamic technological progress as well as more and more difficult business conditions are key factors that stimulate the increase in the use of modern IT tools to manage integrated links within chains. One can point to such approaches as: Industry 4.0, and increasingly even Industry 5.0, emphasizes the importance of technologies such as IIoT (Industrial Internet of Things) and ICT (Information and Communication Technologies). Nowadays, modern technologies are gaining more and more importance in supply chain management, leading to the transformation of its three elements: network structure, business processes and management components. Both in the literature and in business practice, the role of SMAC digital technologies is emphasized, in other words: social media, mobile technologies, advanced analytics and cloud computing (cloud).

Methods: The purpose of the article is to analyze modern technological solutions in the field of supply chain by international enterprises. The research methods used were the analysis of the literature on the subject and diagnostic soda (the original questionnaire form was used). 20 international entities constituted a research sample.

Results: Currently, although it is possible to point to examples of the use of SMAC technology in supply chain management, it should be noted that they are developed primarily by business leaders and are at the stage of developing implementations in the light of such supply chain management concepts as: agile, lean, demand driven, resilient, sustainable.

Conclusions: The current scope and effects of approximate applications in the technology article point to an evolutionary change in supply chain management. High potential for their development in the 21st century, creates the perspective of transformation of supply chain management models in the future.

Keywords: supply chain, digital technologies, digital supply chain, and digitalisation
DETERMINATION THE IMPACT OF SOCIO-ECONOMIC FACTORS ON THE VOLUME OF PASSENGER TRANSPORT ON SELECTED RAILWAY LINES IN POLAND

ABSTRACT

Background: The volume of transport on a given railway line depends on many socio-economic factors. Therefore, before starting the modernization of the line, various analyzes are carried out regarding the scope of work. During such analyzes, many socio-economic factors having a different impact on the volume of passenger and freight rail transport should be taken into account. Many factors have been taken into account so far, but their weights were determined by decision centers or experts.

Methods: The weights of individual socio-economic factors were determined using correlation coefficients. Individual weights were determined, taking into account the impact of various factors on the volume of transport. During the calculations, an analysis was made on railway lines located in various regions of Poland. Two lines were selected from each voivodeship, according to the assumption that one of them is the main line and the other is a local line.

Results: Weights were obtained determining the impact of individual analyzed factors on the volume of transport. This analysis allowed to eliminate factors that had no significant impact on rail transport.

Conclusions: The weights determined in this way using the previously calculated correlation coefficients will be able to be used in the future when analyzing railway lines in Poland in terms of their use in passenger transport, thus it will be possible to avoid subjective expert assessments.

Keywords: railway transport, passenger transport, correlation coefficient, logistics
DAY 2 (19.11.2019 - TUESDAY)

SESSION 2A: SELECTED ASPECTS IN SUPPLY CHAINS

CHAIRMAN: prof. Davor Dujak

- Rebeka Kovacic Lukman and Petra Vidergar
  LIFE CYCLE ASSESSMENT OF A SLOVENIAN TRADITIONAL DESSERT POTICA

- Davor Dujak, Dario Šebalj and Adam Kolinski
  BULLWHIP EFFECTS IN NATURAL GAS SUPPLY CHAIN

- Maja Fosner and Sonja Mlaker Kač
  HOW MATURE ARE COMPETENCIES IN SLOVENE LOGISTICS SECTOR? AN OVERVIEW OF THE COMPETENCE MATURITY AND PLANS FOR THE FUTURE

- Filip Karaśkiewicz, Łukasz Hadaś and Hubert Wojciechowski
  ENGINEERING CHANGES IMPLEMENTATION PROCESS MAP FOR AUTOMOTIVE INDUSTRY

- Jędrzej Charłampowicz and Cezary Mańkowski
  MARITIME CONTAINER SUPPLY CHAIN EFFICIENCY INDICATORS – SELECTED ISSUES FOR RESEARCH AND APPLICATIONS
Rebeka Kovacic Lukman and Petra Vidergar

LIFE CYCLE ASSESSMENT OF A SLOVENIAN TRADITIONAL DESSERT POTICA

ABSTRACT

Background: Food supply chains greatly affect the environment, using large amount of non-renewable energy resources, fresh water and land, thus mayor consequences connected with eutrophication, acidification, toxicity and climate change are inevitable. Life Cycle Assessment (LCA) is one of the most comprehensive methods for evaluating the products’ environmental burdens, caused through the whole life cycle- from the acquisition of raw materials, production, use phase and disposal. It has been commonly used including the food industry and helps to improve sustainability of a food supply chain with indicating the most environmentally critical phases. In this paper LCA of Slovenian traditional dessert is carried out, determing the stages, that greatly affect the environment and suggesting solutions for more sustainable options.

Methods: LCA is based on ISO standard, which is obeyed in this paper. The method consists of goal and scope, inventory analysis, impact assessment and interpretation. Analysis is carried out with Gabi 4 software, using the Centre of environmental science- Leiden University (CML 2016) method.

Results: Results represent impact categories, determing the most environmentally critical processes and comparing different stages in product’s life cycle. The most intense phase is ingredients acquisition, while Global Warming Potential, Human Toxicity Potential and Freshwater Aquatic Ecotoxicity were identified as the most affected impact categories. Alternative solutions are suggested to improve sustainable performance of a dessert.

Conclusions: The preparation of a traditional Slovenian dessert can be carried out in sustainable way with selecting local ingredients, thus transport path are much shorter. It can be improved also by choosing energy efficient oven.

Keywords: Food supply chains, Life cycle Assessment, Sustainability, Slovenian traditional dessert.
Davor Dujak, Dario Šebalj and Adam Kolinski

BULLWHIP EFFECTS IN NATURAL GAS SUPPLY CHAIN

ABSTRACT

Background: Bullwhip (or Forrester) effect is well studied phenomenon in many supply chains where small variations in customer demand have a tendency to become larger and larger when created by upstream members of the supply chain resulting in unneeded increasing in upstream inventory. However, there is substantial deficiency of scientific research on bullwhip effect in natural gas supply chain. Due to relatively smaller number of supply chain members and huge volumes flowing through the natural gas supply chain, benefits of decreasing or even eliminating negative consequences of bullwhip effect could be enormous. This paper aims to provide more insights in reasons for the occurrence, nature and consequences of bullwhip effect by measuring and analysing it in natural gas supply chain of Republic of Croatia.

Methods: After observation of orders and consumption from natural gas supplier, comparisons were made on monthly and yearly level. Well known and accepted metrics were used to calculate existence of bullwhip effect.

Results: Results didn’t show existence of bullwhip effect on lowest level of natural gas supply chain what is in accordance with other researches. Best solution for mitigating potential or real bullwhip effect are information sharing while working on joint demand forecast in supply chain and use of newer forecasting method.

Conclusion: Expected results should contribute to better understanding of bullwhip phenomenon in natural gas supply chain, but also provide possible avoiding strategies based on building trust in supply chain and on appropriate use of information and communication technologies.

Keywords: natural gas, bullwhip effect, supply chain, information distortion.
ABSTRACT
The goal of the article is to present logistics competence maturity model and place Slovenia with its logistics development according to this model. Competencies can in general be described as skills, knowledge and abilities needed for successful work (in our case in logistics). We will present the Slovene study system of logistics (Faculty of logistics), Slovenian logistics association and development of logistics competencies in Slovenia in general. In the end we will according to our own research try to place Slovenia into competence maturity matrix.

Keywords: competence, logistics, competence maturity matrix
ABSTRACT

Background: This paper is devoted to the process of implementing engineering changes. Based on the analysis of implementing engineering changes process and the specific requirements of automotive industry, the map of process was designed. This map shows connections between actions, few levels of details and resources that are being used at following steps. Map is also divided into few rows, each representing one of department of a company. The objective of map of implementing engineering changes process is to provide crucial data to project managers to let them manage the processes of changes having fuller information.

Methods: Basing on the in-depth interview with experts from different automotive companies and results from survey a map of process of implementing engineering changes in automotive companies was designed.

Results: The designed map of process of implementing engineering changes in automotive companies shows steps of accomplishment of each action. Involvement of each department of a company and clients was also specified in the map. Created map was presented to managers from automotive companies to get feedback on the map and to upgrade it.

Conclusions: Map presented in the article is a guidance for managers showing how to perform correctly engineering changes implementation process. The map is a useful tool to coordinate the different aspects (participants, sequence and responsibilities) of this complex process so as to enable them to work together effectively.

Keywords: map of process, engineering changes, automotive industry.
Jędrzej Charłampowicz and Cezary Mańkowski

MARITIME CONTAINER SUPPLY CHAIN EFFICIENCY INDICATORS – SELECTED ISSUES FOR RESEARCH AND APPLICATIONS

ABSTRACT

Background: The maritime container supply chains are present in the vast of the global economy. The proper functioning of the supply chain is crucial in the process of creation of the final value. One of the factors of the process is its efficiency. The complexity of nowadays supply chains implies the difficulty of efficiency evaluation. Therefore, the aim of this paper is to develop a set of the efficiency indicators of the maritime container supply chains based on critical literature review and the model of economic efficiency evaluation of the supply chain.

Methods: General research methods are proposed as critical literature review and methods of logical reasoning, and some system construction methods at the form of business process engineering with a reference model of the proposed system of efficiency evaluation of the maritime container supply chain are also applied. This model is constructed with the usage of block scheme method.

Results: Set of efficiency indicators of maritime container supply chains is developed in relation to the forecasting, planning and control modules of the model of efficiency evaluation of the maritime container supply chains.

Conclusions: The proposed reference model of economic efficiency evaluation in maritime container supply chain (MCSC) is an original, value-added conception to solve the problem on measuring the efficiency. The proposed set of indicators of economic efficiency in MCSC is also an original conception, which supports the model with the specification of indicators to be used.

Keywords: supply chains, efficiency evaluation model, efficiency indicators, maritime container supply chain
SESSION 2B: SUPPLY CHAIN MANAGEMENT

CHAIRMAN: prof. Bogusław Śliwczyński

- Mariusz Szuster
  THE GEOPOLITICAL DIMENSION OF CONSTRUCTION OF THE NEW SILK ROAD

- Rafał Matwiejczuk
  THE DEVELOPMENT OF BUSINESS LOGISTICS CONCEPT. FROM OPERATIONAL MANAGEMENT OF LOGISTICS PROCESSES TO THE INTEGRATED FLOW MANAGEMENT WITHIN THE SUPPLY NETWORK

- Bożena Zwolińska and Agnieszka Tubis
  THE ALGORITHM OF DEVELOPING PRIORITIES IN THE SUPPLY CHAIN

- Magdalena Kopeć
  TRANSPARENCY IN HYBRID SUPPLY CHAINS

- Anatoliy Pilyavskyy, Anna Maryniak and Yuliia Bulhakova
  SUCCESS FACTORS IN MANAGING SUPPLY CHAIN – ISM ANALYSIS

- Boguslaw Śliwczyński
  MODEL OF INTELLIGENT TRUCK TRAFFIC MANAGEMENT SYSTEM IN THE SEA PORT
ABSTRACT

Background: The trade war between the United States and China has fueled the discussion about the legitimacy of implementing a major project called the New Silk Road. For many countries, this project is an opportunity for development. The logistics industry should also benefit. However, the huge scale of the project raises some concerns and the suspicion that the New Silk Road project is only to a small extent to have a positive effect on trade between China and other countries along this route. Fears arise that the transport and logistics facilitation of doing business between the countries concerned are just a cover for the hidden purposes of building Chinese hegemony in the world.

Methods: A descriptive method was used, supported by graphic elements. The most important secondary data on investment rate and trade between China and Europe were shown, taking into account the use of various modes of transport.

Results: A set of official and unofficial goals of project implementation was presented. Similarly potential threats to participants of this project were presented. It has been confirmed that improving transport and communication connections is only part of the entire investment plan.

Conclusions: Despite many advantages perceived at the microeconomic level (facilitation for companies looking for a transport alternative to the two leading transport sectors between China and Europe: sea and air), there are many areas that raise serious doubts. The analysis of the benefits that European companies can obtain shows many limitations. On the other hand, the Chinese government benefits from the project in many areas, also (and maybe even above all) non-economic. The fact is that hundreds of billions of dollars have been invested in infrastructure projects. This confirms the momentous importance of the project.

Keywords: international trade, infrastructure investments.
Rafał Matwiejczuk

THE DEVELOPMENT OF BUSINESS LOGISTICS CONCEPT. FROM OPERATIONAL MANAGEMENT OF LOGISTICS PROCESSES TO THE INTEGRATED FLOW MANAGEMENT WITHIN THE SUPPLY NETWORK

ABSTRACT

Background: Firms constantly search for ways enabling them to achieve and maintain long-term competitive advantage. Among the most significant concepts influencing the achievement of such an advantage by a firm, an important role is played by the business logistics concept. The aim of the article is to identify the most important stages of the logistics concept development, ranging from the operational management of logistics processes to the integrated flow management throughout the entire supply network.

Methods: The article has a conceptual character. A review of significant works devoted to the development of the logistics concept in business was carried out. Within the article there is also a methodical attempt concerning the consecutive logistics concepts (i.e. first logistics concept, second logistics concept, etc.) related to its development towards the flow management in the entire supply network.

Results: Within the logistics concept development one may indicate five main stages, typically named as the consecutive logistics concepts – the first logistics concept, the second logistics concept, etc. Within the first concept, logistics “cuts through” the traditional functional areas of a firm, i.e. procurement, production and distribution. Logistics is then perceived as a service function of a firm, whose main task is to secure the desired availability of materials and goods in accordance with the customers’ needs and expectations. The second logistics concept emphasizes the importance of the coordination function in the area of goods flows. Within this concept the most important logistics’ goal is to optimize the structure of goods flows along the entire value creation network, as well as to reduce the suboptimization of individual activities in the entire flow structure. Within the third concept logistics is perceived as a flow-oriented business management. In this concept the main attention is paid to management functions concerning the individual business management subsystems (planning, organizing, etc.). Within the fourth concept, logistics is perceived as a flow-oriented management across the entire supply chain and value creation system. In this concept logistics is a key part of supply chain management, and supply chain management itself is perceived as the most advanced stage of logistics development and integration. Finally, the fifth logistics concept relates to the most significant and expressive tendencies of supply chains and value chains integration towards the logistics networks and supply networks. Logistics is then perceived as a business concept integrating value chains in the form of global networks.

Conclusions: The concept of business logistics is constantly developing towards the managerial direction. The symptom of such development is the perception of business
logistics as a concept of flow management on the scale of: (1) firm, (2) supply chain, and (3) supply network. These symptoms may be perceived as so-called managerial re-evaluations of the logistics concept within business management.

**Keywords:** logistics, logistics processes, logistics concept, flow management, supply chain, supply network.
THE ALGORITHM OF DEVELOPING PRIORITIES IN THE SUPPLY CHAIN

ABSTRACT

Fully effective management and organization of any production system assumes: zero stocks in the supply chain and zero stops, which are the result of waiting for material needed or random technical equipment failures. In many enterprises elementary reduction of losses from the groups: muri, mura and muda, brings temporary effects only in the improved area. This results from the theory of complex systems. According to it, a manufacturing system is an organization in which components of the system remain in close correlation with each other. Each change, being an improvement area of the system, also determines changes in other (not improved) areas. Therefore, it is necessary to use multi-aspect approaches with simultaneous consideration of the temporal and spatial horizon.

Materials and results: The presented research problem concerns the operational (executive) level and does not include tactical or strategic solutions. The described algorithm concerns the determination of the priority number of objects that are the equipment of any considered production system. The algorithm takes into account the states of work in the external and internal areas of the evaluated system. The analysed characteristics mainly include: values of work levels in the supply chain (to and from the enterprise) and values of system work levels within the company in the area of continuity of the processed material flow and failure levels of technological equipment. The algorithm of the object priority evaluation takes into account the existing synergy of a single element of the system with the whole system (taking into account the influence of time and place).

The developed algorithm was verified on a selected example of a production system. The presented method of determining priorities requires adapting the assessment methodology to the individual characteristics of the test object. For this reason, the analysis includes, among others: the type of the system, its structural and functional complexity, complexity of interoperability and the size of material flow streams and their frequency.

The presented method of assessing priorities enables determination of critical elements of a complex system. The evaluation is carried out in a three-dimensional system. It takes into account machine failure, the operation of processes in the area of the analysed manufacturing system but also the levels of operation of supply systems (supply chains). Due to the complexity of the presented algorithm, the article presents results for a system that is characterized by a relatively high level of process flexibility and has a large number of technological processes. An important parameter of the analysed system is a high level of quality of process implementation, which achieves cumulated quality for the manufactured products over four sigma in the criterion of evaluation in accordance with the Six Sigma method. In addition, the system is characterized by a high assortment variability of input
materials. As a result, this determines a large number of supply chains at the entrance to the production system. In addition, the analysed industry is a system that is characterized by competitiveness of finished products. Therefore, there is a high level of product adaptation to customer expectations, which translates into enterprise flexibility.

**Conclusions:** The developed algorithm takes into account the systemic view consistent with the general theory of systems according to Klira and Meserovicz. The presented algorithm is a general approach to the evaluation of the elementary objects of the system, while taking into account the existing synergy between the other elements of the entire system. In the next stages of the research, the authors will develop algorithms for various production systems (convergent and divergent), for different manufacturing specifications (objective and technological) and for different levels of process flexibility values. Next, the authors plan to validate and compare models for empirical data collected in real production facilities for developed algorithms.

**Keywords:** priorities of objects, supply chain
Magdalena Kopeć

TRANSPARENCY IN HYBRID SUPPLY CHAINS

ABSTRACT

Background: Along with the globalization and digitization of economic activity, virtually every entity operating in a market economy, regardless of the industry, has been associated with many other entities, thus creating an extensive network of relationships within which many supply chains function. For this reason, the study attempts to explain (to simplify) the possible ways of configuring supply chains, with particular regard to their transparency.

Methods: As the starting point of each study should be to determine the state of knowledge, which is also subject to methodological rigor. In this paper the framework and procedures for a literature review on transparency and selected supply chains were set out. Then, using abductive reasoning, a set of selected hypotheses was formulated in relation to the construction of hybrid supply chain transparency.

Results: Due to the lack of precision in literature in defining the term transparency, the essence of transparency in the perspective of various authors was outlined. The identification and description of selected supply chains are presented in turn. Then, a set of selected hypotheses was presented in relation to the construction of transparencies of hybrid supply chains.

Conclusions: Drawing conclusions from this theoretical-conceptual design and their application in further empirical research can contribute to the identification and deepening of knowledge on the management of the transparency of contemporary supply chains, with particular emphasis on their adaptation to changing needs and customer expectations.

Keywords: hybrid supply chains, lean, agile, resilient, green
Anatoliy Pilyavskyy, Anna Maryniak and Yuliia Bulhakova

SUCCESS FACTORS IN MANAGING SUPPLY CHAIN – ISM ANALYSIS

ABSTRACT

Background: The identification of key success factors in managing supply chain (SCM) is one of the main tasks of managers, but still a weakly explored study field. We lack a comprehensive approach, in which financial, infrastructure, logistic, administrative and relational aspects are simultaneously examined. Thus, the aim of the analysis is to identify the hierarchy of importance of different factors and their common relations among these, which were considered as the most important.

Methods: The study material was collected based on in-depth interviews with the use of a structured survey questionnaire. The subjects of the study were the employees of Ukrainian company, which operates in dairy industry. Whereas in the analyses, Interpretive Structural Modelling (ISM) was used.

Results: In this study, we distinguished subject constructs, which included success factors in managing supply chain, we determined the level of their significance and we conducted the exemplification of the possible analyses with the use of a case study. Based on the empirical studies, we distinguished autonomous factors (with a low driving force and a low level of dependence) dependent factors (with a high level of dependence and a low driving force) combined (with a high driving force and a high level of dependence) and independent (with a high driving force and a low level of dependence). We used MICMAC analysis in this.

Conclusions: Based on the conducted empirical study, it can be concluded, that determining the significance of different success factors in managing supply chains and using ISM method to examine them, allows for a more conscious decision-making in developing supply chains. In the examined case, the most important SCM success factors are analytics, short supply chains and market conditions.

Keywords: supply chain, success factors, ISM, logistics, competitive factors
Boguslaw Sliwczynski

MODEL OF INTELLIGENT TRUCK TRAFFIC MANAGEMENT SYSTEM IN THE SEA PORT

Abstract

**Background:** The objectives presented in the article - systemic assurance of better and integrated traffic management, effective use of transport infrastructure and road capacity as well as tracking of traffic and optimization of cargo flow - are completely consistent with the EU direction documents. Currently, traffic in the European sea ports (e.g. Rotterdam, Hamburg, Antwerp, Dover, Gdynia, Felixstowe, Aalborg, Le Havre, Lisbon) periodically reaches the saturation level in the existing road network. This causes trucks queues before entering terminals and on access roads, creating traffic jams and blocking roads in the port and the main access routes, as well as extension of unloading/loading time of ships and reducing the efficiency of terminals' work. The problems identified have a significant impact on the efficiency and duration (and delays) of cross-border road freight transport and cargo flow in import/export as well as in global intermodal supply chains.

**Methods:** The article presents the model of intelligent integration of three operationally associated areas in sea port – e-booking time slots system for all port terminals, the ITS system of traffic control synchronized with terminals and management of the common parking space of the port. Based on analysis results of the cargo flows and processes in the port, a model for estimating the required capacity of access roads and parking space was developed and applied in practice road traffic engineering method HCM-2010. Operational data was used to parameterize the model of intelligent truck traffic management (ITTM).

**Results:** The main future impact effect of applying is eliminating the bottleneck in the sea port as well as undisturbed operations of port terminals and smooth flow of cargo delivery/departure. Results obtained with the ITTM model were compared with traffic management solutions in the largest seaports of Europe.

**Conclusions:** The competitiveness of a sea port depends on their ability to innovate in terms of ICT platform, ITS and IoT technology, as well as organisation and management. Numerous measurable benefits of increased reliability of deliveries and punctuality in delivering cargo presented in the paper are key reasons for the growth of competitiveness of the polish ports among other seaports.

**Keywords:** supply chain efficiency, traffic management system, Intelligent Transport System, time slots e-booking system, bottleneck elimination.
SESSION 2C: TRANSPORT

CHAIRMAN: prof. Halina Brdulak

- Piotr Gorzelańczyk and Zofia Jarka
  ANALYSIS OF BUSINESS ADMINISTRATION USE OF THE PIŁA CITY CARD IN MEANS OF URBAN COMMUNICATION

- Piotr Gorzelańczyk and Ilona Stawińska
  ASSESSMENT OF URBAN PUBLIC TRANSPORT IN NORTHERN WIELKOPOLSKA

- Maciej Stajniak, Bartosz Kozicki and Jarosław Tomaszewski
  MULTIDIMENSIONAL ANALYSIS AND FORECASTING OF TRANSPORTATION OF PEOPLE BY RAIL IN SELECTED EUROPEAN COUNTRIES FOR 2018-2020

- Edyta Przybylska and Katarzyna Dohn
  ANALYSIS OF INTERMODAL FREIGHT TRANSPORT STAKEHOLDERS IN A SELECTED CROSS-BORDER AREA

- Marzena Kramarz and Lilla Knop
  STRATEGY MODEL FOR MULTIMODAL FREIGHT TRANSPORT DEVELOPMENT WITHIN THE CROSS-BORDER AREA

- Piotr Gorzelańczyk, Ryszard Smokowski and Bartłomiej Seweryn
  ANALYSIS OF TELEMATICS TECHNIQUES IN LOGISTIC TRANSPORT MANAGEMENT IN CITIES
Piotr Gorzelańczyk and Zofia Jarka

ANALYSIS OF BUSINESS ADMINISTRATION USE OF THE PIŁA CITY CARD IN MEANS OF URBAN COMMUNICATION

ABSTRACT

Background: Due to the quick and simultaneous development of civilization and technology, it is necessary to improve existing systems. Communication is one such system. Nowadays, efficient and fast communication is very important if not most important. Thanks to an efficient communication system, we can easily change our location in a short time, quickly changing our position from one place to another. Efficient communication is influenced by many elements, such as: roads, means of transportation, facilities systems, efficient planning, safety and people. Communication is one of the elements of the broad concept of collective transport.

The article will present the application and use of the Piła City Card (PCC) introduced in 2009, which is utilized as a ticket in public transport in Piła (MZK). In the next stage, other possibilities of its use will be presented.

Methods: The conducted research and survey among Piła residents will help answer questions about what Piła inhabitants think about the functioning of the Piła city card and where it can still be used.

Results: The aim of the study was to analyze the existing system of how PCC works and to get to know the public opinion on the subject of its functioning and how to further expand its use. The research was carried out in the city of Piła, using a questionnaire consisting of 12 single-choice closed and 2 open questions.

Of the 150 respondents, the majority are women (60%). The vast majority of respondents are young people in the 18-25 age group. These are people who often use the services provided by public transport, who have a PCC and an encrypted ticket on it. They travel frequently to work or to school. The respondents are satisfied with the services provided by the City Transport, however, they have complaints about the functioning of the PCC readers. They also suggested other proposals for the use of PCC.

Conclusions: The test carried out through the survey was successful. Residents of the City of Piła are satisfied with the services provided by MZK and the introduction of an electronic ticket encoded on the PCC. The functioning of this card makes traveling much easier. The respondents also gave many interesting proposals regarding other applications of the PCC than just in communication. Some of the proposals, after consulting them with the city government and MZK, are currently being implemented.

Keywords: city card, public transport, public transport
ABSTRACT

Background: Urban transport has always been very popular due to: the independence in traveling from other people, high frequency of travel, convenience and low cost of travel. Until recently almost everybody used it, and almost no one would get to work or school without it. However, in the recent years, one may notice a smaller number of people using public transport. Transport is a very important element in every city.

The purpose of the article is to assess the quality of urban mass transport services and propose directions for its development. The tests carried out are supposed to reflect the real condition of the rolling stock and the noise level occurring in it, which is an extremely important factor influencing the comfort of the passengers.

Methods: The conducted researches and a survey among the residents of Pila will allow us to assess the quality of services provided by northern greater poland carriers, ie: MTC, CTC, NOVABUS and their comparison with PNR.

Results: Table 1. List of average results of measurements:

<table>
<thead>
<tr>
<th>Transporter</th>
<th>Average fill percentage [%]</th>
<th>Average noise level [dB]</th>
<th>Average delay [min]</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTC</td>
<td>13,50</td>
<td>72,5</td>
<td>0,40</td>
</tr>
<tr>
<td>CTC</td>
<td>22,86</td>
<td>83,1</td>
<td>1,63</td>
</tr>
<tr>
<td>NOVABUS</td>
<td>41,44</td>
<td>80,6</td>
<td>0,45</td>
</tr>
<tr>
<td>PNR</td>
<td>---</td>
<td>---</td>
<td>2,80</td>
</tr>
</tbody>
</table>

On the basis of the presented data, it can be stated that the highest average noise level occurred in CTC and NOVABUS transporters and was 83dB and 81dB. A significantly lower noise level occurred on MTC buses - 73dB. The highest average vehicle crowding percentage reached NOVABUS - 41%. This result should be considered satisfactory. The average percentage of crowding in MTC and CTC buses is 14% and 23%. Average delays occurring in MTC and NOVABUS buses are below 1 minute, while in CTC - 2 minutes and 3 minutes in PNR.

In order to verify the obtained test results, a questionnaire was also carried out. It examined the comfort and satisfaction of passengers with regards to the quality of mass transport services.

Conclusions: On the basis of research, it can be concluded that collective transport in northern Wielkopolska is of a good standard, taking into account the noise level, delay, and opinions of its users. To improve the quality of public transport services, it is necessary to constantly monitor the level of passenger service, travel comfort and follow the news from the public transport industry, appearing at fairs and in other cities.

Keywords: City transport, Wielkopolska, public transport, Pila
Maciej Stajniak, Bartosz Kozicki and Jarosław Tomaszewski

MULTIDIMENSIONAL ANALYSIS AND FORECASTING OF TRANSPORTATION OF PEOPLE BY RAIL IN SELECTED EUROPEAN COUNTRIES FOR 2018-2020

ABSTRACT

W artykule poruszony został problem z zakresu wielowymiarowej analizy i prognozowania danych pierwotnych dotyczących przewozu ludzi transportem kolejowym w wybranych państwach Europy na lata 2018-2020.


Wyniki: Zastosowanie analizy wielowymiarowej pozwoliło na zaobserwowanie prawidłowości w rozpatrywanych grupach zmiennych zależnych w postaci: państw i lat. Ustalono liderów grup, jak również te zmienne objaśniające, którą stają się wartościami odstającymi w grupach zmiennych zależnych. Wykrycie wartości odstającej dla sumy przewożonych ludzi w grupie lat w 2010 roku stało się przesłanką do przeprowadzenia korekty tej zmiennej poprzez zastosowanie średniej arytmetycznej lat 2009 i 2011.

Wnioski: Uzyskana ocena z przeprowadzonych analiz wielowymiarowych pozwoliła na wykrycie trendu rosnącego, co stało się przesłanką do wyboru metody wygładzania wykładniczego Holta do prognozy na lata 2018-2020 danych pierwotnych.

Słowa kluczowe: transport, analiza wielowymiarowa, prognozowanie
**Edyta Przybylska and Katarzyna Dohn**

**ANALYSIS OF INTERMODAL FREIGHT TRANSPORT STAKEHOLDERS IN A SELECTED CROSS-BORDER AREA**

**ABSTRACT**

**Background:** The aim of the article is to identify and to analyze stakeholders whose decisions are related to the development of intermodal freight transport in a selected Polish cross-border area. Areas of this type naturally become important regions for the development of freight transport. This is especially important in Poland, which is characterized by a transit location and a large size of streams of goods flows to and from neighboring countries. Contemporary transport policy emphasizes the necessity of developing intermodal transport (ITr), particularly on an international scale. However, it should be noted that the future of this solution is strongly related to the impact of various stakeholders groups. It is emphasized by more and more frequent consideration of stakeholders analysis as a basic stage in the adopted methodologies of building transport strategies.

**Methods:** Stakeholders maps were used in the article. To their elaboration, criteria were selected that allowed for the division of stakeholders into groups representing the same view in the development of ITr.

**Results:** The final result of an applied approach is an integrated map of stakeholders being the resultant of elaborated maps. It allows to propose recommendations regarding the selection and handling of individual stakeholder groups. This is particularly important in case of identified so-called key stakeholders whose impact must be taken into account in action plans and decisions regarding their implementation.

**Conclusions:** Based on a stakeholders analysis it can be concluded that ITr implemented in a cross-border area faces many challenges, but also offers many possibilities. These challenges in particular concern the organization and implementation of coordination processes in the implementation of projects related to both the development of infrastructure and the organization of ITr processes. The stakeholder analysis in the form of an integrated ITr stakeholders map showed the need to identify such operators, who would be responsible for decisions related to the development of ITr - the leaders in the development of ITr (LeDITr).

**Keywords:** stakeholders, stakeholders analysis, intermodal transport (ITr), stakeholders map, cross-border area, the leaders in the development of ITr (LeDITr)
ABSTRACT

Background: According to the sustainable European transport development policy, it is necessary to create a new transport standard in order to perform the transport using the most effective means or combination of such means (White Paper 2011). The purpose of the studies presented in the paper is the presentation of the strategy model of the multimodal freight transport development within the cross-border area.

Methods: The studies have been performed within cross-border areas between Poland, Czech Republic and Slovakia, within Silesia and Moravia, Silesian and Zylina areas. According to the idea of the European Grouping of Territorial Cooperation TRITIA, the distinguished regions, based on the institutional, social, economic and infrastructural cooperation, create a thriving cross-border area, where the negative impact of political division could be eliminated and its strengths utilized because of common effort. Development of the strategy model of the multimodal freight transport within cross-border area necessitated a selection of a methodology being a combination of different strategic analyses, including: PESTEL analysis, structural analysis, beneficiaries analysis and SWOT analysis. The strategy model is based on the Balanced Scorecard assumptions and six strategic perspectives.

Results: Based on the performed analyses that necessitated performance of both quantitative and qualitative studies, a strategy project encompassing the vision, mission, strategic goals, strategic projects enabling implementation of the assumed goals and an organizational structure for the implementation of the adopted strategy have been developed.

Conclusions: The proposed strategy model has been analysed from the standpoint of conformity with the assumptions for the freight transport development included in the international strategic documents. The proposed methodology is versatile and can be applied in different cross-border areas.

Keywords: multimodal transport, freight transport strategy, balanced score card, logistic network
ABSTRACT

**Background:** The rapid increase in the number of vehicles in cities and the intensity of their movement necessitates the use of appropriate transport management solutions. Various telematics techniques are used in logistics transport management in cities, which are the basis for the functioning of telematics systems. The article analyzes selected telematics techniques used in logistics transport management in cities and presents the developed concept of changes in logistics transport management in the city of Piła, including the use of appropriate telematics techniques. The existing telematics system in the city of Piła and the proposed solutions were subjected to appropriate examination. The aim of the study was to verify the quality of the current state of the system and learn opinions on the proposed solutions that could be implemented in Piła, taking into account the effects that could be achieved as a result of improving the existing system.

**Methods:** The survey method was used to obtain relevant information. The questionnaire developed, containing the elements assumed in the study, was addressed to respondents residing in Piła and around this city. The survey was conducted at the turn of December 2018 and January 2019.

**Results:** The results of the survey were developed and presented on many charts. The obtained results, regarding the answers to individual questions, were provided with appropriate comments.

**Conclusions:** Considering the presented content, especially the developed research results, it can be concluded that a significant proportion of respondents support the introduction of most of the solutions proposed in the article that will allow to minimize the phenomenon of congestion, increase the safety of road participants and improve the efficiency of logistic transport management processes in the city of Piła.

**Keywords:** telematics systems, transport management, city of Piła
Session 3A: Selected aspects in supply chains

CHAIRMAN: prof. Łukasz Hadaś

- Magdalena Satora, Teresa Gajewska and Maciej Szkoda
  ANALYSIS OF SELECTED FACTORS INFLUENCING THE IRREGULARITY OF DELIVERIES OF FRUIT AND VEGETABLES

- Katarzyna Nowicka
  SUPPLY CHAIN MANAGEMENT IN THE ACCESS ECONOMY ENVIRONMENT

- Adrianna Toboła and Piotr Cyplik
  THE ROLE OF CLOUD COMPUTING AND BIG DATA IN THE DIGITIZATION OF SUPPLY CHAINS

- Maciej Bieńczak, Marek Piosik, Hanna Sawicka, Piotr Sawicki, Waldemar Walerjańczyk and Paweł Zmuda-Trzebiatowski
  BEHAVIOR OF CUSTOMERS USING CEP INFRASTRUCTURE

- Zbigniew Czapla and Stanisław Krawiec
  GPS DATA-BASED ESTIMATION OF TRAVEL TIME PARAMETERS FOR ELECTRIC BUSES

- Agnieszka Stachowiak, Joanna Oleskow Szlapka, Natalia Pawlak, Piotr Cyplik and Małgorzata Szpakowska
  CONTEMPORARY SOLUTIONS FOR CITY LOGISTICS - A CASE STUDY ON TRANSPORT IN POZNAŃ
Magdalena Satora, Teresa Gajewska and Maciej Szkoda

ANALYSIS OF SELECTED FACTORS INFLUENCING THE IRREGULARITY OF DELIVERIES OF FRUIT AND VEGETABLES

ABSTRACT

Background: The article is devoted to the issue of the irregularity of the deliveries of fresh fruit and vegetables. Occurrence of any disruptions in the company's operations may have a negative impact on its effectiveness. The aim of the article is to analyze the selected factors affecting the occurrence of this type of problem and to propose actions to reduce its scale. Methods: The problem of irregularities in the supply of fresh fruit and vegetables is presented on the example of the company in which the occurrence of this problem was detected. The company provides services in the field of international road refrigerated transport. In order to determine the factors affecting the irregularity of deliveries, data from six consecutive months (May-October period) in years 2017-18 were analyzed. These data related to, i.a., the number of deliveries of individual fruit and vegetables and their countries of origin. Results: On the basis of the data analysis, it was determined that one of the main factors affecting the irregularity of deliveries of fresh fruit and vegetables may be the seasonality of their supply. Conclusions: The seasonal nature of the supply of fresh fruit and vegetables is a real challenge for companies that deal with their delivery. In the case of enterprises whose activity is focused primarily on the international transport of this type of products, the key is to look for new producers or expand their activities to the domestic country, in order to limit the impact of seasonality on the number of deliveries.

Keywords: delivery of fresh fruit and vegetables, irregularity of deliveries, seasonality of supply, seasonality of demand, refrigerated transport
ABSTRACT

Background: The paper concentrates on the digital platform being the diving force of sharing economy development impact on supply chain business model reconfiguration. First the main accelerators of sharing economy were described and compared with the characteristics of supply chain architecture. Than the results of empirical research are present to illustrate the understanding the digital platform role by supply chain managers.

Methods: Paper is based mainly on literature review and partially on the results of on empirical research conducted between November and December 2018 within 120 supply chain managers using CATI methodology. Selected results from the CATI research are presented in the last section of the paper. Paper has conceptual character.

Results: Digital platform might be used for supply chain competitiveness improvement in several ways – starting from access to the logistics services in the outsourcing model, through the additional solution in supply chain business model portfolio widening the range of distribution channels up to the digital supply chain solution being a digital platform connecting whole ecosystem of supply chain actors (stakeholders).

Conclusions: Sharing economy and the digital platform implementation within the supply chain management is on very early stage and not well recognized by managers. However, due to the promising potential resulted from digital technologies features this solution should be further analyzed to increase knowledge and awareness within scientific and business environment.

Keywords: digital supply chain, platform business model, access economy
Adrianna Toboła and Piotr Cyplik

THE ROLE OF CLOUD COMPUTING AND BIG DATA IN THE DIGITIZATION OF SUPPLY CHAINS

ABSTRACT

Background: Modern supply chains require not only fully integrate processes, but also a high level of activities flexibility that enable the provision of services and products in accordance with the customers requirements. The development of modern technologies and tools supporting supply chain management observed in recent years, as well as significantly increasing customer requirements, often exceeding the capabilities of traditional supply chains requires from the logistics services providers adaptation of performing processes to changing market requirements. The purpose of this article is to present not only the essence of digitization of supply chains in the context of the development of the Industry or Logistics 4.0 concept, but also to pay attention to the key role of modern Cloud Computing and Big Data tools utilizing.

Methods: As part of the literature review conducted in this paper, the definitions of tools relevant to the digitalization process were indicated, thus presenting the relationship between the diversity of Industry 4.0 tools used on the market and the level of supply chain digitization, but also the most important benefits and challenges resulting from their widespread use.

Results: The analysis of the functioning of the tools presented in this article showed a significant degree of dependence between the degree of use of Industry 4.0 tools and the level of digitization of supply chains.

Conclusions: The key factor influencing the development of chains, but also the increase of their profitability in the context of global cooperation of the logistics industry enterprises is the level of the digitization of processes implemented within the supply chains. The development of digital supply chains is conditioned by the use of modern tools that support the integration of all chain participants by providing more comprehensive services that respond to the needs of service recipients.

Keywords: industry 4.0, cloud computing, big data, digital supply chain
ABSTRACT

Background: One of important elements of a logistics infrastructure in the Courier, Express and Parcel (CEP) industry is a Pick-up and Drop-off Point, referred to PUDO. This is the point of relation between a customer and an operator. A dynamic evolution of e-commerce translates directly into the development of this type of infrastructure elements. However, it should be targeted enough to bring the intended effects, that is to increase the availability for the customers while rationally using already existing resources. Assuming that the efficiency of the use of infrastructure is a derivative of the behavior of customers for whom such infrastructure is created, it becomes crucial to recognize the typical behavior patterns of these customers. This aspect has become the main goal of the research undertaken by the authors of this paper.

Methods: The research presented in this paper is based on a multiple stage approach, including: 1) direct interviews with operators and users of PUDO, 2) preparation of the drafted questionnaire, 3) testing, 4) preparation of the final questionnaire, 5) conducting surveys, 6) analysis of the obtained results and exploration.

Results: The direct result of the research is in-deep recognition of the key behavioral aspects related to the use of logistics infrastructure, both in sending and receiving courier parcels. In the paper some specific aspects are considered, such as: PUDO location, time of day of using PUDO, general travel motivations while visiting PUDO, applied means of transport to reach PUDO. A correlation between those aspects and customers’ profile is also discovered.

Conclusions: The obtained results are the basis for shaping strategic directions of development and maintenance of the existing logistics infrastructure in the courier industry.

Keywords: pick-up and drop-off point, logistics infrastructure, users’ behavior
ABSTRACT

Background: The paper presents the novel method of estimation of travel time parameters specific for electric buses utilized in urban traffic. The bus route is divided into sections. There are defined two types of sections. The first section type is the stopping section which encompasses a bus stop. The second section type is the running section. Each running section connects two neighboring stopping sections. The bus is equipped with the GPS receiver. The current positions of the bus and the current measurement time are registered in the GPS data file with a constant frequency. Each position of the bus is assigned to the appropriate section. The analysis of the registered GPS data allows estimation of the travel time parameters. The travel time parameters are estimated for purpose of further evaluation of individual bus routes suitability for the use of electric buses.

Methods: The analysis of the GPS data leads to determination of the travel time parameters for each section. For the stopping sections stopping time of the bus is determined. For the running sections running time, stopping time, and the number of stoppings of the bus are determined.

Results: Experimental results has been obtained for the selected bus route. The results allow to estimate travel time parameters for individual sections of both type and the entire bus route.

Conclusions: Estimation of travel time parameters enables description of moving properties of the bus route and their evaluation with consideration for electric energy consumption of electric buses. Application of the GPS receiver makes measurements not complicated and supplies required data.

Keywords: travel time parameters, electric bus, GPS data, route moving properties
Agnieszka Stachowiak, Joanna Oleskow Szlapka, Natalia Pawlak, Piotr Cyplik and Małgorzata Szpakowska

CONTEMPORARY SOLUTIONS FOR CITY LOGISTICS - A CASE STUDY ON TRANSPORT IN POZNAN

ABSTRACT

Background: One of the paradigms of contemporary management is sustainability – striving for balanced economy and respecting ecological and societal aspects. Sustainability is included in strategies of individual companies, regions and countries. The following paper presents implementation of sustainable approach to city logistics by promoting resources (means of transport) sharing to decrease congestion and pollution. The goal of the research was to present the potential of contemporary solutions for individual transport in the cities based on Poznan example. The range of solutions is introduced, the level of their implementation is identified. The results of the research are presented and discuss to show growing importance of shared mobilities for population of large cities.

Methods: The research methodology benefits from different perspectives, it encompasses the perspectives of stakeholders involved in the transportation process. The stakeholders are identified as users of shared means of transport and providers of shared mobility services. The methods used include the two-stages survey conducted among potential and actual users of shared means of transport and the interview conducted with representatives of companies providing shared mobility services. The results of the survey and interviews are used to characterize the shared mobility market in Poznan.

Results: The results of the research can be used by decision makers to decide on further development of the solutions aforementioned. Entrepreneurs can use the results of the research to enter the market of shared mobility providers or adjust their offer to requirements and expectations of clients. Authorities of cities willing to introduce or expand their offer in the shared mobility area can benefit from benchmarking the solutions presented.

Conclusions: The research was recognize the phenomena of growing popularity of shared mobility solutions in cities, find its drivers and potential drawbacks. The phenomena was described, however the research presented had limited range and scope and can be the motivation for formulating research questions concerning detailed and systematic presentation of shared mobility aspects.

Keywords: city logistics, individual transport, smart city, shared mobility
Session 3B: Omnichannel and relations in supply chain

CHAIRMAN: PhD Szymon Strojny

- **Marek Matulewski**
  LOGISTICAL MEASURES TO COMBAT AFRICAN SWINE FEVER

- **Danuta Głowacka-Fertsch**
  RESOURCE MANAGEMENT IN A PRODUCTION ENTERPRISE

- **Szymon Strojny**
  LOGISTYCZNE ASPEKTY KSZTAŁTOWANIA PUNKTÓW STYKU W PROCESIE OBSŁUGU Klienta

- **Halina Szulce**
  POSSIBILITIES AND METHODS OF BUILDING CUSTOMER RELATIONS ON THE B2B MARKET

- **Piotr Cyplik and Paweł Farfał**
  THE IMPACT OF OMNICHANNEL ON B2B SALES PROCESS

- **Roman Domański and Michalina Łabenda**
  OMNICHANNEL IN TRADE AND DISTRIBUTION LOGISTICS OF PRIVATE LABEL GROCERY PRODUCTS IN TESCO AND CARREFOUR RETAIL CHAINS ON THE POLISH MARKET
Marek Matulewski

LOGISTICAL MEASURES TO COMBAT AFRICAN SWINE FEVER

ABSTRACT

**Background:** The paper was written as a result of research conducted in the field of hunting economy in Poland. The research in this aspect was inspired by the low effectiveness of the originally assumed logistical measures aimed at reducing or even eliminating the outbreaks of this extremely dangerous disease, which attacks both pigs and the wild boar population. A disease that contributes to the necessity to bear, on one hand, increasingly higher costs of preventive actions and, on the other hand, losses caused by the ban on the export of pigs from Poland. The conducted research is an empirical research, the aim of which is to indicate the necessity of coordination of all logistical measures carried out in this field with applicable legal regulations and social awareness. Presentation of best practice in this field applied in other countries struggling with ASF and proposal of an optimal model of disease eradication.

**Methods:** The basic research material was historical data including, on the one hand, data on the development of the disease in Poland (both in terms of the number of outbreaks and the area covered by the disease and potentially endangered by the disease, as well as their geographical location) and the legal regulations in force at the time and public awareness. In the aspect of the latter issue (i.e. public awareness), a questionnaire survey was conducted on deliberately selected research samples.

**Results:** As a result of the analysis, a certain model was created. It contains the necessary elements (logistical measures, legal regulations, social awareness), which in a properly designed model increase the chances of controlling the disease and its effective eradication.

**Conclusions:** Proper design of logistic processes (taking into account time and spatial coordination of all elements) and their subsequent implementation, fully coordinated with the current situation, increases the chances of fighting ASF. Lack of coordination in any scope (inconsistent legal regulations, lack of public awareness) contributes to failure and generates unnecessary costs.

**Keywords:** African Swine Fever, logistical measures, legal regulations, public awareness
ABSTRACT

Background: Resource management is a very important function in a production company. Its importance grows under the conditions of changes that modern production is subjected to. Concepts such as Industry 4.0 and its various varieties create new conditions and pose new challenges to resource management in a modern manufacturing enterprise.

Methods: The purpose of this article is to identify the requirements that modern production poses before resource management. Analysis begins with the presentation of the essence and classification of resources in a production company. Traditional resource management methods are briefly characterized. The most important features of modern production management concepts are presented (process approach, St. Gallen model, intelligent manufacturing, network-centric operations).

Results: Comparisons of similarities and differences between analyzed concepts are compared. On the basis of this comparison, the concept of a holistic approach to resource management in an enterprise is presented. This concept is a proposal for solving the problem of resource management in a modern manufacturing enterprise.

Keywords: resource management, modern production, resource management methods, holistic approach to resource management
LOGISTYCZNE ASPEKTY KSZTAŁTOWANIA PUNKTÓW STYKU W PROCESIE OBSŁUGU KLIENTA

ABSTRACT

Autor dokonał wielowymiarowego przeglądu uwarunkowań strategii przedsiębiorstw w zakresie zarządzania punktami styku z klientem, które stanowią integralny element procesu obsługi klienta i stanowią przedmiot badań wielu autorów na całym świecie. Rozwój nowych form sprzedaży omnikałowej, wpływa na zmiany w procesach zakupowych klientów, dlatego zorientowane na klienta przedsiębiorstwo musi uwzględniać te zmiany w swojej strategii obsługi klienta. Artykuł kończy identyfikacja nowych wyzwań dla logistyki, odnoszących się do zarządzania punktami styku z klientem, a wynikających z rozwoju sprzedaży omnikałowej oraz wskazanie uwarunkowań rynkowych w tym zakresie.

Metody: Artykuł oparto o analizę literatury z zakresu obsługi klienta w przedsiębiorstwach. Przeanalizowano wybrane kluczowe publikacje związane z zarządzaniem punktami styku w strategii omnikałowej oraz podstawowych założeń jej realizacji. Identyfikację wyzwań dla strategii logistycznej obsługi klienta dokonano na podstawie literatury oraz raportów rynkowych.

Wyniki: Rezultatem prac jest identyfikacja „punktów styku” w poszczególnych etapach procesu obsługi oraz nowych wyzwań w obszarze logistycznej obsługi klienta związanych z implementacją strategii handlu omnikałowego.

Wnioski: Przeprowadzona analiza pozwala na stwierdzenie, że „punkty styku” z klientem stanowią obecnie kluczowy element strategii przedsiębiorstwa. Dotyczy to nie tylko strategii komunikacji, ale przede wszystkim strategii sprzedaży i obsługi klienta. Poprzez „punkty styku” (tzw. chwile prawdy), klient ma możliwość zweryfikowania wcześniejszych obietnic składanych przez firmę.. Zarządzanie „punktami styku” musi odbywać się w ujęciu procesowym, a nie funkcjonalnym. Analizowane „punkty styku” występują na wszystkich etapach procesu obsługi klienta, zarówno na etapie przedtransakcyjnych, transakcyjnym, jak i potransakcyjnym. Zauważalny w ostatnich latach w praktyce gospodarczej rozwój sprzedaży omnikałowej, powoduje dodatkowo wzrost liczby „punktów styku” i zmiany w ich charakterze. W tym kontekście nowe wyzwania stają także przed działem logistyki. Logistyka jest odpowiedzialna nie tylko za realizację zamówienia klienta, ale odpowiada także za etap przedtransakcyjny, na którym występują „punkty styku” o charakterze informacyjnym, głównie w zakresie zapewnienia informacji o dostępności produktu w poszczególnych kanałach sprzedaży, zapewnienia krótkich terminów dostaw i wielu innych. Firma chcąc utrzymać swoją relatywną przewagę konkurencyjną musi zatem aktywnie zarządzać procesem obsługi klienta i spełniać wymagania stąd wynikające.

Słowa kluczowe: customer touchpoint, sprzedaż multichannel, logistyczna obsługa klienta
POSSIBILITIES AND METHODS OF BUILDING CUSTOMER RELATIONS ON THE B2B MARKET

ABSTRACT

The objective of the discussion is an attempt to analyse the significance of the manner and conditions of building relations with customers on the B2B market. The assumption was made that partner relationships in the situation of global competition and domination of large enterprises allow to strengthen and stabilize the position of small and medium enterprises. The thesis will be verified on the basis of the identification of about twenty small and medium-sized enterprises of the construction and transport industries in this area.

The research method, apart from the available documentation of the companies, will include in-depth interviews. In addition to considerations indicating the premises and importance of relationship marketing, the ways of building these relationships will be presented. The literature approach indicates that one of the most important skills in an enterprise is not only to identify changes in customer needs, but also to react quickly to these changes. However, in order to induce sales effects, it is also necessary to reach an emotional and cognitive agreement with customers. The win-win reaction requires cooperation and management of the other party's needs, which in turn imposes the necessity of in-depth research, both quantitative and qualitative.

Preliminary research carried out in the transportation and construction sectors has indicated a considerable diversity of strategies. This is most likely due to both the particular type of close contacts with fewer clients of these companies and their greater flexibility. There is a certain "ad hoc" nature of the relationship strategy, there is no deepened customer profile in construction companies, which would allow them to submit earlier business proposals and not to passively wait for their possible orders. At the same time, however, there was a basic set of proposals addressed to all potential customers.

Things were a little different in the transportation companies. They created databases and evaluated the credibility of potential customers. Special offers were sent to selected partners. After "winning" customers, compatible quality, logistics and communication systems were created. However, none of the surveyed companies used the CRM system.

It can be noted that, although these types of enterprises are trying to pursue a relational strategy, they lack the consistency and coherence that can lead to long-term cooperation.

Słowa kluczowe: relationship marketing, key customers, relationship building, CRM
Piotr Cyplik and Paweł Farfał

THE IMPACT OF OMNICHANNEL ON B2B SALES PROCESS

ABSTRACT

Background: Sales cycles in B2B sales tend to be longer and more expensive than in B2C because of its inherent characteristics of the offering. B2B sales cycle recognizes the phases such as opportunity identification, qualification, validation, offer preparation and submission, contract, delivery. There are several advanced B2B sales methodologies like strategic selling, target account selling, value selling framework or solution selling. In all of them a customer is by and large the key focus. Omnichannel, in its essence, focuses on holistic interactions between customer and supplier. Relying on diversified media streams, sellers get better opportunity to learn customers' needs and their buying behavior.

Methods: The aim of this paper is to indicate which phases of the sales process omnichannel influences the most. The second aim is to establish which elements and steps of sales cycle benefit predominantly. To achieve these goals, this research implements a case study method. The research refers to B2B enterprises implemented omnichannel solution.

Results: The analysis shows that omnichannel solutions have the greatest potential to be applied in the early stages of the sales cycle, in particular opportunity identification and qualification and in the product marketing activities as well.

Conclusions: Despite the fact that omnichannel solutions where historically developed to service consumers in retail sales, enterprises operating in B2B sector apply omnichannel tools more widely. In all sales operations customer experience is the overriding consideration. The need to discover new ways of attracting customers is the driving force behind motivations to implement omnichannel solutions across all industries.

Keywords: omnichannel, sales, business-to-business, sales process
ABSTRACT

Background: At present, omni retailing (multichannel), universal retailing (universal channel), is referred to as omnichannel. Customers who are operating today in many sales channels pose new challenges to suppliers' distribution systems. The aim of the article is to identify the state of implementation of omnichanneling of grocery private labels in Tesco and Carrefour hypermarket chains on the Polish market along with critical remarks regarding the development of rational logistic product and price policy.

Methods: The subject of the study is one of the methods of modern distribution - private label. The object of the study covers two comparable retail chains - Tesco and Carrefour. The study focuses only on private label grocery products of these two chains (7 categories, in each of them 3 product representatives) and is limited solely to the Polish market. As part of the analysis, 21 product features are studied. The analysis tool is an on-site survey of Tesco and Carrefour chain stores - brick and mortar (real) and online (virtual) - 84 analyses.

Results: From the perspective of the omnichannel strategy, product range availability and the level of price differentiation should be the same in every distribution channel. Results of omnichanneling trade and distribution in Tesco and Carrefour retail chains are varied. The product range omnichannel of Tesco is 0.90 and Carrefour 0.71 (noticeable disproportion in the product offer). The price omnichannel of Tesco is 0.47 and Carrefour 0.60 (noticeable disproportion in the price offer).

Conclusions: The subject of customer service has been and will remain to be a topical issue in the area of logistics. Irrespective of customers' choice of the form (channel) of contact with the product distributor - the omnichannel variant, they should always be served at the same level. The open question is: always, for each product?

Keywords: omnichannel, private label, grocery products, Polish market, Tesco, Carrefour, customer service level, omnichannel indicators
Session 3C: Digitalization of production and logistics processes

CHAIRMAN: prof. Bożena Zwolińska

- Ryszard Świekatowski
  SERVICES IN THE DIGITAL AGE - REVIEW OF SELECTED SERVICE AREAS

- Adam Maciak and Adrianna Ozga
  INFORMATION TECHNOLOGY SUPPORTING AND INTEGRATING INFORMATION FLOW IN LOGISTIC PROCESSES

- Marek Fertsch
  ARTIFICIAL NEURAL PSEUDO-NETWORK FOR PRODUCTION CONTROL PURPOSES

- Maciej Szkoda and Kacper Cieplik
  ANALYSIS OF SOD CONFLICTS IN SAP ERP SYSTEM LOGISTICS WITH THE USE OF THE SAP GRC APPLICATION

- Tadeusz Zaborowski, Leonid Shvartsburg and Natalia Ivanova
  ECOENERGETIKS CUTTING TECHNIQUES

- Grzegorz Bartoszewicz and Maciej Wdowicz
  AUTOMATION OF THE PROCESS OF REPORTING THE COMPLIANCE OF THE PRODUCTION PLAN WITH ITS EXECUTION BASED ON INTEGRATION OF SAP ERP SYSTEM IN CONNECTION WITH EXCEL SPREADSHEET AND VBA APPLICATION
The article is an attempt at reviewing selected service areas, where the final customer is very demanding, has individualized requests, expects a quick reaction, and wants detailed information at each stage of the order. The study shows digitalization as a process that requires a company to acquire specific competences that go far beyond technologies alone. The article presents selected aspects of digitalization, its essence, new features, role and usefulness not only in managing an organization by giving employees the opportunity to realize their ambitions, but also by giving users the opportunity to benefit from a new reality that is developing new opportunities. Differences between the implementation of the IT solutions, computerization and digitalization are also presented.

**keywords:** implementation of IT solutions, computerization, digitalization, education services, public services, banking services, medical services, logistics services
Adam Maciak and Adrianna Ozga

INFORMATION TECHNOLOGY SUPPORTING AND INTEGRATING INFORMATION FLOW IN LOGISTIC PROCESSES

ABSTRACT

Background: To achieve market success, it is not enough to produce high-quality goods cheaply. First and foremost, one should take into account the proper customer service and the correct and quick flow of information in the logistics processes. This forces constant improvement of systems, processes and methods used. The purpose of the described research was to characterize selected IT technologies supporting and integrating information flow in logistics processes and assessment of their suitability and suitability in the logistics market in the automotive industry.

Methods: Using a research questionnaire, a study was carried out in 81 companies in the automotive industry in Poland. The anonymous research questionnaire contained 18 questions. The questions concerned mainly information systems and improvements in the identification of goods and well as the degree of satisfaction with them and a list of problems that occur during their use.

Results: The IT systems used in small enterprises are mostly: MS Excel (30%) and SAP (30%), in the second place is the GS1 (14%) and EDI (14%) system, while the third is the GPS system (12%). In medium-sized enterprises, respondents indicated that the ERP class system is most often used in 30% and EDI system in 4%, GPS system in 2.5%. In large enterprises over 50% of respondents indicated that the most common system in the company is the ERP class system (51%). The next place is the WMS system (21%). MRPII class systems (3%), SCM (3%) and DRP (2%) and MS Excel (1%) are the least used.

Conclusions: Enterprises taking part in the research, when using IT systems supporting logistics, notice many problems. The main is the low knowledge of the system, lack of adequate knowledge and training of employees and improper service. In the case of goods identification, it is the readability and failure rate of readers. Respondents stated that the implementation of IT systems improved the quality of customer service, the activities performed along with the acquisition of information took place in a much shorter time and the processes taking place in the company improved

keywords: IT systems in Logistics, IT technologies, logistics of the automotive industry
Marek Fertsch

ARTIFICIAL NEURAL PSEUDO-NETWORK FOR PRODUCTION CONTROL PURPOSES

ABSTRACT

Background: Experience from the implementation of the industry 4.0 concept has proved that the key success factor is the use of techniques and methods of artificial intelligence. One of these techniques is artificial neural networks. The development of artificial neural networks has been going on for a long time and has led to a number of important applications of this technique in industrial practice. Simultaneously with the development of practical applications, a wide theoretical base was also created concerning the concepts, tools and principles of using this technique.

Methods & Results: This article contains an attempt to use this theoretical basis to build a specialized tool. This tool is called pseudo-network. It is based not on the whole of the theory of artificial neural networks but only on the targeted elements selected for it. The selection criterion is the use of an artificial neural pseudo-network to control production. The article presents the assumptions of this technique, the architecture of the developed solution and preliminary experience of attempts to use it.

Keywords: industry 4.0, artificial intelligence, neural networks, production control
Maciej Szkoda and Kacper Cieplik

ANALYSIS OF SOD CONFLICTS IN SAP ERP SYSTEM LOGISTICS WITH THE USE OF THE SAP GRC APPLICATION

ABSTRACT

Background: Nowadays, the management and integration of various areas in an enterprise require the implementation of an adequate IT system. There are many such systems, often intended for enterprises of various sizes and industries. An example of an integrated IT system which offers comprehensive support to logistic processes is SAP ERP. In order to perform the different tasks, it is necessary to allocate relevant permissions to system users. Permission management in IT systems is necessary for protecting data against accidental, malicious manipulations, damage or unintentional wrong use.

Methods: The analysis of users’ permissions in SAP ERP and identification of SoD conflicts, if any, is performed automatically in practice, with the use of analytical tools matching the task. In order to get full control over the process of conflict identification and resolution, managing staff decide to implement the appropriate tool of the GRC (Governance Risk and Compliance) class. One of the solutions of the type is the dedicated SAP solution – SAP GRC Access Control. The SoD conflict matrix identified in the analysis is translated into so-called Rulebook written in the form of a specialist scheme integrated with the SAP GRC application. The set contains information about the business processes going on in the enterprise (e.g. materials management or purchases), identified business functions (e.g. acceptance of orders or stock taking exercises) and conflicts. It also includes, inter alia, identifiers of conflict creating functions, their level and type as well as the status of activity in the system (on / off).

Results: In the paper, 17 examples of SoD conflicts are identified for the logistics of the SAP system which, after a user is given too wide access, may involve the risk of wilful or unintentional abuse having a negative effect on the enterprise.

Conclusions: In order to prevent situations of this type, enterprises use applications which supervise users’ permissions. One of such applications is SAP GRC Access Control. This tool supports user- and role-level analyses, enabling automatic support for the process of resolving SoD conflicts, which reduces to the minimum the need to do manual analyses of large quantities of data whilst minimizing the probability of committing errors.

Keywords: SAP ERP, SAP GRC, User permissions, Segregation of Duties (SoD)
The article discusses the relationship between energy quality technologies cutting and their environmental friendliness. Based on the energy analysis shows that energy consumption in the individual technological process is connected with the cutting power and power loss, which form the environmental indicators of the cutting process and reduce its energy efficiency. In addition it is shown that at implementation of technological processes on the equipment, electrical systems are AC systems the implementation of the cutting process occurs when excessive consumption of currents. The article presents the results of studies on the energy efficiency of cutting processes, definition of the complex influence of cutting processes on the environment and humans, the formation of ways of improving environmental and energy performance quality of these processes.

Keywords: technology, machining, quality, energy, ecology, interaction, safety
Grzegorz Bartoszewicz and Maciej Wdowicz

AUTOMATION OF THE PROCESS OF REPORTING THE COMPLIANCE OF THE PRODUCTION PLAN WITH ITS EXECUTION BASED ON INTEGRATION OF SAP ERP SYSTEM IN CONNECTION WITH EXCEL SPREADSHEET AND VBA APPLICATION

ABSTRACT

Background: The ERP systems in spite of its huge functionalities cannot realize all user needs and requirements especially concerning intelligent business analysis and reporting (BI). Therefore it is necessary to find out new, simple and flexible methods and techniques to expand their functionality and report facilities. In this paper we propose the new method of production process analysis, its automation and visualization, based on integration of the SAP ERP/PP module with Excel spreadsheet and VBA application. This approach is very useful for managerial decision making process in production planning and control.

Methods: Basing on the previous developed configuration methods we have proposed an integration approach, connecting data base resources from SAP ERP system with Excel spreadsheet and VBA application.

Results: The new application called FTP Report allows to prepare The compliance report of the production plan with its implementation within the prescribed period. It automatizes the process of data migration from SAP ERP Production Planning module and then supports intelligent data analysis and finally data reporting.

Conclusions: The new redesigned and implemented process of data migration and analyzing is faster and more flexible and allows to speed up the whole process of complex analytical report edition from 2 hours to 5 min.

Keywords: SAP ERP/PP enhancements, Production Planning and Execution, Data Reporting, Business Process Analysis, Production Processes Integration, Production Process Reengineering (PPR), VBA application.
Session 4A: New technologies in transportation

Chairman: PhD Eng. Marcin Hajdul

- Sylwia Konecka, Anna Łupicka and Marcin Jurczak
INNOVATIONS AND MODERN INFORMATION TECHNOLOGIES IN POLISH ROAD TRANSPORT COMPANIES

- Tomasz Tyc and Jacek Białek
THE IMPACT OF THE COMMON MARKET ON THE STRUCTURE OF TRANSPORT COMPANIES IN NEW MEMBERS STATES

- Katarzyna Gdowska, Roger Książek and Antoni Korcyl
FLEET OPTIMIZATION FOR A SELECTIVE SOLID WASTE COLLECTION SYSTEM

- Jędrzej Charłampowicz
THE EFFICIENCY OF THE MARITIME CONTAINER SUPPLY CHAIN AT THE MARITIME CONTAINER TERMINAL WITH REFERENCE TO IDENTIFIED RISKS

- Marcin Hajdul and Angelo Aulicino
DIGITALISATION OF FORWARDING PROCESSES – CASE STUDY
ABSTRACT

Background: The guidelines for the implementation of the sustainable development strategy will probably change over time, but it seems that if this is the case, the changes will be aimed at increasing the effect on social, environmental and economic values and alleviating tensions between them. The same applies to autonomous transport as an area of economic activity.

Methods: The research presented in the article uses a literature review and bibliometric analysis.

Results: The main problem areas in the economy of sustainable development in the context of transport and basic causes of the development of stable concepts of autonomous transport have been identified. The literature analysis was conducted in October 2019 on the basis of the Scopus database. Based on the keywords “autonomous vehicle” and “sustainable development”, a total of 79 publications (combining both issues) were identified. The results of pilot questionnaire studies carried out among 50 road transport operators in Greater Poland in 2019 were also presented. They concerned the perception of autonomous transport and the possibility of implementing autonomous vehicles in Polish road transport companies.

Conclusions: The interrelation of modern technologies and their impact on sustainable development is not a popular subject of research. It should be noted that in the most popular topics of autonomous vehicles in combination with sustainable development are therefore dealt with from a technological perspective rather than in terms of economic analysis or economic efficiency. Representatives of Polish road transport carriers are skeptical about forecasts of 30 years for the implementation of autonomous vehicles. Respondents noticed more threats than opportunities.

Keywords: autonomous vehicle, autonomous transport, road transport, sustainable development
Tomasz Tyc and Jacek Białek

THE IMPACT OF THE COMMON MARKET ON THE STRUCTURE OF TRANSPORT COMPANIES IN NEW MEMBERS STATES

ABSTRACT

Background: The paper is devoted to analysis of the impact of the European Union’s single market on the structure and demography of transport and logistic operators in new member states. The analysis takes into account primarily transport companies without any prejudice towards both the transport mode they represented as well as their legal status and ownership type. This analysis is conducted in the scope of a sufficiently long integration period of the new member states into both supply chains and value chains in the European Union.

Methods: Using publicly available data the authors will use standard statistical measures to assess the level of interdependence of a number of variables. Those chosen for analyses are linked to both the economic features of the European Union’s single market as well as changes occurring in the structure and demography of transport and logistic operators in new member states.

Results: A computational analysis has proven that results vary in regard to both the chosen mode of transport as well as in country-by-country case. The examples of airport and train transport proves to be the most extreme. Both sectors seem to obtain similar results in the terms of the structure of active business entities being at the same time subject to different external pressure.

Conclusions: The computational analysis has proven that further research should be conducted on the actual impact of the European Union’s single market on the structure and demography of transport and logistic operators in new member states.

Keywords: Enterprise size; Business demography; Structure of company; GVC; European Union; Single Market
Katarzyna Gdowska, Roger Książek and Antoni Korcyl

FLEET OPTIMIZATION FOR A SELECTIVE SOLID WASTE COLLECTION SYSTEM

ABSTRACT

**Background:** In the paper the vehicle routing problem (VRP) combined with fleet optimization for selected solid waste collection is presented. The fleet of garbage trucks consists of vehicles of various types which can differ one from another with capacity, size, and exclusive assignment to certain types of waste. Garbage trucks are used to collect segregated solid waste from pickup nodes and transport it to specialized sorting units. In real selective solid waste collection systems, an important issue is to route garbage truck subject to not only their size but also the time windows of pickup nodes. Some solid waste drop-off points are located in narrow streets and they can be served only by small-sized or medium-sized garbage trucks. Some pickup nodes can be served only within predefined time windows and visiting them should be scheduled carefully, so that they can be served in the preferred period and garbage trucks’ extra dwell time or extra kilometrage can be avoided.

**Methods:** The Fleet Optimization Problem for Selective Solid Waste Collection (FOPSSWC) continues the approach adopted for the Selective Solid Waste Collection Routing Problem (SSWCRP). The SSWCRP solves the VRP for a predefined heterogeneous fleet of garbage trucks, includes time windows of pickup nodes, and recognizes segregated waste types to be served by dedicated garbage trucks. The FOPSSWC finds the minimum number of garbage trucks needed to perform selective waste collection service and not to violate any constraint. For the FOPSSWC a Mixed Integer Program was formulated and solved using Gurobi solver.

**Results:** Gurobi solver was employed for solving small-sized and medium-sized instances. Results obtained for exact optimization of the Fleet Optimization Problem for Selective Solid Waste Collection (FOPSSWC) are illustrated with an exemplary instance for which computational experiments are presented and obtained results are reported.

**Conclusions:** The main contribution of the paper is a newly developed Mixed Integer Program combining fleet optimization with the VRP for the selective solid waste collection system. The FOPSSWC may be used by Solid Waste Management for scheduling selective solid waste collection. Obtained schedules may result in reducing the total operational costs of periodical selective solid waste collection.

**Keywords:** selective solid waste collection system, MILP, rich VRP, Solid Waste Management
THE EFFICIENCY OF THE MARITIME CONTAINER SUPPLY CHAIN AT THE MARITIME CONTAINER TERMINAL WITH REFERENCE TO IDENTIFIED RISKS

ABSTRACT

Background: Containers has become one of the most common methods of goods’ transportation. Passing through many links in the chain, containers influence the efficiency of the supply chain. At every point, time and cost needed for performing specific operations, determines the efficiency. While executing those operations it is important to being conscious of the risks, which can be met. Due to wide range of supply chain, importance of maritime transport, strategic role of maritime container terminals and homogeneity of operations’ nature taken at terminal, the problem of efficiency of the maritime container supply chain has been narrowed to the issues concerning supply chain efficiency at the maritime container terminals with reference to identified risks. The objective of this paper is to develop maritime container supply chain efficiency indicators at the maritime container terminal with reference to the identified risks.

Methods: Therefore some general research methods are proposed as critical literature review, logical reasoning and more research purpose oriented methods as methods of risk assessment like HAZOP and SWIFT.

Results: Efficiency indicators with respect to time and cost have been developed with reference to five main risk categories at the maritime container terminal.

Conclusions: Proposed set of indicators offers possibility to examine relation between occurred events and cost and time efficiency of whole maritime container supply chain. General form of the presented indicators gives an opportunity for being suitable and sufficient at general level of maritime container terminal.

Keywords: supply chains, efficiency indicators, maritime container terminal, risk identification, literature review
ABSTRACT

Background: Effective and efficient organization of forwarding processes, for all modes of transport, is an extremely complicated task. This is due to the fact that these processes are characterized by a huge rate of changes occurring in them and the relationship between various actors within the supply chain.

The research conducted on a group of 50 companies from the TSL industry indicates that at some point they reach the limits of their capabilities in servicing current processes, not to mention further development. The reason for this is the dynamic development of companies, which strongly affects the processes carried out in enterprises.

Along with the development of the company, it is worth paying attention to selected changes that then occur in the processes:

- The increase in the number of clients served makes the processes more complex. This results in an increase in the amount of time needed for customer service.
- With the increase in the number of customers served, more and more means of transport and/or external carriers are needed to handle the growing number of orders.
- The increase in the number of customers and service providers results in the need to increase employment in the forwarding company to handle new processes.
- The increase in the number of employees causes the need for greater control of the processes carried out by individual people.

The purpose of the article is to indicate which forwarding processes or activities occurring in them may be digitized to improve the efficiency and effectiveness of the entire forwarding company.

Methods: The computer simulation method using the NovaTMS platform as well as computer simulation and a case study developed on the example of the sea container transport process will be used in the study.

Results: The result of the adopted research methods will be qualitative data presenting what are possible to achieve benefits in the implementation of selected processes thanks to their digitization.

Conclusions: The simulations and the case study show clearly that modern technologies allow even a few-dozen percent reduction in the time of a given process. In addition, a properly programmed machine or device will also minimize mistakes resulting from human errors.

Keywords: Logistics 4.0, Internet of things, digitalisation, transport & logistics management, digital platforms
SESSION 4B: MATURITY AND PROCESS ANALYSIS

CHAIRMAN: PhD Eng. Adam Koliński

- Piotr Banaszyk  
  ATTRIBUTES OF A MATURE LOGISTICS CLUSTER

- Karolina Werner – Lewandowska  
  LOGISTICS MATURITY OF THE 3PL PROVIDERS - EMPIRICAL RESEARCH RESULTS

- Sebastian Wieczerniak, Piotr Cyplik and Jarosław Milczarek  
  METHOD OF EVALUATING THE LEVEL OF PROCESS MATURITY OF COMPLEX SUPPLY CHAINS

- Bożena Zwolińska, Małgorzata Kowalczyk and Paweł Gara  
  LEAD TIMES OF CRITICAL PATH TASKS IN CONVERGENT PRODUCTION

- Mirosław Antonowicz and Sebastian Jarzębowski  
  THE PHYSICAL INTERNET AND DIGITAL SUPPLY CHAINS – SELECTED ISSUES
ABSTRACT

**Background:** The article is devoted to the analysis and identification of the characteristics of a mature logistics cluster. First, the essence of the logistics cluster was presented, indicating its ambiguous understanding in the literature on the subject. Maturity was recognized as one of the stages of the logistics cluster life cycle. In contrast to the typical presentation of this cycle, the need to take into account outside the technical area also the political and cultural areas from which the factors shaping the life cycle of a logistics cluster originate was pointed out. Because a mature logistics cluster is a perfect cluster, therefore the features and conditions of perfect logistics were indicated as necessary to achieve this maturity.

**Methods:** Literature studies are of fundamental importance. On their basis, the meaning of basic concepts and processes was identified and developed.

**Results:** The final result is a summary of the typical attributes of a mature logistics cluster.

**Conclusions:** A mature logistics cluster is characterized by typical attributes in three areas. In the technical area, it is efficiency and economically effective implementation of the logistics function. In the political area, this is efficacy corporate governance and a high level of organizational integration. In the cultural area, it is the professionalism and innovation of human resources.

**Keywords:** logistics, logistics cluster, logistics cluster life cycle.
ABSTRACT

Background: The paper is devoted to the logistics maturity of enterprises providing transport and storage services. Production, trade and service enterprises, regardless of the industry or company's size, strive to improve their operation in order to gain competitiveness on the market and to increase profits. Maturity models allow to assess the current situation of the organization and to determine the direction of further development [Kosieradzka&Smagowicz, 2016, s. 280-293]. Over the years, depending on the management areas, many different maturity models have been emerged [Looy, 2014, s.5-10; Steenberg et al., 2010, 317-332; Janse et al., 2010; Eadie et al., 2011; Battista et al., 2012; Bemelmans et al., 2013; Cao and Jiang, 2013; Battista and Schiraldi, 2013; Jellouli and Abdel-kadhi, 2013; Mazur and Stachowiak, 2014; van Lith et al., 2015; Benmoussa et al., 2015; Tontini et al., 2016]. Additionally, some logistic maturity models that analyze logistics processes occurring in enterprises have been developed [Battista et al., 2012]. In the paper, the author propose a maturity model dedicated to the service sector, in which the areas of logistic activity are subject of evaluation, not logistic processes. It results from the fact that service enterprises, unlike production companies, rarely have precisely defined processes of logistics support as they concern on the service’s delivery process.

Methods: In the research the original logistics maturity model for the service sector (LMM4SI) was used. The assessment of the maturity level is made on the basis of an interview using a questionnaire containing questions on the company’s use of 65 logistic engineering tools. The set of chosen tools was created based on the list of the 100 most popular logistics tools proposed by G. Richards, S. Grinstein [Richard & Grinsted, 2016], which were verified regarding applicability in service industry and own proposals were added. Tools are assigned to 5 areas of logistics activity. The proposed model includes 6 levels of maturity, which are determined by the impact of the logistics tools.

Results: 190 Polish enterprises providing services in the field of transport and storage were included into the research. The surveyed group of enterprises is dominated by areas of logistic activity related to transport management. However 89% of enterprises use means of transport to provide a service, the dominant level of logistics maturity achieved by service companies in the area of transport management is L1. Moreover 99% of all surveyed companies have their own fleet. Only for 13% of the surveyed enterprises it was possible to assess the area related to Supply and Inventory Management. In this area, the vast majority of companies achieved the logistics maturity level L1. In the remaining enterprises, no supplies of materials necessary to perform services in the future were collected.
Conclusions: The research objective of the paper is to determine the relationship between the size of a service enterprise and the achieved logistics maturity level. The presented research results indicate to what extent companies providing logistic services have achieved internal logistics maturity. On this basis, it is possible to determine whether the size of the enterprise affects the level of logistics maturity.

Keywords: logistics maturity, logistics service providers, transport, storage
Sebastian Wieczerniak, Piotr Cyplik and Jarosław Milczarek

METHOD OF EVALUATING THE LEVEL OF PROCESS MATURITY OF COMPLEX SUPPLY CHAINS

ABSTRACT

Background: In the literature there is available knowledge about the organization’s maturity, including the Capability Maturity Model Integration (CMMI) model. In the authors’ opinion, the same as there are levels of the organization's maturity, in the view of the organization as a homogeneous company, the same complex supply chains as networks of connected organizations, have levels of process maturity.

Methods: During the preparation of the article, the method of literature analysis was used to verify the current state of knowledge in the field of methods for evaluating the organization’s maturity levels and the functioning of complex supply chains. Verification of the current state of knowledge was used to investigate the possibility of adapting the organization’s assessment to determine the method of evaluating the level of process maturity of complex supply chains.

Results: In the result of literature analysis it was proved that it is possible to distinguish the maturity levels of complex supply chains and a method of evaluation of the process maturity level of complex supply chains was proposed.

Conclusions: The article presents methods of evaluation of the organization’s maturity and after analysis of available literature proposes a summary of method of evaluation of process maturity in complex supply chains. The methods presented in the article is used to evaluate complex supply chains and to indicate areas for improvement of these chains.

Keywords: maturity levels, process maturity of the organization, process maturity of the supply chain, complex supply chains, SCM
ABSTRACT

Now, in time of Industry 4.0, the development trend in many companies is integration of the real world and the virtual world. In accordance with the Industry 4.0 assumptions, the factories are fully automated and allow exchange of any information during production. Along with digitization of all areas of production company and development of numerical machines, implementation of computationally complex production control support algorithms becomes possible. One of the company growth aspects, in line with the Industry 4.0 mainstream, is product customization. Depending on the specific character of industry, there are different methods to match the product to individual expectations of the customer.

Materials and results: The paper includes a study of a real production facility that offers a wide range of products and at the same time is characterized by a high degree of product match to the individual expectations of customers. The result is a relatively high dynamics of labour intensity levels of individual production structure areas. In addition, the offered range is a complex system consisting of many semi-finished products (which also are complex systems) and its final form offered to the customer is made during the so-called convergent production. Taking into account the multifaceted complexity of a production system, including the complexity of material flow stream, it becomes extremely important to relatively accurately evaluate the order lead times in order to keep a high customer service KPI (Key Performance Indicators).

The paper presents an algorithm for production tasks lead times that accounts for characteristic features of the studied production system. The algorithm is a modification of the PERT (Project Evaluation and Review Technique) method in which the evaluation of the cumulated production tasks lead time for critical path is more accurate than in the classical PERT method.

The paper presents comparative results of two evaluation methods of production order lead time: one according to the classical PERT method and the other according to the proposed algorithm. The analyses were carried out for actual data collected on selected few days in one month. The data selection criteria included varied labour intensity levels of individual production areas which are directly determined by varied customer orders.

The comparative analyses of two methods of critical task lead times evaluation refer to three representative product groups. Selection criterion of product sets from the cumulated demand number during a year and a demand variability index. The presented analyses do not include all possible cases of work labour intensity variation during production which will be accounted for during further research.
**Conclusions:** The paper presents an algorithm for determination of cumulated production tasks lead times based on a modified classical PERT method. The proposed algorithm accounts for operating parameters of the studied system and an improvement of lead time probability estimation in individual planning itineraries of individual streams of processed materials. The proposed algorithm should be subjected to a detailed validation for longer time perspectives, e.g. one year. The reason is a seasonal character of demand at the turn of the year (from November to February). In addition, the next algorithm verification tests should account for the holistic approach of the entire production system and the multitude of critical paths for various product groups. The obtained results will form a basis to develop a tasks ranging model for the studied class of production systems.

**Keywords:** PERT, critical path, convergent production
Mirosław Antonowicz and Sebastian Jarzębowski

THE PHYSICAL INTERNET AND DIGITAL SUPPLY CHAINS – SELECTED ISSUES

ABSTRACT

**Background:** Information technology is penetrating every aspect of today’s businesses; without a sound IT infrastructure companies cannot keep up with competitor firms who effectively use IT. Successful companies have already recognized this trend and have started to adapt – both to continually stay ahead of their competitors and to exploit the potential of digitalization to increase profit.

In the environment, transport and logistics to relevant topics, about which it says should be the idea of the physical Internet and digitization of supply chains. Goods flow processes in time and space (transport and logistics), their efficiency and reliability, affect the efficiency of business processes and determine the ability to timely, appropriate to meet the needs of individual clients and institutional players.

The physical Internet is a global system of closely related logistics network, based on efficiency and reliability is the use of linked interoperable logistical assets interoperable based on unified protocols collaboration, standard transport unit modular and intelligent interfaces. Today's supply chains are long and complex. This is connected with the fundamental problems that the physical Internet can reduce or eliminate. In terms of transport, which is still the way, untapped potential and transport space and inefficiencies in processes.

**Methods:** The research included within the paper is based on the results of the query sources, literature and case studies of companies developing and using digital technologies.

**Results:** Regardless of supply chains in the B2C relationships in recent years has undergone a real revolution driven by technological innovations. As is evident for example the report prepared by the Advisory company Deloitte in cooperation with the Association of MHI, the digital revolution also affects supply chains in manufacturing industry and B2B relationships. The greatest influence on changes to trends related to robotics and automation, data analytics, and Internet of things (IoT). Confirmation of the above trends we find in the report the company PwC. Thanks to the construction of the foundations of digital capture, analyze, integrate, use and interpret high-quality data in real time. These data are fueling process automation, predictive analytics, artificial intelligence and robotics, or technology that soon will take over to supply chain management.

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1 Źródło: Opracowanie własne z wykorzystaniem definicji zaproponowanej przez Benoit Montreuil (twórcę koncepcji), Erica Ballot i Russela D. Mellera, prezentacja 2e Colloque de l’Ortl2l Internet Physique, Observatoire Régional des Transports et de la Logistique de Lorraine, 27-11-2014
3 Transport and Logistics Trendbook 2019
**Conclusions:** The aim of the article is an indication of the ability to apply the idea of the physical Internet and an indication of the role of modern technology in the management of modern supply chain. The research included in the paper is based on the results of the query sources, literature and case studies of companies developing and using digital technologies.

**Keywords:** the physical Internet, digitization, digital supply chain
SESSION 4C: SUPPLY CHAIN OPTIMIZATION

CHAIRMAN: PhD Eng. Aleksader Niemczyk

- Henryk Franciszek Tylicki
  OPTIMIZATION OF THE WAREHOUSE ELEMENTS OF THE ENTERPRISE'S LOGISTICS SYSTEM

- Patrycja Hoffa-Dąbrowska, Katarzyna Grzybowska and João Paulo Estevam de Souza
  SUSTAINABLE SUPPLY CHAIN: REVIEW OF CASE STUDIES

- Waldemar Osmolski, Adam Kolinski and Zafer Kilic
  CONCEPT OF COMMUNICATION INTEGRATION FOR AUTOMATED PRODUCTION PROCESSES REGARDING LOGISTICS 4.0

- Witold Statkiewicz and Joanna Sobkowiak
  IMPLEMENTING IOT (INTERNET OF THINGS) SOLUTIONS ON THE BASIS OF PROCESS ANALYSIS AND DESIGN THINKING (ON THE EXAMPLE OF A PRODUCTION COMPANY)

- Jaroslaw Milczarek and Sebastian Wieczerniak
  CHALLENGES AND CONSTRAINTS FOR PURCHASING IN SMALL AND MEDIUM-SIZED FAMILY ENTERPRISES
ABSTRACT

Background: The article is devoted to the optimization of the warehouse process in an enterprise. The quality of the warehouse process and its effective implementation depends on the operation of the warehouse logistics system and warehouse infrastructure elements in the enterprise. Effective implementation of the warehouse process is possible provided that the logistic process is the best due to the specific evaluation indicators of this process. It is connected with the possibility of using appropriate procedures ensuring maximum efficiency of the warehouse logistics system, including the determination of the optimal set of its elements. Therefore, one of the most important problems, apart from many others, is the development of a procedure that allows optimal determination of the components of the warehouse logistics system. The methods of determining the elements of a warehouse logistic system, on the example of storage racks, using a multi-criteria optimization method, problems connected with it, and proposals for solving them are presented in this study.

Methods: Based on the developed mathematical model of multi-criteria optimization, an algorithm for obtaining the optimal storage system has been built, the main elements of which are the areas of operation: determining the optimal set of shelves; determination of the optimal picking technology; determining the optimal transport system; determination of the optimal technology for the automation of the warehouse process. The algorithm for obtaining elements of the optimal storage system includes the following stages: determining the set of acceptable solutions X; determining the criterion function for each area of activity F; determination of solutions for local optimization tasks according to the "ideal point" method for each area of activity; determination of the global solution of the elements of the optimal solution.

Results: The computational experiment consisted in using the developed algorithm to implement the warehouse logistics optimization procedure in the selection of storage racks. The scope of implementation includes: determining the set of acceptable solutions X, determining the value of the criterion function F(X) and determining the dominance relationship Φ; solution of the multicriteria optimization task; visualization of the solution.

Conclusions: The developed methodology presents, on the example of selection of storage racks, the way of optimization of the warehouse logistics process of the company. Analysis of the results of the numerical experiment of the methodology showed the usefulness of the developed algorithm to determine the elements of the optimal warehouse system of the company. The main advantage of the algorithm is its universality, which allows its use to select elements of other areas of the company's logistics process.

Keywords: warehouse logistic system, optimization of the logistics system, selection of storage racks.
ABSTRACT

Industry is characterized by multilateral supply-production ties with other branches of the economy. As a result of the industry economic activity it affects spatial management and the social and environmental dimensions of sustainability. Therefore, it can be observed multilateral couplings with economic and social development as a result of its strong bonds with the development of science. The history of the Industry is experiencing significant changes on its drivers – from the first mechanization, after electrification with subsequently digitization, to systems integration and at last the creation of business networks under Industry 4.0. Nowadays Industry integrates people and digitally controlled machines using Internet and information technologies. The Industry development can improve human conditions, although it can has been degrading natural environment. Resulting on effects on the environment such as more frequent heat waves; shifting of climatic zones; changes in precipitation; melting of glaciers; disappearing of rivers, conversion of agricultural areas into steppes; changes in ocean currents; increase in the power of hurricanes and extinction of species. Industry activity is also impacting the social dimension with changes in the employment structure of the labour market; increasement of unemployment; digital exclusion; work monotony; and therefore marginalization of the human role. Hence, it is necessary to strive for sustainable development, where economic development is met without compromising the ability of future generations to meet their environmental and social needs. Industry and sustainability is not mutually exclusive. In many cases, actions for sustainable development in business can bring new business opportunities and provide economic development without degrading the environmental and social dimensions. This study has the objective to present examples of effective implementation of sustainable development practices in the supply chain.

Methodology. To achieve the objective of this study we used a literature review of publications using the Web of Science and Scopus databases. The retrieved publications, provided the base for a bibliometric analysis and discussion of the practices.

Results. Considering that much of the unsustainable activity in the world can be traced to industrial activity, the necessity of sustainable development calls for changes in the industry development models. As a result of the review in the studied area, it was possible to identify a number of examples of effective application of sustainable development practices in operations and supply chains.

The theoretical contribution. Over the centuries, significant technology changes have been observed in the industry. The technology changes are considered indispensable to meet the humanity needs. Although there are positive impacts resulting in higher standards of living,
although they can be also related to many negative impacts. The observed adverse impacts in the environment and social dimensions can take us to the conclusion that industry’s development cannot be unconditional and must take into account its social environmental impacts.

**Keywords:** Industry, Sustainability, Environment, Social Space, Economic, Sustainable development
Waldemar Osmolski, Adam Kolinski and Zafer Kilic

CONCEPT OF COMMUNICATION INTEGRATION FOR AUTOMATED PRODUCTION PROCESSES REGARDING LOGISTICS 4.0

ABSTRACT

Background: Constantly changing market needs and concentration of the entire supply chain on the customer service level, forces both in the business and scientific world to search for modern solutions which improve logistic processes. This trend is leading to the transformation of current solutions towards intelligent supply chains. The use of modern technologies is aimed at improving logistics processes at the operational level by shortening the time of execution of activities, minimizing bottlenecks and errors which result from faulty information flow. Nowadays, there are numerous innovative solutions that lead the supply chains along the digitisation way.

Material and methods: Since 2016, the Institute of Logistics and Warehousing and the Poznan School of Logistics have been conducting intensive research work both in the scientific area and in the possibilities of applying individual solutions in business practice. Jointly developed long-term research methodology aims at applying the synergy effect of research work in the field of identification of innovative solutions for supply chain digitisation, with an analysis of their possible application in economic practice.

Results: The aim of this paper is to present the concept developed to evaluate the communication integration efficiency of automated production processes as one of the key elements of the intelligent supply chain. The result of this work is participation in a research project L4MS, and at the end of the project work the possibility of verifying the efficiency of intelligent solutions implementation in economic practice.

Conclusions: Information technologies, wireless sensors and advanced control systems are becoming the key of the new industry. However, it should be emphasized that such high value-added products can be realized with advanced computer-controlled machines. For this reason Industry 4.0 requires equipment and has the potential to expand through. It also creates a secondary market in areas such as automation equipment, robots and special machinery in logistics.

Keywords: Logistics 4.0, automated production processes, autonomous devices, communication integration, information flow efficiency
Due to advancing market needs and technological development, companies are required to continuously grow and analyse their operations. The aim of this article is to outline the process of implementing changes within an organisation, which are meant to achieve competitive advantage. Thanks to the process analysis and the multi-layered survey of the range and complexity of their particular stages, the most efficient IoT-related solution will be selected out of those presented in the text.

Methods: The study was conducted in a company with a complex production structure. The basic method was process analysis aiming to diagnose the problems occurring at various stages of product development: from designing, to production, logistics, customer support, and after-sales service. The research results were used for a more in-depth analysis of the various stages of the process and for the selection of areas which require improvement as well as for the development of optimum IoT solutions which could improve the process. The design thinking method was employed as well, serving as auxiliary methodology in the creation and selection of the final solutions.

Results: This article describes the output processes of a company, which have been carefully mapped and analysed. The authors present the actual state of individual stages, accompanied by the theoretical base, the factors of the selection of state-of-the-art IoT solutions, and the estimated effects of their implementation. The final result is the business process model with implemented examples of using IoT at various stages of product development and customer service.

Conclusions: A proper process analysis in a company and the implementation of customised IoT solutions are indispensable elements of development strategies in innovative companies whose goal is to build competitive advantage. The article presents selected process aspects, the most important change determinants, as defined by the authors, and selected methods of implementing new solutions. The paper outlines the framework of further studies and necessary implementations.

Keywords: technological processes, process analysis, BPMN 2.0, IoT, innovation, Industry 4.0, design thinking
ABSTRACT

Background. Business activity involves decision making at various management levels and triggers a number of implications within its functional areas. Scale of their occurrence depends both on the strength of its external environment and the characteristics of the enterprise itself, including risk attitude of its owner. The subject of this article are small and medium-sized family businesses, where the owner often takes direct part in purchase decision-making. The aim of this paper is an identification of constraints and related challenges for purchase departments in family small and medium-sized businesses.

Methods. Questionnaire survey and interviews with purchasing managers of family enterprises have been conducted.

Results. Propensity of an enterprise owner to take risks and the stage of development of his business give rise to consequences for the functioning and efficiency of the entire organization and its particular departments. Among most frequently constraints finds an authoritarian management style, in which an open-mindedness for new technologies isn’t followed by open-mindedness for latest management systems.

Conclusions. Purchasing activity of family enterprises is strongly dominated by their owners. The role of purchasing departments then becomes not only the performance of their duties, but also the challenge of making the business owners aware of the existing constraints for the purchasing area. Future research shall focus on developing a method to overcome the constraints and to emphasize opportunities from purchase activity when it is unaffected by enterprise owner.

Keywords. purchasing, procurement, challenges and constraints for purchasing, family enterprise, SME