Transporta un sakaru institūts
Transport and Telecommunication Institute

RESEARCH and TECHNOLOGY – STEP into the FUTURE

Volume 17. No. 1 - 2022

ISSN 1691-2853
ISSN 1691-2861
(On-line: www.tsi.lv)

Riga
2022

THE JOURNAL IS DESIGNED FOR PUBLISHING PAPERS CONCERNING THE FOLLOWING FIELDS OF RESEARCH:

- mathematical and computer modelling
- mathematical methods in natural and engineering sciences
- computer sciences
- aviation and aerospace technologies
- electronics and telecommunication
- telematics and information technologies
- transport and logistics
- economics and management
- social sciences

Articles and review are presented in the journal in English, Russian and Latvian (at the option of authors). This volume is published without publisher editing.

EDITORIAL CORRESPONDENCE

Transporta un sakaru institūts (Transport and Telecommunication Institute)
Lomonosov 1, LV-1019, Riga, Latvia. Phone: (+371)67100594. Fax: (+371)67100535
E-mail: Gruzite.V@tsi.lv, http:// www.tsi.lv

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No 1

ISSN 1691-2853, ISSN 1691-2861 (on-line: www.tsi.lv)

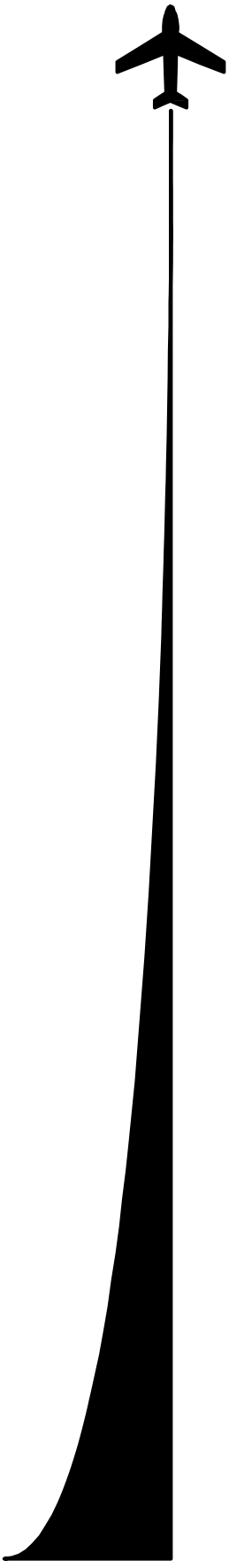
The journal of Transport and Telecommunication Institute (Riga, Latvia)
The journal is being published since 2006

PROGRAMMING COMMITTEE

- **Igor Kabashkin**, Professor, Chairman, Director of Programme, TSI
- **Irina Yatskiv**, Professor, Chairwoman of the Board, TSI
- **Boriss Misnevs**, Professor, Director of the study program, TSI
- **Irina Kuzmina-Merlino**, Professor, Director of Programme, Transport and Management Faculty, TSI
- **Mihails Savrasovs**, Professor, Vice-Rector for Academic & Research, TSI
- **Yulia Stukalina**, Professor, Pro-dean of Transport and Management Faculty, TSI
- **Alexander Grakovski**, Professor, Director of Programme, Engineering Faculty, TSI
- **Ishgali Ishmuhametov,** Assistant Professor, Transport and Management Faculty, TSI
- **Alexander Medvedev,** Professor, Vice-dean of the Engineering faculty, TSI
- **Irina Pticina,** Professor, Vice-rector for Student Affairs, TSI

ORGANIZING COMMITTEE

- **Irina Yatskiv,** Professor, Chairwoman of the Board, TSI
- **Mihails Savrasovs,** Professor, Vice-Rector for Academic & Research, TSI
- **Jelena Baranova,** Lecturer, Engineering faculty, TSI
- **Viktorija Gruzite,** Organizing Manager, TSI
- **Dmitry Pavlyuk,** Professor, Vice-dean of the Engineering faculty, TSI



The 41th Research and Academic Conference

RESEARCH AND TECHNOLOGY – STEP INTO THE FUTURE

22 April 2022 Riga, Latvia

41. zinātniski praktiskā un mācību metodiskā konference

ZINĀTNE UN TEHNOLOĢIJA – SOLIS NĀKOTNĒ

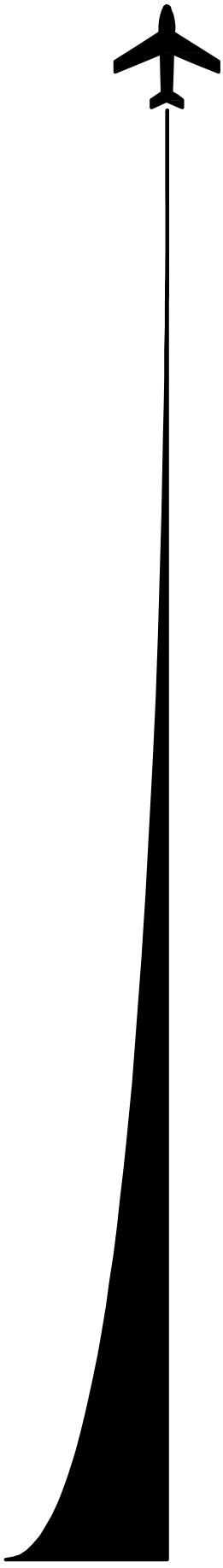
2022. gadā 22. aprīlī, Rīga

41-я научно практическая и учебно-методическая конференция

НАУКА И ТЕХНОЛОГИЯ – ШАГ В БУДУЩЕЕ

Рига, 22 апреля 2022 года

CONTENTS



Open Workshop

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 9
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

THE IMPACT OF GEOPOLITICAL CHANGES AFTER FEBRUARY 24, 2022. SELECTED ASPECTS OF THE LOGISTICS SERVICES OF INTERNATIONAL EXCHANGE OF GOODS

Jakub Donski-Lesiuk

Department of Logistics and Innovations, Faculty of Economics and Sociology, University of Lodz
Lódź, Poland
jakub.donski@uni.lodz.pl

Keywords: Russo-Ukrainian war; Logistics channels; Resource availability changes; International exchange of goods reconfiguration

Background: Central and Eastern Europe has a special place in the logistics service of international trade, not only due to the strategic geographic location determining the transit position in the Trans-Eurasian supply chains. Also to the significant share of services provided by enterprises located in the countries of the region.

The outbreak of the armed conflict on February 24, 2022, initiated by the attack of Russian troops on the territory of Ukraine, should be considered a key determinant of changes in the economic ties that have existed so far. As a result of the so far made and expected subsequent decisions in the field of international political and economic relations, the region's logistic connections will undergo reconfiguration. Importantly, their effects will be visible not only in the countries of Central and Eastern Europe, but also on a supra-regional scale.

Methods & Results: The presentation addresses the issue of the short and long-term effects of economic disturbances resulting from the Russian-Ukrainian war and their implications for the changes in flows related to the handling of international trade in goods. It is based on the perspective of geopolitical dependencies and changes in the strategic order, which is reflected in the ongoing crisis. It uses statistical data determining the hitherto involvement of individual countries in international flows and indicates the potential consequences of restrictions on international trade in goods.

Conclusions: The obvious, after all, forced by the ongoing conflict limitations in access to resources and the possibilities of their effective delivery in supply chains will cause far-reaching changes of global importance, Sanctions and retaliatory sanctions in Russia's relations with the West, preventing the implementation of the current supplies from Ukraine covered by military operations, will shape the market selected goods and logistics service markets to a large extent. At this stage, it is important to be aware of the consequences of the conflict that has begun.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 10
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

INTELTRANS PROJECT: STUDY OF NEW INTELLIGENT TECHNOLOGIES FOR FUTURE TRANSPORT PROFESSIONALS

Igor Kabashkin

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

Keywords: Intelligent transport systems, smart mobility, transport education

In modern conditions, transport is one of the main components of the development of the world economy. At the intersection of information technology, telecommunications and electronics, such new areas as intelligent transport systems (ITS), autonomous vehicles, smart mobility, mobility-as-a-service, and others are actively developing.

Under these conditions, on the one hand, the dynamics of the development of educational programs in the field of transport lags the real development of this sector of the economy, and on the other hand, internationalization and the global nature of changes require a coordinated approach to training specialists in this global market.

The INTELTRANS project is designed to overcome this gap. The partners of the projects are TTK University of Applied Sciences (Estonia), Häme University of Applied Sciences (Finland) and Transport and Telecommunication Institute (Latvia).

The project aims to contribute towards transport system that is safe, resilient, seamless and environmentally friendly for citizens, companies and society as a whole. To achieve this goal, project partners want to modernize transport and traffic management professional higher education curricula, learning processes, and learning environments.

In the effort of harmonizing transport curricula, we must consider new insights and demands connected with transport infrastructure, driver behaviour, as well as both the physical and general business environment. Globally new technologies for vehicles are coming and traffic management will be key to handle negative impact of transport. The project partners, universities of applied sciences, address emerging development needs by creating a joint Intelligent Transport and Traffic Management study module and pilot it with multinational groups of students, together with methodology and materials that are applicable and replicable outside current partnership.

The study module includes the following courses: Wise mobility, EU legal bases of traffic management, Traffic Safety in environments, ITS solutions for traffic and safety management, Practical project activities.

The paper describes a brief content of the training module and a general approach to its study based on blended learning approach.

Acknowledgements

This paper has been financially and conceptually supported by the EU grant of INTERREG Central Baltic project INTELTRANS.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 11-12
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

INTRODUCTION INTO MODERN AIR TRAFFIC CONTROL (ATC) SERVICE ENVIRONMENT AND ORGANIZATION

Jörg Kundler

DFS Deutsche Flugsicherung GmbH, Langen
Am DFS-Campus 8, D-63225 Langen
kundler@mailbox.org

Keywords: terms, legal regulation, fee calculation, air space management, airspace structure, service map

Air Traffic Control (ATC) service is responsible to guarantee the safety of civil aviation on the national airspace. The ATC service carries on an own national service provision and presents an end-to-end service on international and European level. So, the ATC framework bases on regulated settings by ICAO, Single European Sky and national authorities. Definitions of ATC tasks and responsibilities are given by this paper.

This work presents the results of an investigation about the actual ATC specific service frameworks in context to the legal status of ATC organizations and their given official tasks by the government. The ATC services are described as part of an integrated traffic system of civil aviation. A system overview of services, their frameworks and key performance indicators has been worked out. The service framework is defined by air traffic control, air traffic management and integrated air information services.

Based on these frameworks the specific ATC and ATM services are developed by using of the service map method. The service map is structured into air traffic control, air traffic management and air information services. These operational services are designed in context to used technical systems for communication, navigation and surveillance. This work also presents the basics of airspace organization, the definition of airspace structure and air routing network. The principals of airspace sector management, metrics and the flexible-use-of-airspace for civil and military aviation usage is described. The air traffic management is defined by the implemented Centralized Flow Management Unit at Eurocontrol.

The method and principles of ATC fee calculation for a regulated business will be described. The paper presents the formulas and conditions for the ATC fee calculation. The calculation is described by a practical example for a specific flight route.

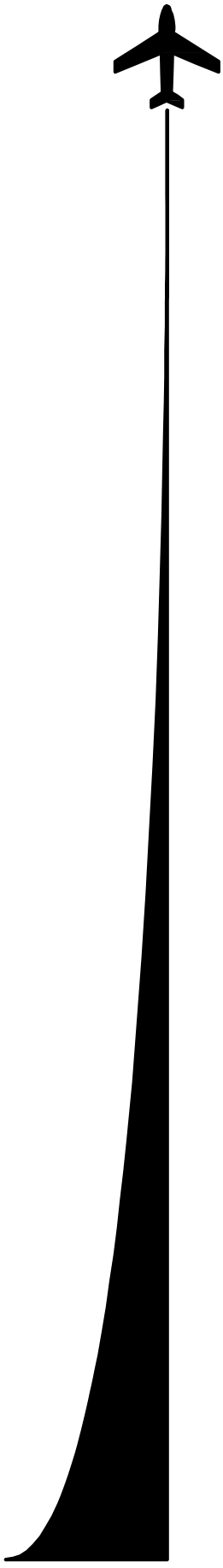
The research objectives and methodology for investigation are formulated to solve the task of harmonisation of ATC services at EU level from national fragmented airspace to a service and business-oriented provision at Functional Airspace Block (FAB) layer. Used technologies and technical services were synchronized to ATC controller services to control the required technical key performance indicators in correlation to the ATC Controller Key Performance Area (KPA).

New ATC specific methods, like direct routing, green approach and remote tower control to save the environment and reduce the noise pollutions are mentioned in the paper too.

References

1. https://www.dfs.de/dfs_homepage/de (March 20, 2022)
2. https://www.dfs.de/dfs_homepage/de/Presse/Publikationen/dfs_kurzportraet_D_2017.pdf (March 20, 2022)
3. Waldinger, Peter. (2005/2006) Vorlesung Flugsicherung, Technische Universität Darmstadt, Fachbereich 16 Maschinenbau Fachgebiet Flugsysteme und Regelungstechnik.

4. Kundler, Jörg. (2015) Vorlesung ATC IT-Service Management, Technische Hochschule Mittelhessen.
5. Kundler, Jörg. (2014) Doctoral Thesis, Volume 1. The Methodology of Maintenance and Technical Service Model Development for Air Traffic Control Service Provider, Riga, 2014, ISBN 005-1449-097.
6. Direct Mitarbeiterzeitung der DFS (2022), Ausgabe 1 2022, Herausgeber Deutsche Flugsicherung GmbH, ISSN: 0947-2843.



Session 1

Computer Problems of the Information Society

Informatīvās sabiedrības datorizācijas problēmas

Компьютерные проблемы информационного общества

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 15
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

PROJECT "eMEDIATOR": MODEL OF ECOSYSTEM FOR EUROPEAN EDUCATION MOBILITY AS A SERVICE

Boriss Misnevs [1], Igor Kabashkin [2], Kristine Uzule [3]

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
[1]bfm@tsi.lv, [2]kiv@tsi.lv, [3]uzule.k@tsi.lv

Keywords: Ecosystem, Education Mobility, Gig Economics, Competences, e-CF

Modern society creates new challenges for the education and training systems which form new mobility requirements for the European education ecosystem based on Gig economy principles. The creation of an ecosystem model with a demo portal that used principles of service and competence-based, student-centered education and business-academia partnerships is the main goal of the eMEDIATOR (Ecosystem for European Education Mobility as a Service) project.

The paper presents the results of the first period of the study within the frame of this project, the purpose of which was to create an information model of an open-source network portal. This portal will offer Gig educational services to academics, students, and institutions to meet educational and employment needs by finding and mastering courses within the EU common educational space. The model is built based on competency units using digital standards (CEN and EC, 2014). The architecture of the model is built considering its extensibility, improvement, and considering recommendations on the user experience of education management systems.

A key contribution of this study is the web portal model as an open educational resource (Misnevs *et al*., 2022). This model is built on cloud architecture and makes the unlimited mobility of online education in the EU a reality. The ecosystem being developed can unite the main players in the education market in one virtual space on an ongoing basis, regardless of geographical location. This model integrates European values of social and professional justice as students are better able to satisfy their educational curiosity and teachers are given the tools to overcome the lack of teaching, research, information, and financial opportunities in their current location.

The paper presents the results of the analysis of modern achievements in the field of mobile learning, gives a brief overview of existing solutions in the form of digital educational services, and provides the basic functional and non-functional requirements for the development of eMEDIATOR ecosystem.

Acknowledgments

This research has been financially and conceptually supported by the EU grant of ERASMUS+ project eMEDIATOR (Agreement N 2021-1-LV01-KA220-HED-000027571).

References

1. CEN and EC, *European e-competence framework 3.0*, (2014). Available at: http://ecompetences.eu/wp-content/uploads/2014/02/European-e-Competence-Framework-3.0_CEN_CWA_16234-1_2014.pdf (27.03.2022).
2. Misnevs, B., Kabashkin, I., Uzule, K. (2022) Education Mobility as a Service: Model of the Ecosystem. In: Kabashkin, I., Yatskiv, I., Prentkovskis, O. (eds) *Reliability and Statistics in Transportation and Communication. RelStat 2021. Lecture Notes in Networks and Systems*, 410, 598-607. Springer Cham. Available at: https://doi.org/10.1007/978-3-030-96196-1_54

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 16
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

PROJECT "INGENIOUS": STRENGTHENING DIGITAL PEDAGOGY SKILLS AND COMPETENCIES OF EDUCATORS

Boriss Misnevs [1], Igor Kabashkin [2], Kristine Uzule [3]

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
[1]bfm@tsi.lv, [2]kiv@tsi.lv, [3]uzule.k@tsi.lv

Keywords: digitization; green; competence; pedagogy; knowledge; skills

At present, vocational education and training are going through a difficult period. The need for specific, well-trained specialists is growing, and the number and quality of graduates of vocational education are increasingly lagging behind the needs of industries.

The INGENIUS project is dedicated to the study of issues of improving digital and "green" competencies of teachers of vocational education. Currently, the second period of the project has been completed and interesting results have been obtained.

Professional teachers point out various problems in education that are identified in the process of surveys. For example, surveys conducted in 6 countries (Greece, Italy, Slovenia, Latvia, Bulgaria) by participants of the INGENIOUS project confirmed the fact that teachers lack the digital and green competencies necessary to conduct professional training at the modern level.

Many of these learning problems can be solved by digitizing vocational education. To do this, it is necessary to create a special well-structured digital platform that will solve many problems of modern vocational education and will be integrated into the European green ecosystem.

The research is devoted to the development of a new combined model of digital and green competencies of teachers of vocational education with a view to its subsequent integration into a digital platform. The implemented model meets the requirements of the "green" economy and is based on the DigCompEdu standard, considering specific digital competencies determined by industry requirements and relevant aspects of the e-CF standard.

The paper presents the results of the analysis of modern achievements in the field of VET, gives a brief overview of existing solutions in the form of digital educational services, provides the main functional and non-functional requirements for the development of the EQO digital platform for the implementation of pilot training courses for VET teachers.

Acknowledgments

This paper has been financially and conceptually supported by the EU grant of ERASMUS+ project INGENIOUS (Agreement No. 2014-2020-1-EL01-KA226-VET-094871).

References

1. Gebhardt, J., Grimm, A., Neugebauer, L. (2015) Developments 4.0. Prospects on future requirements and impacts on work and vocational education, *Journal of Technical Education*, 3(2), 116-133, 2015.
2. European Commission. (2021) *The digital education plan 2021-2027*. Available at: https://ec.europa.eu/education/sites/default/files/document-library-docs/deap-communication-sept2020_en.pdf (27.03.2021).

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 17-18
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

A PREDICTIVE MODEL FOR DETECTION OF CREDIT CARD FRAUD USING MACHINE LEARNING

Vladislavs Osmuskins

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
borgilon@mail.ru

Keywords: credit card fraud, Machine Learning, classification, fraud detection, ML algorithms

Nowadays, banking transaction stream is growing and with the nowadays technological revolution, fraudulent activities finding new methods and technologies, which lets to trick security measures of financial organizations (Sadgali *et al*., 2020). The negative effect of card fraud costs businesses millions of dollars that negatively impacts on the world's economy (Abdou *et al*., 2019). Also, the numbers of fraud cases may rise in a significant way over the next few years, as well as because the pandemic is contributing to increase in card fraud. As it was marked by Swaroop *et al*. (2019), on average, every 10 million out of an estimated 12 billion transaction, which are made annually, belongs to fraudulent.

In this way, for companies that produce bank cards, it is very significant not only to recognize fraudulent transactions correctly, but also to do it timely. One of the possible options to automate the solution to this problem and reduce the negative impact of fraud is the use of algorithms based on Machine learning (ML).

The techniques of ML are based on the theory of mathematical programming and gives a significant performance on a wide range of problems, existing with bank cards. Maniraj *et al*. (2019) have suggested using ML-based algorithms with outlier detection, such as Isolation Forest and Local Outlier Factor and developed a system in which accuracy of the correct classification of translation data was achieved up to 99.6%, and the percentage of transactions which were relevant was about 33%.

Moreover, ML prediction models have possibility to learn from normal behaviour patterns. Such models adapt very fast to changes in this normal behaviour, and as a result, they can quickly recognize fraudulent cases. In other words, it means that the model can detect suspicious customers even if there was no chargeback.

This research paper includes modification and validation of the algorithm that contains adding several ML techniques for improving work of the model. The algorithm itself is based on the binary classification of the financial transactions, which divides them into two categories that includes normal of fraudulent transactions.

Should be noted, that selection criteria for the taken algorithm was defined by using Analytic Hierarchy Process method. As a result, there were taken such important characteristics as accuracy, recall and the running time of the algorithm. So, in this case, accuracy is identifying the percentage of correctly predicted fraudulent translations out of all transactions. Also, recall of the algorithm talks about the actual number of fraudulent cases a model correctly identified. Finally, the algorithm running time is based on the input of transaction data taken from the selected datasets.

As it was noted, the algorithm is based on the binary classification, so the algorithm modification includes the addition of several ML techniques, such as Decision Tree and Random Forest, in order to improve the classification results of the fraud detection.

The datasets, which were used in the stage of testing the modified algorithm, were taken from the Kaggle source. These datasets include information only about credit card transactions made within two days. Also, since these datasets includes over thousand transactions, it was

decided to use Data Ladder tool for data cleaning in aim to remove mislabeled types of variables from datasets.

The preliminary results, based on defined earlier metrics of the algorithm and taken datasets showed that the accuracy of the modified algorithm was over 83% with the recall value of almost 60%. However, should be marked that the selected datasets that were used in this research had limited number of records, and to achieve higher results of the classification there should be used a really huge datasets of credit card transaction data with many thousands of records.

The research supervised by Associated professor, Dr. sc. ing. Dmitry Pavlyuk.

References

1. Sadgali, I., Sael, N., Benabbou, F. (2020) Adaptive Model for Credit Card Fraud Detection. *International Journal of Interactive Mobile Technologies*, 14(3), 54-65.
2. Abdou, H., Khalifa, W., Roushdy, M., Salem, A. (2019) Machine Learning Techniques for Credit Card Fraud Detection. *Future Computing and Informatics Journal*, 4(2), 98-112.
3. Swaroop, K., Amruta, D., Sanath, J., Pooja, G. (2019) Credit Card Fraud Detection Using Machine Learning. *International Journal of Engineering Research & Technology*, 7(10), 1-5.
4. Maniraj, S., Saini, A., Ahmed, S., Sarkar, S. (2019) Credit Card Fraud Detection using Machine Learning and Data Science. *International Journal of Engineering Research & Technology*, 8(9), 110-115.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 19
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

RESEARCH OF MACHINE LEARNING METHODS IMPLEMENTATION FOR EARLY IDENTIFICATION OF E- LEARNING STUDENTS AT RISK OF FAILING

Jibin Manjaly James

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
st58770@students.tsi.lv

Keywords: Learning analytics, Deep Learning, Machine learning

Educational Data Mining and Deep Learning are critical in identifying academically underperforming students at an institution and assisting them in improving their performance via the development of various recommendation systems. These tools guide pupils toward their future goals by revealing valuable hidden patterns in their knowledge history.

Predicting student performance has become a significant topic for data mining and machine learning researchers in the globalized education industry, where multiple factors impact prediction models (Agrawal *et al*., 2015). The purpose of this study is to use classification algorithms to the evaluation of students' failed performance in higher education and to find the critical variables that impact the prediction process (Beikzadeh *et al*., 2005). The purpose of this research is to examine the outcomes of using hybrid VGG 19 and VGG19 deep learning algorithms to predict students' academic achievement on their final tests. The approach presented consisted of two parts (Steiner *et al*., 2014). The first step included input data and data pre-processing, which involves preparing, consolidating, cleaning, and removing the missing value from the dataset and is also divided into training and testing sets. The evaluation of the classification performance and prediction and result generation will be done in the second stage the whole process employed an algorithm according to the deep learning approach (Siemens *et al*., 2012).

The prediction model's output indicates a low, medium, and high risk of failing. As well accuracy precision and recall parameters will be carried out during the simulation. This prediction will aid teachers in assisting high-risk students by implementing relevant interventions, and this work will be simulated using MATLAB software.

This research is supervised by Professor Boriss Misnevs.

References

1. Agrawal, R.S., Pandya, M.H. (2015) Survey of papers for Data Mining with Neural Networks to Predict the Student's Academic Achievements, *International Journal of Computer Science Trends and Technology (IJCST*), V3, I5, Sep-Oct 2015.
2. Beikzadeh, M. R. and Delavari, N. (2005) A New Analysis Model for Data Mining Processes in Higher Educational Systems, *Proceedings of the 6th Information Technology Based Higher Education and Training, 7-9 July, 2005*.
3. Steiner, C., Kickmeier-Rust, M., & Albert, D. (2014) Learning Analytics and Educational Data Mining: An Overview of Recent Techniques. *Learning analytics for and in serious games*, 6-15. Retrieved from https://graz.pure.elsevier.com/en/publications/learning-analytics-and-educational-data-mining-an-overview-of-rec (03.03.2022).
4. Siemens, G., & Baker, R.S. (2012) Learning analytics and educational data mining: towards communication and collaboration. Retrieved from https://www.upenn.edu/learninganalytics/ryanbaker/LAKs%20reformatting%20v2.pdf (03.03.2022).

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 20-21
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

STUDY OF TIME SERIES ANOMALY DETECTION USING AGGREGATION OF METHODS CLUSTER ANALYSIS AND TADGAN MODEL IN CLOUD ENVIRONMENT

Veronika Grundmane

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
veronika.grundmane@gmail.com

Keywords: time series data, anomaly detection, aggregation process, cluster analysis, K-Means, Time Series Anomaly Detection using Generative Adversarial Networks (TadGAN)

Nowadays, the growth of modern technology makes it very important to extract new and meaningful information from large amounts of data. Consequently, the importance of the result of analyses increases in such a large information space and one of the key points of identification of existing anomalies is its detection. (Braei *et al*., 2020).

A fair number of research these days use neural networks to recognise anomalies in time series, in some cases it is possible to reduce the time taken to decide whether the current sequence contains any anomaly or not. The problem solved by the approach explored in the current research paper is to significantly reduce the neural network running time required to recognise anomalies in the cloud using an aggregation process.

The purpose of this study is to evaluate the effectiveness of the K-means method and Time Series Anomaly Detection using Generative Adversarial Networks (TadGAN) model aggregation process for time series anomalies detection in cloud environment. The main purpose of K-means in this approach is to compress multivariate data by replacing a set of consecutive values with their average, thus making the data dimensionally more compact. The result of this hybrid method is to compress the amount of time series data received by the TadGAN model by pre-processing the data using cluster analysis, thus reducing the time required for the model to detect anomalies. To achieve the goal of this research, the following tasks have been done: state-of-art on the anomaly detection, analyze and highlight methods that are used for anomaly detection in time series, analyze and prepare a time series dataset suitable to detection anomalies, develop the aggregation of methods K-means cluster analysis and TadGAN model, train and test the developed model, evaluate the effectiveness of aggregation model by comparing the TadGAN model work without aggregation. The combination of the two methods affects the detection time as well as the quality of anomaly detection in time series data.

This research provides a hybrid model using aggregation process, which should detect anomalies for time series data in the cloud environment. In development of the hybrid model, the next algorithms were used: K-means, a model based on the TagGAN was presented (Geiger, *et al*., 2020).

To evaluate the effectiveness of anomaly detection with the hybrid model, tests were carried out on different time series datasets and compared with the TadGAN model which does not use the aggregation method. The results demonstrate how efficiently and accurately the hybrid method can be used to detect anomalies in large amounts of temporal data in a cloud environment.

The research is supervised by Dr.sc.ing. Dmitry Pavlyuk.

References

1. Braei, M. and Wagner, S. (2020) *Anomaly Detection in Univariate Time-series: A Survey onthe State-of-the-Art*. arXiv preprint arXiv:2004.00433.
2. Geiger, A., Liu, D., Alnegheimish, S., Cuesta-Infante, A., Veeramachaneni, K. (2020) TadGAN: Time Series Anomaly Detection Using Generative Adversarial Networks. In: *Proceedings of the International Conference on Big Data*, 10–13.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 22-23
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

APPLIED RESEARCH ON LEARNING PROCESS IMPROVEMENT BASED ON AI SOLUTIONS

Dmitrijs Mamontovs

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
dim97@inbox.lv

Keywords: Machine learning, Eye tracking, Facial expression recognition, Convolutional neural network, Computer vision, Engagement detection

Nowadays, more and more educational establishments use distant learning services. And the demand in quality distant learning system has increased significantly. Remote educational process is not so effective as intramural education for a variety of reasons. For example, students have more difficulties with focusing on educational materials, teachers are not able to monitor students' engagement effectively and it's difficult for students to communicate with teachers and ask question regarding educational material. So, it is important to improve learning process by extending such systems with additional functionality, that help to monitor and increase student's engagement. Students' on-task engagement during adaptive learning activities has a significant effect on their performance, and at the same time, how these activities influence students' behavior is reflected in their effort exertion (Sharma *et al*., 2019).

Artificial intelligence approaches and technologies, such as machine learning and computer vision are applied in various fields of science and areas of everyday life, including sphere of education. It already supports various management systems and evaluation systems, but artificial intelligence still not so common for services of distant learning.

The purpose of this study is to consider, test and compare several algorithms of artificial intelligence that could be used in distant learning systems to monitor and evaluate students' engagement during learning process. These algorithms then could be used for detection of possible issues in educational materials and learning process improvement.

It was identified most applicable methods and algorithms that then was used in engagement detection system:

- Convolutional neural network facial expression recognition and Video oculography for eye tracking (Klaib *et al*., 2020);
- Deep neural network and recurrent neural network for decision-making;
- Back propagation and neuroevolution as algorithms of learning for neural networks.

To achieve the goal there have been formulated next tasks: State-of-art on the usage of AI in learning processes; Analyze existing subject area to find real cases of using AI in learning process and evaluate its efficiency; Develop the data collecting methods and tools for creation of APIs; Train and test the developed model; Unite all modules in one system; Evaluate the effectiveness of used AI models.

This research provides an implemented engagement detection system with included trained Machine learning models. And results demonstrate which methods and its' combination is more efficient for considered task.

The research is supervised by Dr.sc.ing. Professor Dmitry Pavlyuk.

References

1. Sharma, K., Giannakos, M., Papamitsiou, Z. (2019) Building pipelines for educational data using AI and multimodal analytics: A "grey-box" approach. *British Journal of Educational Technology*.
2. Klaib, A., Alsrehin, N., Melhem, W., Bashtawi, O., Magableh, A. (2020) Eye Tracking Algorithms, Techniques, Tools, and Applications with an Emphasis on Machine Learning and Internet of Things Technologies. *Expert Systems with Applications*, 166.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 24
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

DECISION-SUPPORT FRAMEWORK FOR SOLVING THE IOT-RELATED PROBLEMS

Darja Mozoleva

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
mozoleva@yahoo.com

Keywords: Internet of Things, risks, literature review

The Internet of Things (IoT) is a network in which data is transferred between physical objects (things). In the past decade, thanks to the cloud as storage and its computing power, the implementation of the Internet of Things has become easier and more affordable. Although there are still many factors hindering the rapid development of this technology.

The purpose of the study is to determine the current state of affairs and find ways to overcome the factors hindering the development of the Internet of Things technology.

In the course of the work, a semi-systematic and integrative review of the literature was conducted. (Snyder, 2019) This helped to identify the main areas of use of the IoT, the main problems and possible ways to solve them.

As a result of the work, a decision-support map was designed to identify factors that negatively affect the development of the IoT technology. Methods for overcoming them are proposed.

The research supervised by Assistant Professor, Dr. sc. ing. Ilya Jackson.

References

1. Snyder, H. (2019) Literature review as a research methodology: An overview and guidelines. *Journal of Business Research*, 104, 333–339.
DOI: https://doi.org/10.1016/j.jbusres.2019.07.039

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 25-26
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

COMPARISON OF MODERN METHODS OF QUERY OPTIMIZATION WHEN WORKING WITH RELATIONAL DATABASES

Eduards Gruberts

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
eduards.gruberts@gmail.com

Keywords: DBMS,Query Optimisation, Dynamic programing, Neural networks

With the constant growth of data, the task of storing and processing it does not lose its relevance to this day. One of the most successful data organization and storage models is the relational model proposed by Edgar Codd in the early 1970s. The model he proposed is based on a solid theoretical foundation of relational algebra and allows describing data in its natural form without any restrictions imposed by the physical storage environment.

Interaction with the database is carried out using the high-level declarative query language SQL, that is, the declarative paradigm describes what we want to get, but does not say how. This task falls entirely on the database management system (DBMS).

Any request can be fulfilled in different ways. The difference in execution time between optimal and non-optimal plans can be many, many orders of magnitude, so the planner that performs parsed query optimization is one of the most complex components of the system. Each new join of tables increases the complexity of optimization exponentially, and from the study (Leis *et al*., 2015) we can conclude that the accuracy of optimization drops significantly. I would like to note that the classical methods of optimization by dynamic programming have a limit of up to 12 joins, if the query exceeds this limit, then it is optimized by heuristic algorithms, such as genetic algorithms. Currently, complex analytical systems have long passed the milestone of 12 associations, as noted in article (Neumann *et al*., 2018) there are requests in which more than five thousand associations participate. And given the fact that decision-making systems and analytics are constantly evolving, I can safely conclude that this task of query optimization does not lose its relevance to this day. In the course of the study, the works (Zhou *et al*., 2022; Marcus *et al*., 2019) were analyzed, in which modern approaches to query optimization were proposed, which are based on neural networks. But no comparison was made between the existing classical approaches and modern ones in solving problems involving a large number of associations.

For research conducting, a PostgreSQL DBMS test bench was prepared with a rather traditional architecture, which makes it a convenient object for demonstrations. In addition, its source code is available in open source, which allows you to change its internal structure.

A driver has also been prepared that allows us to bring the query optimization stage into the Python language, thereby making it possible to make changes to the query execution stage.

The expected results will reflect the state of the problem with optimizing queries with a large number of joins, which can potentially help improve optimization techniques.

The research supervised by Assistant professor, Dr. sc. ing. Jelena Kijonoka.

References

1. Leis, V., Gubichev, A., Mirchev, A., Boncz, P., Kemper, A. and Neumann, T. (2015) How good are query optimizers, really? *Proceedings of the VLDB Endowment*, 9(3), 204-215.

2. Neumann, T., Radke, B. (2018) Adaptive Optimization of Very Large Join. In: *Proceedings of 2018 International Conference on Management of Data, Houston, TX, USA, June 10–15, 2018 (SIGMOD'18*), 16.
3. Zhou, X., Cha, C., Li, G. and Sun, J. (2022) Database Meets Artificial Intelligence: A Survey. *IEEE Transactions on Knowledge and Data Engineering*, 34(3), 1096-1116.
4. Marcus, R., Negi, P., Mao, H., Zhang, C., Alizadeh, M., Kraska, T., Papaemmanouil, O. and Tatbul, N. (2019) Neo: A Learned Query Optimizer. *Proceedings of the VLDB Endowment*, 12(11), 1705-1718.
5. Marcus, R. and Papaemmanouil, O. (2019) Plan-structured deep neural network models for query performance prediction. *Proceedings of the VLDB Endowment*, 12(11), 1733-1746.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 27-28
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

CRITICAL ASPECTS IN BUSINESS PROCESS AUTOMATION

Natalja Lazareva

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
Natalja_riga@mail.ru

Keywords: Digitalization, Robotic Process Automation (RPA), RPA Challenges, Business Process Management, Intelligent Process Automation

Today we live in dynamic and changing business world and success of organisation highly depends on its possibility and ability to react and adapt to changes in a quick and flexible way. Organisations are interested in improving the efficiency and quality of their business processes and here comes business process management (BPM) initiatives which might include proper documentation of the processes, reorganisation of them, process monitoring, controlling and optimisation, process improvement, process automation, quality management etc. But competition inside the industries is pushing companies to take additional actions to be more efficient and productive, to save costs and time. Companies are looking for new technologies to be more competitive.

One of the new technologies is Robotic Process Automation (RPA). RPA is relatively easy to adapt and integrate into process and system and development time of RPA is shorter than other technologies (Axmann *et al*., 2020).

According to Deloitte survey (2017), in 2017 64% of respondents already started the journey with RPA either on strategic or company level. McKinsey & Co survey (2020) showing that in 2020 66% respondents have already tried to automate at least one business process, comparing to 57% in 2019 and it is highlighting that the percentage of companies which have fully automated at least one function, has grown from 29% in 2018 to 31% in 2020.

Covid-19 pandemic economic pressure influenced in a positive way RPA development, pandemic has expedited digital transformation efforts in companies by putting more investments within infrastructure to support automation (IBM Cloud Education, 2021) and still RPA market is expected to grow significantly through 2024 (Gartner, 2020). This is a very clear tendency and highlight the actuality and importance of this process development direction.

RPA solutions have lower costs of delivery and higher reliability but has also a number of limitation and pre-requisites. And there should be sufficient volume of transactional work to justify the need of RPA development. Cem Dilmegani (2021) is highlighting that >40% of RPA projects fail to deliver expectations in terms of implementation time, implementation cost and cost savings due to RPA. It is very important to find the right balance of process steps to automate and efforts/investments to develop them.

RPA topic is relatively new, but already now there are quite many abstracts and researches around it – what is RPA, examples of RPA implementation, how to select RPA solution, pitfalls and advantages. But not so much attention is devoted to main part of RPA project - process assessment or opportunity framework – from where to start, how to make right decision on process to automate, what to consider, who should be the decision maker and how to evaluate potential benefits of RPA implementation.

This study intends to identify the main tasks of business process automation, which include review of the benefits of process automation, exploration of main challenges and next steps or future in business process automation. The main objective of this work is to develop a framework for process automation and prepare practical recommendations for evaluating the usefulness of process automation.

The research is supervised by Prof., Dr. sc. ing. Mihails Savrasovs.

References

1. Axmann, B., Harmoko, H. (2020) Robotic Process Automation: An Overview and Comparison to Other Technology in Industry 4.0. In: *2020 10th International Conference on Advanced Computer Information Technologies (ACIT). IEEE*, 559–562. https://doi.org/10.1109/ACIT49673.2020.9208907.
2. Dilmegani, C. (2021) *21 RPA Challenges & Pitfalls & Audit Checklist to Tackle Them*, https://research.aimultiple.com/rpa-pitfalls/
3. Deloitte. (2017) *The robots are ready. Are you?* Untapped advantage in your digital workforce, https://www2.deloitte.com/content/dam/Deloitte/tr/Documents/technology/deloitte-robots- are-ready.pdf.
4. Gartner. (2020) *Gartner Says Worldwide Robotic Process Automation Software Revenue to Reach Nearly $2 Billion in 2021*, https://www.gartner.com/en/newsroom/press-releases/2020-09-21-gartner-says-worldwide-robotic-process-automation-software-revenue-to-reach-nearly-2-billion-in-2021.
5. IBM Cloud Education, 2021. *Intelligent Automation*, https://www.ibm.com/cloud/learn/intelligent-automation.
6. McKinsey & Company. (2020) *The imperatives for automation success*, https://www.mckinsey.com/business-functions/operations/our-insights/the-imperatives-for-automation-success.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 29-30
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

A PERSONALISED END-TO-END DIGITAL SERVICE FOR STUDENTS IN UNIVERSITY

Tony Philip Joykutty

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
tonyphilipjoysm@gmail.com

Keywords: Digitalization, services, universities, libraries, case studies, framework

In the twenty-first century, the university must become a digital leader, and this needs the university to be data-driven and user-experience centred. Artificial intelligence and predictive analytics, have the potential to generate disruptive opportunities. Transformative changes must occur beyond the introduction of technology to achieve significant long-term performance improvement. Any business's digital transformation is an exceedingly expensive process. The University should treat all its clients with dignity and provide a safe and secure digital environment. Decisions should be backed by information obtained on a constant basis from a variety of sources, including the voice of the customer (throw survey) and business indicators. With the emergence of new digital technologies, such as social networks, mobile, big data, and so on, organizations in practically every industry sector are launching different projects to study and capitalize on their benefits (Fitzgerald *et al*., 2013; Ross *et al*., 2016). This typically entails the change of essential company activities and has an impact on goods, processes, and organizational structures, as organizations must adopt management strategies to oversee these complex shifts (Matt *et al*., 2015). As a result of the development of digital technologies and their pervasive penetration of all marketplaces, society is undergoing rapid and drastic transformation (Barboni, 2019).

Students represent critical user group in any high education entity and the really demand it because digital skills will affect their professional lives in future. ***The goal of research*** is to analyse the tendencies in university digitalization from a student perspective and how students perceive the digital services in the Transport and Telecommunication Institute (TSI).

Digital services or "e-Services" can be defined as "the provision of service over electronic networks such as the Internet" (Rust *et al*., 2002). Personalization makes customers feel more appreciated and satisfied and end-to-end solutions adhere to a concept of removing as many middle layers or procedures as possible, which aids in optimizing a business's performance and efficiency.

The overall intention in the theoretical part is to look at case studies about whatever goals were established while adopting digitalization and how effectively they were met. Author analyses key factors for the success in university digitalization and fulfils comparative analysis of digital services from different best practices.

From the student point of view, it will be examined how they perceive the digitalization of the TSI. The survey will include the questionnaire where students will answer on different questions cover to main parts: how do they perceive the current digitalization of TSI, and what digital services development and implementation they suggest?

Based in collected and analysed data author will suggest the approach for the implementation of a personalised end-to-end digital services for students of Transport and Telecommunication Institute. The services should provide high level flexibility and customisation across all platforms, such as the website, intranet, and student portal.

Usually, students welcome an expansion of blended learning concepts, online platforms, and administrative processes, but concretisation and personalised of these services are the most promising for higher education. The approach will result in a framework for TSI.

The research is supervised by Dr.sc.ing., Professor Irina Yatskiv.

References

1. Fitzgerald, M., Kruschwitz, N., Bonet, D., Welch, M. (2013) *Embracing Digital Technology: A New Strategic Imperative.* MIT Sloan Management Review, Research Report.
2. Ross, J., Sebastian, M., Beath, M., Jha, L. (2016) *Designing Digital Organizations*, 46. MIT Center for IS Research.
3. Matt, C., Hess, T., Benlian, A. (2015) Digital transformation strategies. *Business & Information Systems Engineering*, 57(5), 339-343. DOI:10.1007/s12599-015-0401-5
4. Barboni, L. (2019) *From shifting earth to shifting paradigms: How webex helped our university overcome an earthquake.* CISCO, Upshot By Influitive.
5. Rust, R. T., Kannan, P. K., Peng, N. (2002) The Customer Economics of Internet Privacy. *Journal of the Academy of Marketing Science*, 455–464. DOI: 10.1177/009207002236917.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 31
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

METHOD FOR IMPROVING THE LANDING PAGE ON THE SITE FOR VISIBILITY IN SEARCH ENGINE

Nikita Kulevs

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
St59182@students.tsi.lv

Keywords: landing page improvement, search engine, SEO, web analytics, onsite optimization

A landing page usually uses promotional product company's promotions but doesn`t use organic search. According to Milestone Research in 2021 46.5% of traffic on websites was from organic search engine results. It is hard to improve a one-page website for search engine visibility and doesn`t exist methods to do the improvement. Website optimization is about maximizing the return on a website investment (King, 2008).

This study focused on methods and algorithms, which can be used for landing page improvement, generally about search engine optimization (SEO). SEO can be onsite and offsite. This case study will be considered an only onsite improvement to make it easier to find the landing page for search engines. To improve the rank by implementing SEO techniques it is important to start with improvement in the on-page SEO factors of the website (Bansal, 2015). To evaluate the performance of the developed method using the Google Search tool for a one landing page at a time. Google Search console tool contains a diagram that shows us grow of frequency visibility after starting using the developed method. To evaluate the method chosen criteria will be used proposed by Active Campaign to measure the landing page (Minning, 2021).

The main goal of the study is to develop a new method for landing page onsite improvement for increasing search engine visibility.

The research question includes:

- How can the landing page onsite be improved to increase search engine visibility?

This research paper includes next methods:

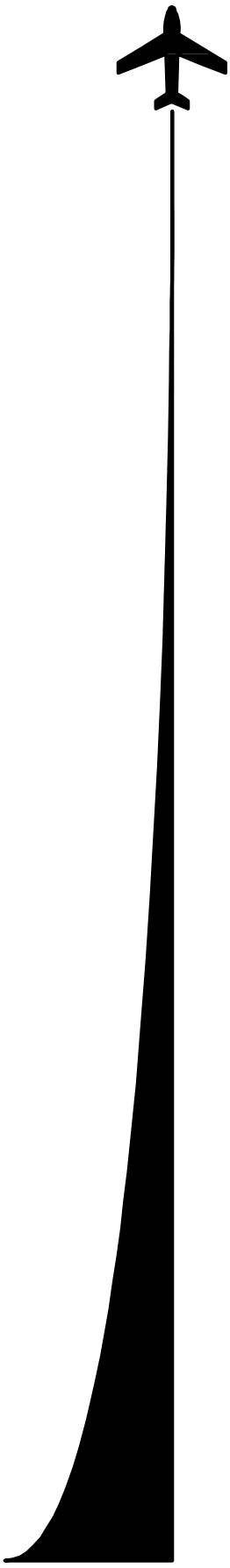
- literature review,
- case study,
- observations,
- data analysis.

The developed method will be useful to improve a one-page website for search engine visibility.

The research was supervised by Professor, Dr. Sc. Ing. Boriss Misnevs.

References

1. King, A. (2008) *Website optimization*. O`Reilly media, Sebastopol. 22 p.
2. Meenakshi, Bansal, Deepak, Sharma. (2015) Improving Webpage Visibility in Search Engines by Enhancing Keyword Density Using Improved On-Page Optimization Technique. *International Journal of Computer Science and Information Technologies,* 6(6), 5347-5352.
3. Minning, L. (2021) *5 Landing Page Metrics: What's the Best Way to Measure Landing Pages.* Chicago, USA, https://www.activecampaign.com/blog/landing-page-metrics



Session 2

Innovations and Smart Technologies in Transport and Logistics

Inovācijas un viedās tehnoloģijas transportā un loģistikā

Инновации и умные технологии в сфере транспорта и логистики

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 35
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

A REVIEW OF 3D SCANNER TYPES FOR AIRCRAFT SURFACE DAMAGE ASSESSMENT

***Irina Bodrova*[1,2]**

[1]S7 Engineering LLC Domodedovo Airport, Building 9,
Moscow Region 142015, Russia
[2] Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
i.bodrova@s7.ru

Keywords: Aircraft maintenance, MRO, structure repair, tooling, inspection

Time has been always critical in aviation. Even one hour of airplane downtime can lead to airline huge financial losses. In these circumstances, aircraft maintenance, repair and overhaul (MRO) become significant element of the industry. The organizations need to accurately measure the aircraft impact damages to speed up its repair. These processes are still characterized by a high manual effort, because adequate digital product models for automation purposes are often not available (Grosser *et al*., 2012). With developing 3D scanning technology, the dilemma of time-consuming aircraft maintenance can be solved. The subject tooling can significantly improve the efficiency of the external surface damage definitionand assessment.

This paper provides a taxonomy of various 3D scanner types generally used in MRO organizations. The key area of the study is to compare accuracy and duration of manual damage definition technics and 3D scanning technology. It focuses on how the aircraft external surface metallic repair could be accelerated not reducing the flight safety. Recommendations of the improvement of the impact damage assessment process are formulated in the conclusion.

The current research is supervised by Dr.hab.sc.ing., Professor Igor Kabashkin.

References

1. Grosser, H., Muller, P., Stark, R. (2012) Integrated Solutions for 3D Scanning and Generation of Digital Product Models in MRO Processes. In: *Proceedings of the 1st International Conference on Through-life Engineering Services (TES-Conf)-Enduring and Cost-Effective Engineering Support Solutions.* Cranfield University, UK, 2012.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 36-37
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

IMPACT OF THE ARCTIC SEA LINES OF COMMUNICATION ON THE INTERNATIONAL MARITIME CARGO FLOW

Andžejs Zarakovskis

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
andzejs.zarakovskis@gmail.com

Keywords: global warming and climate change, Arctic, the Northern Sea Route, supply chain, impact analysis

Global warming and climate change have led to average temperatures rising and melting of ice. Since the mid-20th century, average global temperatures have warmed about 0.6°C (1.1°F), defined by NASA (earth observatory, 2010). One of the affected regions is the Arctic. The improved ocean temperature measurements further confirm the warming trend over the last decade (IPCC, 2019). Climate change has already resulted in clearly noticeable changes in the marine Arctic ecosystem (Wassmann *et al*., 2011). Global warming and the contraction of the Arctic ice cap is lengthening the navigation season (Song *et.al*., 2015). As the Arctic warms, it increasingly has a potential for unrestricted freedom of navigation.

The U.S. Cooperative Strategy for 21st Century Seapower (USCG, 2007) describes that climate change is gradually opening up the waters of the Arctic, not only to new resource development but also to new shipping routes that may reshape the global transport system. A decade ago, in the summer of 2010, several shipping companies had announced the start of pilot shipments along the Northern Sea Route (NSR). Of all alternative sea routes in the Arctic, the NSR stands out as the first choice from a shipping point of view (Jørgensen-Dahl, 2010). Climate change is one factor that impacts logistics, and several supply chains are likely to change drastically (Gruchmann *et al*., 2018).

Per the International Maritime Organization, over 90% of international trade (by volume) is by sea (Bhadury, 2016). The NSR has the potential to generate significant savings for both cargo and shipowners with reduced fuel consumption, transportation time, and CO2 emission. The fuel savings alone, with a reduced voyage time of approx. 15 days are substantial (Tschudi, 2022). In theory, distance savings can be as high as 50% compared to using the current shipping lanes via Suez or Panama Canal (Rahman *et al*., 2014), where the shipping cost is the most important determinant for choosing a shipping route for global companies that operate supply chains (Medina *et al*., 2021).

The research aims to provide impact analysis and recommendations to advise how the new sea route (in the Arctic) would impact international maritime cargo flow (east-west). Considering the fact that global warming and climate change may open an unrestricted sea line of communication through the Arctic, it is potentially the most time and cost-effective solution for sea shipments from the east-west, with a significant impact on international maritime cargo flow. The research explicitly covers the routes for cargo shipping from Northeast Asia to Europe and the U.S. ports (refers to east-west) through the Suez Canal, Panama Canal, and the Arctic.

The research is theoretical and based on existing examples of the Panama Canal expansion and its impact on international trade and the global shipping network east-west. A comparison of quantitative data and analysis is used to propose the potential impact on international trade and the global shipping network east-west if there was an active sea line through the Arctic year-round. Consequently, the research is theoretical with practical application.

The research is supervised By Dr. sc. ing., Assistant professor Evelīna Budiloviča.

References

1. Bhadury, J. (2016) Panama Canal expansion and its impact on East and Gulf coast ports of U.S.A. *Maritime Policy & Management*, July.
2. Gruchmann, T., Melkonyan, A., Krumme, K. (2018) Logistics Business Transformation for Sustainability: Assessing the Role of the Lead Sustainability Service Provider (6PL). *Logistics.*
3. IPCC. (2019) *Chapter 5: Changing Ocean, Marine Ecosystems, and Dependent Communities*, Geneva, Switzerland: WMO and UNEP.
4. Jørgensen-Dahl, A., (2010) *ARCTIS Knowledge Hub.* [Online] Available at: http://www.arctis-search.com/Future+of+Resources+and+Shipping+in+the+Arctic&structure=Marine+Transport+and+Logistics [Accessed 27 02 2022].
5. Medina, Jorge, Kim, Jong-Ho, EunSu, Lee. (2021). Did the Panama Canal expansion benefit small U.S. ports?. *Maritime Transport Research*, 2, 1-9.
6. NASA. (2010) *Earth observatory.* [Online] Available at: https://earthobservatory.nasa.gov/features/GlobalWarming [Accessed 12 02 2022].
7. Rahman, A. N.S.F., Saharuddin, A.H., Rasdi, R. (2014) Effect of the Northern Sea Route Opening to the Shipping Activities at Malacca Straits. *International Journal of e-Navigation and Maritime Economy*, 12(1), 85-98.
8. Song, Dong-Wook, Panayides, P. M. (2015) *Maritime Logistics, A guide to contemporary shipping and port management.* 2nd ed. London: Kogan Page Limited.
9. Tschudi. (2022) *Tschudi Shipping Company AS.* [Online] Available at: https://www.tschudigroup.com/articles/tschudi-pioneers-in-opening-historic-route-through-the-arctic-to-china [Accessed 02 03 2022].
10. USCG. (2007) *United States Coast Guard.* [Online] Available at: https://www.uscg.mil/Portals/0/Strategy/MaritimeStrategy.pdf [Accessed 12 02 2022].
11. Wassmann, P., Duarte, C. M., Agusti, S., Sejr, M. K. (2011). Footprints of climate change in the Arctic marine ecosystem. *Global Change Biology*, 17(2), 1235-1249.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 38-39
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

INCREASING WAREHOUSE MANAGEMENT EFFICIENCY IN THE ARMY TACTICAL LEVEL UNIT

Edgars Kapustins

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
edgars.kapustins@gmail.com

Keywords: warehouse, order picking, effectiveness, efficiency of operations

According to (The Heritage Foundation, 2018) article, the challenges of military logistics are unique. Further (The Heritage Foundation, 2018) cited that many of industry's best practices and technologies are relevant and even vital to the modernization of military logistics, the agility, survivability, responsiveness, and effectiveness of military logistics require another level of integrated innovation in technology and operational concepts. Warehouse management is the art of operating a warehouse and distribution system or, better still, of operating it efficiently.

Nowadays, the main question for warehouses is how to increase the picking productivity. Order picking is the retrieval of products from specified storage locations on the basis of customer orders. In general, the order picking process is the most laborious activity in a warehouse (Burinskiene, 2010). The efficiency of the order picking process depends on such main factors as:

- Size of warehouse;
- Picking systems;
- Storage strategies;
- Layout strategies;
- Routing strategies (Burinskiene, 2010).

There is no management responsibility in industry equivalent in scope or complexity to the responsibility of managing the military supply system. Private and military warehouses mostly operate on the same management principles. The biggest difference is that the private warehouse's concept is to reduce costs to increase profits, but on the other hand, the military warehouse's concept is to reduce recourses to increase effectiveness.

The aim of this research is to identify current issues and affecting factors in army tactical level unit in warehouse management. Based on findings develop a logical and efficient warehouse design for army tactical level unit. Further implement multiple new trends and techniques into computer simulation to determine the results.

In theoretical part of the research, the author while analysing scientific literature and the United States army doctrines will answer following questions:

- What is the effective warehouse management characteristics?
- What is differences between private and military warehouse management processes?

Many of the most difficult management problems are directly associated with the magnitude of the system. Other problems arise from the absence of the profit motive, by which industry controls and evaluates its day-to-day operations, the lack of competition, and the rapid rate of change that characterizes military operations in general and which poses particularly difficult problems for the warehouses and supply managers. Based on findings develop a logical and efficient warehouse design for army tactical level unit. With the help of the AnyLogic simulation system, the author will set parameters based on new trends and techniques and following will run multiple simulations to determine experiment results.

After in-depth literature analysis and multiple simulation tests, the author will conclude his research with compiled results. Further will provide suggestions for follow on research and possible results implementation in real-life military warehouses.

The research is supervised by Dr.habil.sc.ing., Professor Jurijs Tolujevs.

References

1. The Heritage Foundation. (2018) Logistics: The Lifeblood of Military Power, available at https://www.heritage.org/military-strength-topical-essays/2019-essays/logistics-the-lifeblood-military-power [accessed: 17 March2022]
2. Burinskiene, A. (2010) Order picking process at warehouses. *International Journal of Logistics Systems and Management*, 6(2), 162-163, 2010.
3. Ten Hompel, M. and Schmidt, T. (2007) *Warehouse Management: Automation and Organisation of Warehouse and Order Picking Systems*. Springer-Verlag Berlin Heidelberg.
4. Headquarters, Department of the Army. (2014) *Supply Support Activity Operations.* Washington, DC.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 40-41
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

WAREHOUSING AS A PROFIT CENTER IN BUSINESS UNIT

Andrejs Koskevičs

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
andrejs.koskevics@gmail.com

Keywords: goods warehouse, warehouse operations, optimizing warehouse processes

During operation of any business unit there are a lot of different tasks that needs to be accomplished and goals that should be met. There are a lot of moral and ethical limitations that should be met during operation of business. Still, the main and base criteria of how successful business is- net profit. To get optimal result, it's necessary to evaluate such things as geographical position of country and IT performance that can be implemented in warehouse operations. Warehouse and distribution operations has an economic value to company. The economic value assures company that the SKU in inventory receives time-and-place value (Mulcahy, 1994), warehousing is expensive – making up between 2% and 5% of the cost of sales of a corporation (Frazelle, 1996). Therefore, operations with goods in supply chain can be grouped in several processes such as, buying (purchase), transport, operation in warehouse and distribute. Since warehousing can make 2% to 5% of operations, it shows that proper organization of process and level of goods, can have dramatic effect on cost efficiency of business. Operations in business warehouse will be divided in such processes:

a. Inbound;
b. Handling (Stock control);
c. Outbound operations.

If unproperly organized all these processes can lead to dramatic cost increase. Inbound logistics is a vital step in warehouse receiving processes and has a direct impact on supply chain costs and performance. As a result of an inefficient check-in operation, the incoming trucks may experience inordinate wait times between arrivals and check-in, which in turn leads to unnecessary cost to the company in the form of detention fees (a penalty for holding the truck and driver beyond the agreed upon time) and delayed delivery of subsequent consignments (Smith *et al*., 2019). Also, proper handling of stock, can prevent possible losses that can occur during operations (loss of damage of goods, loss of stealing, loss upon improper environment in warehouse), outbound operations also can have dramatic cost increase effect- if production isn't properly located in warehouse, if there are insufficient amount of mechanic vehicles for operations in warehouse, etc.

In research author will analyse efficiency of stock handling (stock level, handling cost, operation cost), there will be used fundamental logistics approaches to determine local optimums through cost saving perspective. Approach to determine costs will be used activity-based approach. EOQ levels for procurement/purchase operations, ABC/XYZ for placing goods for order-picking and storing. Any activities flowing into and out of the warehouse, and those that ripple out to the extended supply chain, can be improved with a good WMS – from receiving and storage to picking, packing, and shipping (sap.com, 2022)

Aim of research is to create scientifically proven approach for warehouse process organization in Baltics, research is made based on fiscal politics in Latvia - tax rates used are actual for year 2022, also it will be evaluated most recent WMS solutions available for companies in the market. Author will combine fundamental approach of warehousing theory with practical IT solutions available.

The work is supervised by M. sc. Aleksandrs Avdeikins.

References

1. Frazelle, E. H. (1996) World class warehousing,Logistics Resources International, p. 22.
2. Mulcahy, D. E. (1994) Warehouse and distribution operations handbook, McGraw-Hill, p.18.
3. SAP.com. (2022) Available online: https://www.sap.com/insights/what-is-a-wms-warehouse-management-system.html, accessed 01/04/2022.
4. Smith, D., Srinivas, S. (2019) A simulation-based evaluation of warehouse strategies for improving inbound logistics operations. *Simulation Modelling Practice and Theory*, 94, 303-320.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 42-43
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

REDUCTION OF GREENHOUSE GAS EMISSIONS BY REPLACEMENT OF UKRAINIAN TRANSPORT COMPANY'S FUEL-BASED FLEET WITH ELECTRIC POWERED

Kyryl Yereshchenko

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
kyereshchenko@gmail.com

Keywords: electric-powered trucks, emission-free transportation, Sustainable logistics, future logistics trends, pollution reduction, Ukraine, Green deal

At the moment, the increase in greenhouse gas emissions can be observed around the world. According to the European Commission website, the transport sector accounts for a quarter of the greenhouse gas emissions of the entire European Union. The aim of European Union is to be the first climate-neutral continent by 2050, such aim requires great changes in transport in general. They are aimed to reduce transport gas emissions up to 90%, what is realistically aimed on a long-term perspective (European Commission, 2022).

The relevance of the topic of the research is due to the growing role of environmental logistics in a market economy and the increasing impact on the efficiency and competitiveness of domestic enterprises. The active involvement of Ukrainian enterprises in the European Green Deal poses an urgent task of rational management of the supply, production and marketing of products that must meet the requirements of consumers at minimal cost and with minimal damage to the environment. To do this, companies are increasingly using the latest methods and technologies, the use of electric vehicles and environmental management of logistics.

The purpose of the research is to justify the use of electric vehicles in the logistics activities of the company, to reveal the theoretical foundations of "green" logistics, as well as to develop practical recommendations for organizing the logistics activities of an enterprise to reduce the harmful effects of logistics activities on the environment.

According to the goal, the following tasks are defined:

- to determine the main approaches to understanding "green" logistics and measuring the environmental efficiency of electric transport;
- to analyze the activities of logistics operators in the Ukrainian market and determine their directions of activity in the field of environmental friendliness;
- to analyze green technologies and logistics solutions;
- develop project recommendations to improve logistics activities based on the principles of sustainable development and "green" logistics.

The object of the study is the processes of the logistics activity of the enterprise using the ecological approach to the use of electric transport.

The subject of the study is the improvement of the organization of the logistics activities of enterprises using the principles of green logistics.

During the research, the following methods were used: analysis and synthesis to systematize the logistics processes of enterprises, a generalization method to study the features of green logistics, statistical analysis in the study of the logistics activity of the enterprise.

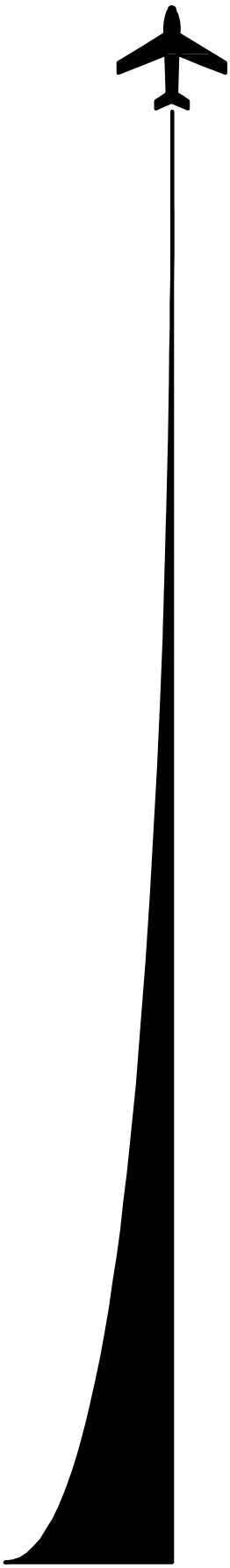
The expected result of the study is substantiating of the effectiveness and relevance of the use of electric vehicles in the logistics activities of transport companies in Ukraine and

development of practical recommendations for organizing the logistics activities of an enterprise for reduction of the harmful effects of logistics activities on the environment.

The given materials reflect the research,supervised by Ph.D. Juris Kanels.

References

1. European Commission. (2022) A European Green Deal. Available at: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en



Session 3

Market: Research, Projects, Technologies and Problems of the Modern Economy

Tirgus: pētījumi, projekti, tehnoloģijas un mūsdienu ekonomikas problēmas

Рынок: исследования, проекты, технологии и проблемы современной экономики

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 47-48
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

IMPACT OF UNPREDICTABLE MAJOR EVENTS ON AVIATION INDUSTRY: CHALLENGES, BENEFITS, AND PROSPECTS FOR RECOVERY

Viktorija Gorodnicka

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
viktoria.gorodnicka@gmail.com

Keywords: Pandemic, Aviation, Risks, Crisis, Aviation Industry, Recovery

Any business activity in the transport-related industry is associated with risk, which increases the probability of an occurrence of danger, an adverse event with specific consequences, and an uncertain amount of damage. From the beginning of 2020, the whole world got introduced to the risk of unpredictable epidemiological events such as SARS-CoV-2 (Covid 19). Unfortunately, this circumstance especially has affected the aviation industry and is presented in its' production, commerce, innovation, and other activities (Suau – Sanchez *et al*., 2020).

As part of global efforts to contain the outbreak of the pandemic and protect human health, governments around the world have imposed full or partial isolation regimes, closed borders, imposed strict travel restrictions, and issued recommendations warning against travelling unless absolutely necessary (WHO, 2021). As these measures have led to an unprecedented drop in demand for air transportation, therefore aviation has become one of the most affected sectors (ICAO, 2020).

All downshifts of major unpredictable events have required the aviation industry to adapt to the new reality immediately. While considering and implementing ICAO's Regulatory Frameworks, the industry still has to take into account sustainability, innovations, contribution to social development, and economic growth (Dube *et al*., 2020).

The goal of this research is to review the effects and impacts of unpredictable event on AviationIndustry with the development of recommendations based on suitable strategies.

The main object of this research is the evaluation of the impact of SARS COVID-19 on the aviation industry. The evaluation is based on a case study on Flight Consulting Group LTD (includingsubsidiaries companies).

As anticipated results, the authors aimed at:

- Researching the most affected components;
- Identifying the individual causes of affected areas within Flight Consulting Group LTD;
- Development and evaluation of recovery strategies for the company management.

Impact evaluation will be partially assessed by standard OECD – DAC criteria (OECD-DAC, 1991), as well as mixed methods of Bamberger (2012) will be used.

This research recommends that as the industry recovers, it does so by adjusting the organizational system and its activities by paying attention to – health measures protecting employers and travelers, cost-efficient business models, and improving quality and innovative standards. The aim of the research is to identify possible recommendations for recovery strategies to ensure business stability in the aviation industry based on challenges and benefits.

The current research is supervised by Dr.Sc.Eng., Professor Iyad Alomar.

References

1. International Air Transport Association. (2021) *Reduced Losses but Continued Pain in 2021.*
2. International Civil Aviation Organisation. (2020) *Guildelines on Economs and Financial Measures to Reduce the Impact of Coronavirus Outbreak on Avation.*
3. Macaio, R., Van de Voode, E. (2009) *The impact of the economic crisis on the EU Air Transport Sector.* Available at: https://www.europarl.europa.eu/document/activities/cont/200911/20091111ATT64267/20091111 A TT64267EN.pdf
4. Suau-Sanchez, P., Voltes-Dorta, A., Cuguero-Escofet, N. (2020) *An early assessment of the impact of COVID-19 on air transport: just another crisis or the end of aviation as we know it?*DOI:10.1016/j.jtrangeo.2020.102749
5. World Health Organisation. (2021) *Advise to the public: Coronovirus disease.*
6. Dube, K., Nhamo, G. (2020) Major global aircraft manufacturers and emerging responses to the SDGs Agenda. O.G.M.V. Nhamo, G. (Ed.) *Scaling up SDGs Implementation Emerging Cases from State, Development and Private Sectors, Springer International Publishing, Springer Nature Switzerland AG* (2020), 99-113. DOI: 10.1007/978-3-030-33216-7_14.
7. OECD – DAC. (1991) *Principles for Evaluation of Development Assistance.* Paris: Organisation for Economic Co-operation and Development – Development Assistance Committee (OECD-DAC). Available at: http://www.oecd.org/dac/evaluation/50584880.pdf
8. Bamberger, M. (2012) *Introduction to Mixed Methods in Impact Evaluation. Guidance Note,* 3. Washington DC: InterAction. Available at: https://www.interaction.org/blog/impact-evaluation-guidance-note-and-webinar-series/

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 49-50
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

FUTURE DEVELOPMENT OF AIRPORT INFRASTRUCTURE BASED ON REQUIREMENTS OF THE AVIATION INDUSTRY

Arsenijs Eduards Averjanovs

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
arseniy.averyanov@icloud.com

Keywords: Aviation, Airport, passenger terminal, modernization

Modern aviation before the pandemic showed an increase in the number of passengers carried. With the increase in the number of passenger traffic at the airport, the load on the passenger terminals increases. The paper analyzes the airport capacity and solutions to increase passenger capacity. Passenger terminal capacity analysis is based on the performance of various elements of the passenger terminal, such as: check-in areas, passenger security screening points for prohibited items, waiting area, boarding gates and others (Milan, 2013). To evaluate these elements of the terminal, the passenger handling theory or queuing theory is used, in this way it is possible to describe passenger service models (Matthews, 1995).

The increase in airport capacity, as a factor in improving the quality of services provided, is considered in the research of the following scientists (Young *et al.,* 2019), (Kenville *et al*., 2014), (Kalakou *et al*., 2021), (Graham, 2013) and (Hamzawi, 1992). Based on the scientific study of the data of the authors, conclusions were drawn on the passenger flow at the Airport Riga.

Goal of the research to develop measures to modernize the passenger terminal to increase throughput. To develop modernization measures a case study is considered; Airport Riga was chosen for the study. Statistics show that the passenger traffic at Airport Riga is increasing every year. Airport modernization issues are raised very often by airport management and researchers, as it possible to see from National Statistic Airport Riga has a great impact on the Latvian economy (Ministry of Transport, 2021). The IATA study considers the facts that tourists arriving in Latvia by plane spend money on the local economy and thereby create an additional 12,000 jobs. In total, 28,000 jobs are created due to air transport and tourists using the services of airlines. The air transport industry, including airlines and their large supply chain, is estimated to contribute $450.6 million to Latvia's GDP (IATA, 2018).

Based on the analysis of the passenger flow of the Riga airport, the author proposed to modernize the passenger terminal. The modernization involves the expansion of the passenger terminal “C”, which serves both Schengen and non-Schengen passengers. The modernization will increase the number of passengers handled by increasing the number of boarding gates and passenger waiting areas. The proposal for the modernization of the passenger terminal involves the addition of 8 boarding gates, of which 4 will be with telescopic bridges. The modernization of terminal C will be handled by applying the architectural solutions described in (Neufert, 2020). Additional aircraft parking spaces near the terminals will increase the speed of flight turnaround, and a bus will not be required to transport passengers. Also, the area of the passenger waiting area will increase, which will allow opening additional passenger service places, such as restaurants, cafes, or shops. After the development of the concept of modernization, an economic calculation of efficiency will be carried out.

It is also worth noting that the modernization will be carried out using new technologies and the principles of sustainable development. Reviewing various research on best option and proposed solutions of terminal modernization, Author decided to equip the terminal C with water flow control systems and solar panels to generate electricity as proposed by (Boca Santa,

2020). The research considers environmental aspects for the sustainable development of the airport, calculates the economic effect of the proposed measures to modernize the Riga airport. All these proposals will help to increase the passenger traffic of Airport Riga.

Acknowledgements

I wish to extend my special thanks to Professor, Dr. oec. Inna Stecenko, who offered guidance and support. This project would not have been possible without her support.

References

1. Milan, J. (2013) *Airport Analysis, Planning and Design: Demand, Capacity and Congestion,*Nova Science Publishers, Incorporated.
2. Matthews, L. (1995) Forecasting peak passenger flows at airports. *Transportation*, 22(1), 55-72.
3. Ministry of Transport (2021) Aviation industry in Republic of Latvia.
4. IATA. (2018) *THE IMPORTANCE OF AIR TRANSPORT TO LATVIA*. The air transport sector makes a major contribution to Latvia's economy.
5. Young, S. *et al*. (2019) *Airport Planning & Management.* Airports and Airport Systems: Organization and Administration.
6. Kenville, K. and Smith, J. (2014) Finding the Perfect Organizational Structure for an Airport. *ACRP Synthesis of Airport Practice*, 40. Publisher: Transportation Research Board. ISSN: 1935-9187
7. Kalakou, S. and Moura, F. (2021) Analyzing passenger behavior in airport terminals based on activity preferences. *Journal of Air Transport Management*, 96, September 2021, 102110.
8. Graham, A. (2013) *Managing Airports: an International Perspective*. (fourth ed.), Routledge.
9. Hamzawi, S. (1992) Lack of airport capacity: exploration of alternative solutions. *Transp. Res. Part A Policy Pract.*, 26, 47-58.
10. Neufert, E. (2000) *Neufert Architects' Data*, Third Edition.
11. Boca Santa, S. L. *et. al*. (2020) A Green Airport model: Proposition based on social and environmental management systems. *Sustainable Cities and Society*.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 51-52
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

IMPACT OF CORPORATE SOCIAL RESPONSIBILITY PRACTICES ON CUSTOMER AND EMPLOYEE LOYALTY IN THE AVIATION INDUSTRY

Viktorija Maslova

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
victorialebedeva33@gmail.com

Keywords: corporate social responsibility, aviation enterprises, CSR practices

The area of corporate social responsibility is already internationally standardized; the standards include ISO 26000 (International Organization for Standardization), IQ NET (International Certification Network), etc. GRI (Global Reporting Initiative) and IIRC (International Integrated Reporting Council) standards contain requirements, including for the management of Corporate Social Responsibility (CSR).

The relevance of this topic lies in the fact that most researchers tend to consider CSR from the standpoint of a macro-institutional approach: the main emphasis is on the relationship between the company and external stakeholders. The goal of the business is to reduce social tensions, improve the image and increase profits. As well as CSR can boost employee morale in the workplace and lead to greater productivity, which has an impact on how profitable the company can be. However, this does not take into account the internal environment of companies, the opportunities that lie in the managerial function of CSR in relation to the personnel of companies.

The *aim* of the research is to assess the impact of Corporate Social Responsibility practices on customer and employee loyalty in the Aviation Industry, especially in Latvia, Riga. The research *questions* include the following:

1. What is the role of Corporate Social Responsibility (CSR) in the aviation industry?
2. What CSR practices are the most popular in the aviation industry nowadays?
3. What methods and procedures can be used to assess the impact of Corporate Social Responsibility practices on customer and employee loyalty in aviation enterprises?

Based on the research questions, the following research *tasks* were developed by the author:

1. To study main theories of CSR.
2. To explore common CSR practices used in the aviation industry.
3. To examine the state of CSR of the aviation enterprises in Latvia.
4. To develop a methodology for the assessment of the impact of Corporate Social Responsibility practices on customer and employee loyalty in aviation enterprises.

The *methods* of the research include analysis of theoretical literature and preceding research, analysis of legal regulations of Corporate Social Responsibility, as well as in-depth interviews and questionnaires. The *object* of the research is the aviation enterprises in Latvia. The *subject* of the research is the practices needed for the implementation of corporate social responsibility by aviation enterprises.

For aviation managers this research will give the enforcement of the existing legislation, improving its own efficiency in activities related to the company and as well voluntary initiatives in non-operating field, such as charities and community development.

The current research is supervised by Dr.sc.admin., Professor Yulia Stukalina.

References

1. International Organization of Standardisation. (2015) *ISO 26000 and the International Integrated Reporting.*
2. Carroll, A. (2008) A History of Corporate Social Responsibility: Concepts and Practices. In: *The Oxford Handbook of Corporate Social Responsibility*.
3. Cederholm, T. (2014) Global Airline Passenger Traffic and Capacity Continue to Grow. Corporate Social Responsibility Practices in the Aviation Industry. *14 International Journal of Research in Business Studies and Management*, 5, 2018.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 53-54
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

ОЦЕНКА СТЕПЕНИ УДОВЛЕТВОРЕННОСТИ КЛИЕНТОВ ЛОГИСТИЧЕСКОЙ КОМПАНИИ

Ольга Иванова

Институт транспорта и связи
Ломоносова 1, LV-1019, Рига, Латвия
ivanovaffamily@mail.ru

Ключевые слова: Удовлетворенность потребителей, удовлетворенность клиентов, логистическая компания

Актуальность темы исследования обусловлена существенным влиянием удовлетворенности клиентов на результаты деятельности компании, а также, на ее конкурентоспособность. Логистические компании отличаются высоким уровнем ответственности перед клиентом ввиду высокой стоимости перевозимых грузов, вследствие чего, обеспечение удовлетворенности клиентов является достаточно серьёзной задачей для таких предприятий. Способ, который компании часто используют для решения задач обеспечения удовлетворенности клиентов, – это развитие качества логистических услуг.

Удовлетворенность клиентов является фундаментальной концепцией маркетинга и бизнес-стратегии (Mahmoud *et al.*, 2018). Kotler *et al*. (2019) утверждает, что удовлетворенность клиентов состоит из чувства удовольствия или разочарования, возникающего в результате сравнения ожиданий покупателя и воспринимаемой производительности (или результата) продукта. Согласно Fernandes *et al*. (2018), удовлетворенность клиентов возникает в тот момент, когда компании удается предоставить логистическую услугу, которая соответствует ожиданиям клиентов или превосходит их. Микалут *et al*. (2020) предполагают, что качество логистических услуг может влиять на удовлетворенность клиентов. Согласно Ким и Лайчук (2020), удовлетворенности клиентов является основой клиентопотока и, как следствие, доходов логистической компании.

Из вышесказанного следует, что изучение и оценка степени удовлетворенности клиентов является важным шагом к увеличению потока клиентов логистических компаний, а также, улучшению доверия клиентов к компаниям, что формирует их лояльность.

Целью данного исследования является разработка методологии оценки степени удовлетворенности клиентов логистического предприятия SIA Toplogistic, а также оценка степени удовлетворенности клиентов данного предприятия путем апробации разработанной методики.

Для достижения цели работы, поставлены следующие задачи исследования: 1) Изучить теоретические аспекты анализа удовлетворенности потребителей, в том числе, возможности использования результатов анализа удовлетворённости потребителей как инструмента повышения качества обслуживания; 2) провести анализ деятельности и мониторинг удовлетворенности потребителей качеством работы на примере предприятия SIA Toplogistic; 3) разработать методологию оценки степени удовлетворенности клиентов логистического предприятия SIA Toplogistic; 4) провести апробацию разработанной методологии для оценки степени удовлетворенности клиентов предприятия SIA Toplogistic; 5) разработать предложения для руководства компании по повышению удовлетворенности клиентов.

Объект исследования: логистическое предприятие. Предмет исследования: методы, используемые для оценки степени удовлетворенности клиентов логистического предприятия.

Методология исследования включает в себя:

- Изучение теоретической литературы и исследований на данную тему.
- Опрос клиентов.
- Интервью с руководителями предприятия.
- Интервью с экспертами отрасли логистики Латвии.

Предполагается, что результаты исследования помогут логистической компании увеличить поток клиентов, а также, улучшить доверие клиентов к компании, что сформирует их лояльность.

Исследование выполняется под руководством
Dr.sc.admin., профессора Юлии Стукалиной.

Список использованной литературы

1. Fernandes, D.W., Moori, R.G. and Filho, V.A.V. (2018) Logistic service quality as a mediator between logistics capabilities and customer satisfaction, *Revista de Gestão*, 25(4), 358-372.
2. Kotler, P., Keller, K., Manceau, D., and Hemonnet-Goujot, A. (2019) *Marketing Management*.
3. Mahmoud, M. A., Hinson, R. E. and Anim, P. A. (2018) Service innovation and customer satisfaction: the role of customer value creation. *European Journal of Innovation Management*. 21(3), 402-422. © Emerald Publishing Limited.
4. McGrath, R. G. and MacMillan, I. C. (1995) *Discovery driven planning*, p. 44. Philadelphia: Wharton School, Snider Entrepreneurial Center.
5. McKinsey. (2016) *Customer experience: Number 1, Winter 2016. Creating value through transforming customer journeys*. Available from: https://www.mckinsey.com/~/media/mckinsey/industries/public%20and%20social%20sector/our%20insights/customer%20experience/creating%20value%20through%20transforming%20customer%20journeys.pdf
6. Бруковская, О., Осовицкая, Н. (2021) *HR-бренд. 5 шагов к успеху вашей компании*. Litres.
7. Ким, А. Г. и Лайчук, О. В. (2020) Оценка качества обслуживания клиентов транспортно-логистической компании. *Азимут научных исследований: экономика и управление*, 9, 2(31), 179-182.
8. Микалут, С. М., Рябикина, В. В., и Кузьменко, Я. В. (2020) Влияние качества логистических услуг на удовлетворение и лояльность клиентов. *Актуальные вопросы экономических наук и современного менеджмента. Сборник статей по материалам XL-XLI международной научно-практической конференции*. 14-21. Новосибирск. Издательство: Общество с ограниченной ответственностью "Сибирская академическая книга" (Новосибирск).
9. Папикян, М. А. (2019) Лояльность и удовлетворенность клиентов. *Economics*, 1(39), 13-16.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No. 1, 55-56
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

IMPROVING THE PRODUCTION PROCESSES OF AIRCRAFT ENGINES REPAIR BASED ON THE REENGINEERING PRINCIPLES

Marietta Belitskaya

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
marietta.belitskaya@gmail.com

Keywords: Maintenance, Repair and Overhaul; Aircraft engine; Reengineering; Simulation model

Improving the processes of aircraft engines operation and repair remains relevant and sought-after, since it is associated with an increase in reliability, efficiency, inspectability and environmental friendliness of aircraft engines (Абрамова, 2006).

Nevertheless, maintenance and repair of aircraft engines is a business, and currently, small companies appear, which provide certified services for maintenance, repair, and overhaul of aircraft engines.

Achieving the peak of their production capacities, technological processes and financial resources, companies inevitably face a tipping point, manifested in the obsolescence and self-exhaustion of entrenched production technologies for aircraft engines repair which do not meet the modern and dynamic realities of the Maintenance, Repair and Overhaul (MRO) industry (Hammer *et al*., 2006). This turning point assumes 2 possible scenarios for a company: either the MRO uses this moment as a golden opportunity to rethink, restructure and enhance its production and business processes through the introduction and application of the reengineering principles (Gildingersh *et al*., 2020), which will allow the company to overcome the crisis and reach a new level, or the MRO gradually loses its competitiveness, that leads to the loss of its customers, finance, goodwill and the company itself.

The main goal of this paper is to develop a set of recommendations and solutions based on the reengineering principles aimed at improving production processes, reducing the duration and ensuring an increase in key performance indicators (KPIs) of aircraft engines repair production. The research object constitutes Engine Shop. The research subject is the production processes of aircraft engines repair with a modular design at a MRO service provider, which can certify aircraft engines.

The expected result of this paper is the development of a simulation model that will enable to produce a range of simulations with a certain set of key production input parameters and conditions, that will let effectively plan, organize, and control production processes, as well as respond in a timely manner to arising unscheduled adverse situations during the aircraft engines repair.

The current research is supervised by Dr.Sc.Eng., Professor Iyad Alomar.

References

1. Gildingersh, M. G., Martynova, J. A., Sirotkin, V. B. (2020) The Essence of Business Process Reengineering as an Effective Management Method. In: *Proceedings of the International Conference on Economic and Social Trends for Sustainability of Modern Society (ICEST 2020)*, 647 – 654. Krasnoyarsk, May 2020. European Publisher.
2. Grover, V. and Kettinger, W. J. (1998) *Business Process Change: Reengineering Concepts, Methods and Technologies*. Harrisburg and London: Idea Group Publishing. 704 p.

3. Hammer, M. and Champy, J. (2006) *Reengineering the Corporation: A Manifesto for Business Revolution*. Harper Business. 272 p.
4. Абрамова, И. Г. (2006) *Оперативное Планирование и Управление Производством на Предприятии Аэрокосмического Двигателестроения*. Самара: Самарский государственный аэрокосмический университет. 60 с.
5. Безъязычный, В. Ф., Месхи, Б. Ч., Стрижов, А. Н., Бессуднов, И. А., Румянцева, Н. В., Бардинова, С. Н., Урядов, С. А., Смирнов, А. В., Калугин, С. С., Чукарина, И. М. (2021) *Технология Ремонта Деталей Авиационных Двигателей*. Москва; Вологда: Инфра- Инженерия. 272 с.
6. Туровец, О., Родионов, В., Бухалков, И. и др. (2019) *Производственный Процесс и Основные Принципы его Организации*. Москва: НИЦ ИНФРА-М. 506 с.

RESEARCH and TECHNOLOGY – STEP into the FUTURE

ISSN 1691-2853 & ISSN 1691-2861 (on line)

THE JOURNAL IS DESIGNED FOR PUBLISHING PAPERS CONCERNING THE FOLLOWING FIELDS OF RESEARCH:

- mathematical and computer modelling
- mathematical methods in natural and engineering sciences
- computer sciences
- aviation and aerospace technologies
- electronics and telecommunication
- telematics and information technologies
- transport and logistics
- economics and management
- social sciences

Articles and review are presented in the journal in English, Russian and Latvian (at the option of authors). This volume is published without publisher editing.

EDITORIAL CORRESPONDENCE
Transporta un sakaru institūts (Transport and Telecommunication Institute)
Lomonosov 1, LV-1019, Riga, Latvia. Phone: (+371)67100594. Fax: (+371)67100535
E-mail: Gruzite.V@tsi.lv, http:// www.tsi.lv

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2022, Vol. 17, No 1
ISSN 1691-2853, ISSN 1691-2861 (on-line: www.tsi.lv)

The journal of Transport and Telecommunication Institute (Riga, Latvia)
The journal is being published since 2006