

Transporta un sakaru institūts
Transport and Telecommunication Institute

RESEARCH and TECHNOLOGY – STEP into the FUTURE

Volume 18. No. 2 - 2023

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

Riga
2023

EDITORIAL BOARD:

Prof. Igor Kabashkin (Editor-in-Chief), *Transport & Telecommunication Institute, Latvia*
Prof. Irina Yatskiv (Issue Editor), *Transport & Telecommunication Institute, Latvia*
Assoc. Prof. Darius Bazaras, *Vilnius Gediminas Technical University, Lithuania*
Dr. Zohar Laslo, *Sami Shamon College of Engineering, Israel*
Dr. Enno Lend, *College of Engineering, Estonia*
Prof. Andrzej Niewczas, *Lublin University of Technology, Poland*
Prof. Lauri Ojala, *Turku School of Economics, Finland*
Prof. Irina Kuzmina-Merlino, *Transport & Telecommunication Institute, Latvia*
Prof. Alexander Grakovski, *Transport & Telecommunication Institute, Latvia*

Editor:

Irina Alekseeva, *Transport & Telecommunication Institute*

Supporting Organization:

Latvian Transport Development and Education Association
Latvian Operations Research Society

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 and Latvian (at the option of authors).
This volume is published without publisher editing.

EDITORIAL CORRESPONDENCE

Transporta un sakaru institūts (Transport and Telecommunication Institute)
Lomonosova 1, LV-1019, Riga, Latvia. Phone: (+371)67100586
E-mail: rutkovska.j@tsi.lv, [http:// www.tsi.lv](http://www.tsi.lv)

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No 2

ISSN 1691-2853, ISSN 1691-2861 (online: 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 Study Programme, 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
- **Emmanuel Merchan**, Professor, Acting Dean of the Engineering 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
- **Jelena Rutkovska**, Organizing Manager, TSI
- **Dmitry Pavlyuk**, Professor, TSI



**The 44th Research and
Academic Conference**

**RESEARCH AND
TECHNOLOGY – STEP
INTO THE FUTURE**

8 December 2023 Riga, Latvia

**44. zinātniski praktiskā
un mācību metodiskā
konference**

**ZINĀTNE UN TEHNOLOĢIJA –
SOLIS NĀKOTNĒ**

2023. gadā 8. decembrī, Rīga

CONTENTS

PLENARY SESSION

Design Development of Civil Aircraft <i>Anna Zervina, Olga Zervina</i>	8
---	---

Socratic Method for PROMPT Engineering – New Teaching Design <i>Boriss Misnevs</i>	10
---	----

Session 1. Computer Problems of the Information Society and the Modern Electronics

Analysis of VPN Obfuscation Methods <i>Andris Začs</i>	14
---	----

Container Orchestration Platform Challenges on Kubernetes Example <i>Junaid Ahmed</i>	16
--	----

Application of Reinforcement Learning Methods for Test Case Prioritization <i>Oskars Koleda</i>	17
--	----

Stereoscopic Dataset Extraction from Video Recordings Using Fish Behavior as Example <i>Jurijs Malahovs</i>	19
--	----

Reconstruction of Hidden Parts of Human’s Face in Face Recognition Problems <i>Evgeny Tenenbaum</i>	21
--	----

Application of AI for Support Task Processing in a Multisystem Environment <i>Ilja Pozdejevs</i>	22
---	----

Agile Implementation Issues in Software Development at Public Sector in Latvia <i>Olga Gorgijoska</i>	24
--	----

Hilbert Transform Based Non Data Aided Carrier Offset Estimation Method <i>Vladimirs Sklarovs</i>	26
--	----

The Influence of Big Data-Driven Decision-Making on Financial Project Success <i>Dairis Usenieks</i>	28
---	----

Securing the Future of Remote Work: Novel Cyber Threat Mitigation Strategies <i>Jana Kudinova</i>	30
--	----

Session 2. Transport and Logistics

Contemporary Logistics Services Procurement Process: Industry Data Based Model <i>Aleksandrs Kotlars, Valerijs Skribans</i>	34
--	----

Artificial Intelligence in Supply Chain Management in India <i>Ahmed Shaheen Alangadan</i>	35
---	----

Aspects of Sustainable Transportation in Military Logistics <i>Inga Lencēviča</i>	37
--	----

Impact of Data Processing and Interpretation of Smart Containers on Enhancing Supply Chain Efficiency <i>Jeļena Kudrjavceva</i>	38
--	----

Session 3. Market: Research, Projects, Technologies and Problems of the Modern Economy and Business

Development of Business Model for Low-Cost Carrier Utilizing Regional Cargo Aircraft <i>Toms Sakalausks</i>	42
Improvement of Fatigue Management Methodologies Related to Flight Crew <i>Sofija Alomara</i>	44
The Integration of Artificial Intelligence in Management of Airline Operations Control Center (Occ) Processes <i>Christy Oommen Jacob</i>	46
Importance of Customer Communication in E-Commerce: Improving Customer Satisfaction <i>Taley Muhammad</i>	48
Training and Development for Enhancing Employee Performance in the Hotel Industry <i>Sandeep Verma</i>	49
Process Optimization Through Lean Management in An Aircraft Maintenance Organization <i>Nikita Lairand</i>	51
Risk and Threat Mitigation for Civil Aviation Flights Over and Near Conflict Zones <i>Bexultan Zhailybayev</i>	53
Resilience in the Airline Industry: Key Factors for a Successful Airline Business in Crisis <i>Stefan Bonhardt</i>	55



PLENARY SESSION

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 8-9
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

DESIGN DEVELOPMENT OF CIVIL AIRCRAFT

Anna Zervina¹, Olga Zervina²

¹Riga Secondary School 21
Tomsona iela 35, LV-1013, Riga, Latvia
annahomovna@gmail.com

²Transport and Telecommunication Institute
Lomonosova 1, LV-1019, Riga, Latvia
zervina.o@tsi.lv

Keywords: Commercial aviation, modernization, values, annotation

The aviation knowledge base evolves as information accumulates as a result of pioneering advances in research and prototype development. The potential advantages and challenges of the future aircraft concept have been the subject of extended literature sources (Hepperle, 2012; Moore, 2014). Jansen *et al.* (2017) and Bowman *et al.* (2018) provided an overview of conceptual designs supported by NASA. Gnadt *et al.* (2019) presented a list of seventy all-electric aircraft designs conceptualized in the past. Brelje *et al.* (2019) offered a broad overview of the impact of electric propulsion on aircraft sizing and emphasized the need for an interdisciplinary optimization framework. In addition, an overview of the study of conceptual design systems and prototypes was presented.

However, little attention has been paid to the study of the values of consumers of aviation services, primarily passengers. The values that passengers expect from aviation can make big changes to the design of the aircraft: it may require more comfort, more entertainment, more legroom, more aesthetics, a better appearance of the aircraft, etc.

Reasons why the design of the future aircraft must consider the changing values and desires of passengers:

- Passenger expectations and priorities are likely to continue to change over time as culture, lifestyle, and technology evolve.
- Focusing only on technological capabilities and environmental regulatory requirements can lead to aircraft that don't resonate with what passengers actually want from their experience.
- Features that enhance comfort, convenience, entertainment, and aesthetics can allow airlines to differentiate and charge award fares.
- As air travel becomes more affordable around the world, the passenger base is diversifying. Aircraft interiors and maintenance must conform to a wider range of cultural values and norms.
- As flight durations increase, the well-being of passengers on long journeys becomes increasingly important.
- Millennial travellers and Generation Z can expect better connectivity and productivity capabilities compared to previous generations.

Considering the values of passengers will lead to more competitive and successful aircraft designs.

In this research work, the issues of development of the design of civil aviation aircraft are considered, attention is paid to the aspects of modernization, corresponding to social values in the context of civil aviation: speed, safety, comfort, and others.

The purpose of the study is to identify historical changes in aircraft design, their relationship with values in the context of the concept of the value proposition, and to learn about future trends in the transformation of civil aviation aircraft design in the context of social values.

To achieve this goal, it is planned to conduct a study that includes both the analysis of available literature data, aviation start-ups text mining to identify values, and expert interviews in the field of aviation sector design and public values. In addition, the forecasts of engineers and scientists about future changes in the design of civil aircraft, driven by the values of society, will be taken into account. Methods include a literature review, annotation of the texts of startups' home pages in the aviation domain, and interviews with experts. At the end the prototype of the possible aircraft design based on passenger values is created using machine learning tools.

The results of this study will provide a comprehensive picture of the direction in which civil aviation aircraft design can evolve in response to societal challenges.

References

1. Bowman, C.L., Felder, J.L., Marien, T.V. (2018) Turbo-and Hybrid-Electrified Aircraft Propulsion Concepts for Commercial Transport. In: *Proceedings of the 2018 AIAA/IEEE Electric Aircraft Technologies Symposium (EATS)*, Cincinnati, OH, USA, 12–14 July 2018; pp. 1–8.
2. Gnadt, A.R., Speth, R.L., Sabnis, J.S., Barrett, S.R. (2019) Technical and environmental assessment of all-electric 180-passenger commercial aircraft. *Prog. Aerosp. Sci.* 2019, 105, 1–30.
3. Hepperle, M. (2012) *Electric Flight-Potential and Limitations, Presented at the Energy Efficient Technologies and Concepts of Operation*, Lisbon, Portugal. 2012. Available online: <https://elib.dlr.de/78726/> (accessed on 22 November 2023).
4. Jansen, R., Bowman, C., Jankovsky, A., Dyson, R., Felder, J. (2017) Overview of NASA Electrified Aircraft Propulsion (EAP) Research for Large Subsonic Transports. In: *Proceedings of the 53rd AIAA/SAE/ASEE Joint Propulsion Conference*, Atlanta, GA, USA, 10–12 July 2017; p. 4701. *Aerospace* 2020, 7, 44-57.
5. Moore, M.D. (2014) Misconceptions of Electric Aircraft and their Emerging Aviation Markets. In: *Proceedings of the 52nd Aerospace Sciences Meeting, National Harbor, MD, USA*, 13–17 January 2014, 0535.

*RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 10-11
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia*

SOCRATIC METHOD FOR PROMPT ENGINEERING – NEW TEACHING DESIGN

Boriss Misnevs

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

Keywords: Critical thinking, digital competence, software engineering, large language models, checklist

The emergence of widely available artificial intelligence (AI) in the form of Large Language Models (LLMs) has forced us to rethink our pedagogical heritage and return to classical methods, such as the Socratic method, in a completely new form – dialogue with a computer.

Socratic teaching is a method of teaching that involves a dialogue between the teacher and the students (Blog, 2022). The teacher asks open-ended questions to the students, and the students are encouraged to think critically and come up with their own answers. This method of teaching is often used in law schools and other graduate programs, but it can be used in any classroom setting. In the research, the Socratic method is used in combination with the Prompt Engineering method in Software Engineering teaching.

The goal of the Socratic method is not to provide information or facts but to help students develop their own understanding and ideas (Delic, 2016). The method encourages students to consider why things are a certain way and to consider arguments for and against different viewpoints on a topic. In the research, we are designing a teaching process for university students training in Requirement Analysis and Design competencies involving a technology of Prompt Engineering with LLMs.

However, it is important to note that the Socratic method of teaching may not be the best fit for every student or every subject. It is important for teachers to consider the needs of their students and the subject matter they are teaching when deciding whether to use this method. The case of Software Engineering Requirements Analysis and Design was the best, from the author's point of view, which fits both teaching/learning methods – Socratic and Prompt Engineering.

Prompt engineering is a relatively new discipline and is an integral facet of generative artificial intelligence (AI).

The Socratic method of teaching is a proven method that can help students learn and can be an effective way to teach software developers, but it is important to consider the needs of the students and the subject matter being taught before deciding to use this method (Socratic Method, 2023). In our case, it is a new digital competence to use Prompt Engineering for Software Engineering.

It encourages students to consider why things are a certain way and to consider arguments for and against different viewpoints on a topic. Students are questioning their own ideas and thus developing their critical thinking.

After the emergence of Large Language Models (LLMs) as a new stage in the development of artificial intelligence, it became possible to organize educational dialogues in the style of Socrates not only with a human accountant but also with AI (Giray, 2023).

An innovative teaching design was developed to implement a study plan that emphasizes critical thinking and decision validation in software requirements analysis and design using prompt engineering and LLM (Language Model) for university students. The developed type of teaching may be implemented in the form of practical hands-on classes or as individual home assignments (Project).

This design contains the following 5 steps:

1. Project Context Setting (Introduce a realistic business problem to solve through software application development)
2. Task Briefing and Deliverables (Provide a detailed overview of the assignment, including the requirements for:
 - a. Software application design
 - b. Main features identification
 - c. Architecture planning
 - d. Implementation considerations
 - e. Feasibility study
 - f. Risk evaluation)
3. Teaching Methodology (Prompt Engineering with LLM, Checklist-Based Approach)
4. Project Execution and Evaluation (Project Phases, Ongoing Feedback)
5. Final Deliverables and Assessment (Final Presentation and Documentation, Assessment Criteria).

The result of this project will be the complete set of project documentation required for software development and delivery. The developed solution may be supplied with a mock-up generated by AI for demonstration purposes.

The critical requirements for the successful teaching design implementation are resources such as access to relevant literature, tools, case studies, and sample projects to aid students in their decision-making process.

The educational design proposed in the study contains all the basic elements for teaching critical and computational thinking - problem decomposition, pattern recognition, generalization of results, implementation of algorithms, and verification and validation of results. The use of interactive communication with Large Language Models in teaching significantly expands the student's learning opportunities using the best world practices in the field of software development. The use of checklists with a combination of Prompt Engineering during independent work of students allows to improve the quality of management of the process of completing educational tasks.

In conclusion, it can be argued that Large Language Models (LLMs) can play not only the role of a technical consultant in the field of Software Engineering but also actively participate in the formation of necessary soft digital competencies, such as Prompt Engineering.

References

1. Blog. (2022) *The Socratic Method of Teaching: What It Is, Its Benefits, and Examples*. <https://www.saintleo.edu/about/stories/blog/socratic-method-teaching-what-it-its-benefits-and-examples> [accessed Nov 18 2023].
2. Delic, H., Bećirović, S., (2016) Socratic Method as an Approach to Teaching. *European Researcher. Series A*, 111(10), 511-517, 2016.
3. Giray, L. (2023) Prompt Engineering with ChatGPT: A Guide for Academic Writers. *Ann Biomed Eng.*, 51, 2629–2633, <https://doi.org/10.1007/s10439-023-03272-4> [accessed Nov 18 2023].
4. Socratic Method as an Approach to Teaching (2023) Available from: https://www.researchgate.net/publication/309634848_Socratic_Method_as_an_Approach_to_Teaching [accessed Nov 18 2023].



Session 1

**Computer Problems of the
Information Society and the
Modern Electronics**

**Informācijas sabiedrības
datorizācijas problēmas un
mūsdienu elektronika**

ANALYSIS OF VPN OBFUSCATION METHODS

Andris Začs

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
andriszac0@gmail.com*

Keywords: VPN Obfuscation, deep packet inspection, steganography, traffic morphing

The need for various VPN obfuscation techniques came about due to the rapid advancement of Deep Packet Inspection (DPI) technologies, which brought with it concerns regarding online privacy and unrestricted internet access (El-Maghraby, 2017). This paper offers an analysis of VPN obfuscation's present situation and potential future developments, emphasizing novel approaches to foil DPI strategies that are becoming increasingly complex. As a recent example, we have the Geneva algorithm which employs genetic algorithms to generate dynamic, packet-manipulation-based evasion strategies, providing a new take on DPI evasion (Bock *et al.*, 2019).

Steganography can also be utilized in VPN obfuscation. This method provides a way around DPI systems by embedding VPN traffic inside regular data streams. Steganography enables regular web traffic, like audio or video streams, to conceal VPN packets, making it difficult for DPI tools to discern between encrypted and regular traffic (Kundur, 2003). The effectiveness and subtlety of this method are assessed, offering insights into its limitations and useful applications in different network environments.

The investigation of traffic morphing is another essential component of VPN obfuscation. By altering the properties of VPN traffic to resemble regular HTTP or HTTPS traffic, this method avoids detection by DPI systems. Traffic Morphing obfuscates by modifying packet sizes, timing, and other traffic attributes (Wright, 2009). The efficacy of this approach is evaluated, considering variables such as network performance and adaptability to various DPI technologies.

Another way of obfuscating VPN traffic is through the application of port and multi-protocol obfuscation. To avoid detection, Multi-Protocol Obfuscation involves switching between several VPN protocols and adjusting their settings. On the other hand, port obfuscation concentrates on using non-standard ports for VPN traffic, which can assist in getting around simple DPI systems that keep an eye on popular VPN ports. The usability of these techniques, along with their effects on security and network performance, is carefully examined.

More novel obfuscation techniques are also analysed like Randomized Packet Padding, Shadowsocks usage, and Tor integration with VPNs. By adding variance to VPN packets, randomized packet padding makes it more difficult for DPI systems to recognize patterns. An encrypted proxy called Shadowsocks is used to make VPN traffic look like HTTPS traffic (Clowwindy). Tor and VPNs work together to add an extra layer of encryption and obfuscation, though there may be a trade-off in connection speed. This thorough examination attempts to give readers a basic understanding of different VPN obfuscation methods while assessing their efficacy in a world where internet censorship and monitoring are becoming more commonplace.

The research is supervised by Mg.sc.comp. Jeļena Revzina.

References

1. Bock, K., Hughey, G., Qiang, X., Levin, D. (2019) Geneva. *Proceedings of the 2019 ACM SIGSAC Conference on Computer and Communications Security*.
2. El-Maghraby, R.T., Abd Elazim, N.M. and Bahaa-Eldin, A.M. (2017) A survey on deep

- packet inspection. *12th International Conference on Computer Engineering and Systems (ICCES)*. IEEE. Available at: <https://doi.org/10.1109/icces.2017.8275301>.
3. Clowwindy, Madeye, and L. Max. Shadowsocks. [Online]. Available: <http://www.shadowsocks.org/>
 4. Kundur, Deepa & Ahsan, Kamran. (2003) *Practical internet steganography: data hiding in IP*.
 5. Wright, C.V., Coull, S.E., & Monroe, F. (2009) Traffic Morphing: An efficient defense against statistical traffic analysis. *Network and Distributed System Security Symposium*.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 16
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

CONTAINER ORCHESTRATION PLATFORM CHALLENGES ON KUBERNETES EXAMPLE

Junaid Ahmed

Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
st79316@students.tsi.lv

Keywords: Kubernetes, container orchestration, load balancer, services, performance, scalability

Traditional monolithic frameworks often face challenges in scaling, load balancing, performance, and maintenance of container-based applications. Consequently, there has been a shift towards containerization, which supports users in creating, deploying, or deleting containers. To facilitate container manipulation, leading container orchestration tools such as Kubernetes have been introduced (Mondal *et al.*, 2022). This thesis critically analyses the existing literature on Kubernetes container orchestration. A semi-systematic approach was used to collect data from well-known databases, including IEEE Xplore, ScienceDirect, Springer, Taylor and Francis, and ACM Digital Library. As a result, performance, scalability, security, and availability have been identified as significant challenges in containerization technology. Unlike other studies, the proposed strategy in this thesis optimizes Kubernetes container orchestration, focusing on performance, scalability, security, and reliability. This thesis introduces innovative methods to enhance Kubernetes orchestration. Systematic evaluation of scalability and performance challenges, such as increasing workloads, provides deeper insights into the performance of Kubernetes container orchestration under varying workloads.

The proposed strategy effectively utilizes resource isolation to prevent performance degradation. Namespace 1, Namespace 2, and Namespace 3 show CPU requirements in mCPU as 405, 216, and 397, respectively. The results indicate that the performance within a cluster in Kubernetes is better due to the accurate usage of CPU and memory requests. Moreover, the serving pod, as per the proposed strategy, has 0 restarts, indicating the high reliability of orchestration strategy. A system with multi-node cluster, hosting a set of pods that run the containerized applications. Sufficient CPU and memory resources were requested.

In this thesis, we propose a strategy to investigate the scalability and performance of Kubernetes container orchestration. This thesis highlights performance and scalability issues, such as over-commitment or under-commitment of resources, network performance, fluctuations in pods and nodes within a cluster, and achieving optimal performance through configuration. The proposed strategy efficiently utilizes resources and maintains resource availability in all scenarios. Misconfiguration, container vulnerabilities, network policies, and resource isolation are key issues in Kubernetes container orchestration. This thesis also demonstrates a reliability assessment through the activation of automated rollbacks and a self-healing mechanism for auto-restarting failed containers.

The research is supervised by Mg.sc.inf.sys., PhD(c) Aleksejs Vesjolijs.

References:

1. Mondal, S. K., Pan, R., Kabir, H. D., Tian, T. & Dai, H.-N. (2022) Kubernetes in IT administration and serverless computing: an empirical study and research challenges. *The Journal of Supercomputing*, 1-51.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 17-18
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

APPLICATION OF REINFORCEMENT LEARNING METHODS FOR TEST CASE PRIORITIZATION

Oskars Koleda

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
st79245@students.tsi.lv*

Keywords: Test case prioritization, regression testing, reinforcement learning, machine learning, continuous integration

The demand for efficient regression testing strategies has persisted for over two decades, driving the development of techniques such as Test Case Selection, Test Case Minimization, and Test Case Prioritization (TCP) to mitigate the resource and time costs associated with this critical testing phase (Rothermel *et al.*, 2001). With the increasing adoption of continuous integration (CI) practices in software projects, where software builds are generated more frequently, the need for effective regression testing becomes even more pronounced. While CI offers advantages such as reduced integration issues and accelerated development cycles, the execution of extensive regression test suites after each software build becomes impractical for larger projects, consuming substantial time and resources (Bagherzadeh *et al.*, 2022).

In response to this challenge, numerous TCP techniques leveraging machine learning approaches have emerged over the years, incorporating supervised learning, unsupervised learning, natural language processing, and reinforcement learning (RL) (Pan *et al.*, 2021). RL has demonstrated promise in adapting to dynamic and evolving scenarios, allowing algorithms to learn and update policies through interaction with the testing environment (Bagherzadeh *et al.*, 2022). However, the development of effective RL techniques for TCP poses several challenges.

A systematic literature review conducted by Pan *et al.* (2021) examined seven relevant studies published between 2006 and 2020, highlighting common trends in RL for TCP. These efforts have focused on devising new reward functions and applying various RL algorithms to improve model performance. While using consistent datasets based on test execution history simplifies performance comparisons among RL models, it also reveals a limitation – existing state-of-the-art RL methods for TCP have primarily been tested on a limited set of features or imbalanced datasets. This emphasizes the critical need for further exploration and experimentation with diverse datasets and additional features to thoroughly assess the capabilities and limitations of RL techniques in the TCP domain.

Acknowledging the challenge posed by limited datasets, a few previous studies (Yaraghi *et al.*, 2023 and Elsner *et al.*, 2021) have provided extensive datasets for addressing the TCP problem. In contrast, other studies have achieved a state-of-the-art in applying RL for TCP, even though they utilized suboptimal datasets (Bagherzadeh *et al.*, 2022). This study aims to address this gap by concentrating on the application of state-of-the-art RL techniques for TCP model training. Consequently, the study details the datasets and RL algorithms used to train new models for test case ranking prediction. In certain combinations, improved performance results were achieved compared to those reported in previous state-of-the-art RL techniques for TCP, underscoring the significance of high-quality datasets for model training. While the comparison of models using the NRPA (Normalized Rank Percentile Average) performance metric did not yield significant improvements compared to those reported by Bagherzadeh *et al.* (2022), a notable 12% increase was observed in the APFD (Average Percentage of Faults Detected) metric when compared with the results presented in the same study. The description of the feature set used to train the models is also provided.

Acknowledgements

Many thanks to Professor Dmitry Pavlyuk for his guidance and supervising the work.

References

1. Bagherzadeh, M., Kahani, N. & Briand, L. (2022) Reinforcement learning for test case prioritization. *IEEE Transactions on Software Engineering*, 48(8), DOI:10.1109/tse.2021.3070549.
2. Elsner, D., Hauer, F., Pretschner, A. & Reimer, S. (2021) Empirically evaluating readily available information for regression test optimization in continuous integration. In *Proceedings of the 30th ACM SIGSOFT International Symposium on Software Testing and Analysis*, Virtual, Denmark, July 11-17. ACM, New York, NY, USA, 14 pages.
3. Pan, R., Bagherzadeh, M., Ghaleb, T. A. & Briand, L. (2021) Test case selection and prioritization using Machine Learning: A Systematic Literature Review. *Empirical Software Engineering*, 27(2), DOI:10.1007/s10664-021-10066-6.
4. Rothermel, G., Untch, R. H., Chu, C. & Harrold, M. J. (2001) Prioritizing Test Cases for Regression Testing. *IEEE Transactions on Software Engineering*, 27(10), DOI:10.1109/32.962562.
5. Yaraghi, A. S., Bagherzadeh, M., Kahani, N., Briand, L. (2023) Scalable and Accurate Test Case Prioritization in Continuous Integration Contexts. *IEEE Transactions on Software Engineering*, 49(4), 1615-1639. DOI: 10.1109/tse.2022.3184842.

STEREOSCOPIC DATASET EXTRACTION FROM VIDEO RECORDINGS USING FISH BEHAVIOR AS EXAMPLE

Jurijs Malahovs

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
keita210492@gmail.com*

Keywords: Artificial intelligence, computer vision, fish behavior, patterns, ANN, OpenCV, Python

According to IBM information (IBM, 2023), interest in Computer Vision experiments started growing in 1959, with attempts to correlate a cat's brain response to a set of images that neurophysiologists showed it. By definition (Wilcox and Harris, 2010), stereoscopic vision involves understanding the depth and other resulting parameters of an object whose image is received by two slightly offset receivers (e.g., eyes or cameras). Retrieving a set of data that carries information about the actual movements of objects in real world is the one difficult and complex task that, once accomplished, allows to work with that data and accomplish various different tasks on computer that otherwise would not be possible.

According to a recent study (Linton *et al.*, 2022) the interest in 3D objects recognition has increased over the last few years due to the recent advances in computer image processing using Artificial Intelligence (AI). This allows us to improve our understanding on how animals move in 3D world and helps us find better ways to interpret their movements by extracting more detailed information from the recorded data.

The study performs tasks with two identical cameras to collect the data, then pre-process using object detection algorithms, identify and locate the observed fish in each frame using a pre-trained YOLOv8 model. In the next step, the stereoscopic motion of the object is calculated using OpenCV algorithms (OpenCV, 2023) and all the obtained information (e.g., detected object label, movement speed and movement direction) is provided as a dataset for the use of AI model to use for further processing (Zhang *et al.*, 2023).

An obtained result of the study is the ability to use the extracted dataset, classified by the operator to be easily transferred to the AI as the labelled dataset for ANN training purposes. Proposed methodology includes the next steps: correctly detect object of interest; calculate and apply stereoscopic motion detection calculation; prepare the dataset, classified by an operator, and use this labelled data in AI model training. Some of the practical applications to the obtained results include using the data in fish health monitoring with AI and alerting the operator whenever there is human intervention required or simulating actual fish movement patterns in computer models.

The research is supervised by Dr.sc.ing., Professor Aleksandrs Grakovskis.

References

1. IBM. (2023) The History of computer vision, <https://www.ibm.com/topics/computer-vision>, last accessed 11.10.2023.
2. Linton, P., Morgan, M., Read, J., Vishwanath, D., Creem-Regehr, S., and Domini, F. (2023) New approaches to 3D Vision, London: philosophical transactions of the Royal Society B: *Biological Sciences*, 378(1869), <https://doi.org/10.1098/rstb.2021.0443>, last accessed 11.11.2023.
3. OpenCV. (2023) Open Source Computer Vision, <https://docs.opencv.org/4.x/index.html>, last accessed 11.12.2023.

4. Wilcox, L., Harris, J. (2010) Fundamentals of stereopsis, In: *Encyclopaedia of the Eye*, <https://www.sciencedirect.com/topics/medicine-and-dentistry/stereoscopic-vision#:~:text=Introduction,derived%20from%20the%20two%20eyes>, last accessed 11.11.2023.
5. Zhang, A., Lipton, Z., Li, M., and Smola, A. (2023) *Computer vision, in dive into deep learning*, 1st ed., pp. 592-689. Cambridge University Press.

*RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 21
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia*

RECONSTRUCTION OF HIDDEN PARTS OF HUMAN'S FACE IN FACE RECOGNITION PROBLEMS

Evgeny Tenenbaum

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

Keywords: Face recognition, hidden parts, reconstruction

Extract and represent relevant information from an image are not always possible due to the fact that part of the image could be hidden and because of this it's impossible to extract information from the image, or the significance of such data is greatly reduced. The reduction in significance can be significant, making such images inapplicable in many areas. For example, the US National Institute of Standards and Technology conducted their study on the accuracy of masked face recognition, out of 89 algorithms tested, the error rate always increased from 5% to 50% depending on the algorithm (Ngan, 2020). Significance can be quite critical in many applications hence purpose of research to reconstruct image in order to improve image quality and increase accuracy.

Research delves into the various methods and approaches for reconstruction of hidden parts, with a particular focus on their application for face recognition. The study compares the improvement in accuracy and searches for the optimal type of reconstruction of hidden areas, as well as checking the use of reconstruction to improve the accuracy in cases where there is sufficient accuracy. The main methods that were tested were inpainting and several variations of synthetic data augmentation. Photos were taken, glasses were applied, then recognition was made without reconstruction and with reconstructions.

The preliminary result of the study shows that reconstruction is an effective means of improving accuracy. But in cases where high accuracy and speed are required - personal identification, acquiring and others, the use of this technology is somewhat premature, because biometric systems have very high accuracy and images after recovery not passing threshold. Apparently, due to reasons, banks, for example, do not use such functionality. But the technology is developing and perhaps in the near future the situation may change.

The research is supervised by Dr.sc.ing., Professor, Alexander Grakovski.

References

1. Ngan, M., Grother, P., Hanaoka, K. (2020) *Ongoing Face Recognition Vendor Test (FRVT) Part 6A: Face recognition accuracy with masks using pre-COVID-19 algorithms*, available at: <https://nvlpubs.nist.gov/nistpubs/ir/2020/NIST.IR.8311.pdf> [accessed: 12 November 2023].

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 22-23
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

APPLICATION OF AI FOR SUPPORT TASK PROCESSING IN A MULTISYSTEM ENVIRONMENT

Ilja Pozdejevs

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
St70952@students.tsi.lv*

Keywords: AI, support task processing, multisystem environment, architecture

In this study, the problem is focused on the multisystem environment, where manual processing of support tasks by IT support staff often leads to delays, increased workload, and as result, decreased customer satisfaction. Goal of this study is to enhance IT support efficiency in a multisystem environment through proposed AI-based architecture.

Possible solution for the addressed problem is integration of AI technologies like natural language processing and machine learning algorithms. These technologies have the capability to automate the process of categorizing requests and assigning priority to tasks based on their level of difficulty and urgency, resulting in a more efficient support process.

A multisystem environment, in the context of IT support, is an infrastructure that uses different systems and applications to perform a variety of business functions. These systems may include customer service systems, task management software, such as Jira, Zendesk and other tools for monitoring, analyzing, and managing data.

AI's role in communication has been pivotal in increasing efficiency and enhancing user interactions, making it invaluable in IT support contexts (Ackerman *et al.*, 2022).

In this research, for the addressed problem, proposed solution is an AI-based architecture designed to speed up IT support request processing in a multisystem environment. The proposed architecture uses a three-level approach that combines different levels - request creation, request processing and request response data.

The first level is the request level, it consists of cloud services and server systems that can make a request for intelligent support.

The second level is the processing level, it uses AI to link the request level and the data level, offering intelligent support. It uses AI modules to analyze and make decisions based on data collected from different systems at the data level. AI modules are selected for specific needs, and their number within the architecture is not limited.

The third level is the data level, which consists of cloud services and server systems that provide data to the second level.

In order to validate the proposed architecture, the study evaluates the applicability of one of its potential technical implementations for company X. Which is a global corporation that specializes in offering electronic payment technologies. On average, X company receives 200 support requests daily through Jira Service Desk.

The technical implementation of the proposed architecture is based on the creation of a Support Actions Recommendation Module as one of many modules that can be used. This module combines the work experience of IT support staff and data from data-level systems to create a structured action plan for solving support problems.

As a result of this study, the practical application of the proposed architecture was evaluated through selected quantitative metrics, such as task processing time and others. Analysis of these

metrics confirmed the hypothesis that this AI-based architecture increases the speed of IT support task processing in a multisystem environment.

This research is supervised by Dr.sc.ing., Professor Irina Pticina.

References

1. Ackerman, S., Anaby-Tavor, A., Farchi, E., Goldbraich, E., Kour, G., Rabinovich, E., Raz, O., Route, S., Zalmanovici, M., & Zwerdling, N. (2022) *High-quality conversational systems*. Retrieved from: <https://arxiv.org/abs/2204.13043>

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 24-25
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

AGILE IMPLEMENTATION ISSUES IN SOFTWARE DEVELOPMENT AT PUBLIC SECTOR IN LATVIA

Olga Gorgijoska

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
st78644@students.tsi.lv*

Keywords: Public sector, implementation challenges, government organizations, organizational culture, change management, digital government services

In recent years, there has been a growing popularity of Agile project management methodologies attributed to their capacity to enhance the quality and pace of software development projects. Presently, numerous research documents delineate diverse methods for agile implementation within organizations, particularly tailored for private sector enterprises.

In the context of this research topic, the focus is on the implementation of Agile methodologies in Latvia's public sector. It is noteworthy that despite the acknowledged benefits, the implementation of Agile methodologies poses certain challenges, including issues related to procurement processes (Ocampo *et al.*, 2021), a deficient comprehension of the methodologies (Kupi *et al.*, 2021), and difficulties in adapting to new processes (Mohagheghi *et al.*, 2020).

This master's thesis aims to address a research gap identified by Kupi *et al.* (2021) pertaining to specific optimization issues in Agile implementation within Latvia's public sector. These issues encompass crucial aspects such as adaptability to change, fostering innovation, and reducing project timelines, as emphasized by (Bogdanova *et al.*, 2020).

The research objective is to contribute valuable insights by proposing effective methods, time-saving approaches, and recommendations for selecting an optimal Agile methodology in context of Latvia's public sector. This will be achieved through a meticulous analysis of questionnaire results and a thorough examination of challenges associated with implementation. This research provides a concise comprehensive exploration of Agile implementation in the public sector, offering guidance for practitioners in Latvia.

Methods, which will be evaluated for applicability in thesis work: analytical hierarchy approach (AHP), Literature review is to have background knowledge on agile implementation issues into public sector worldwide. Domain Decision Matrix (DMM). This would help in designing a framework to conduct this research.

As the expected outcome, the research will propose methods, approaches, and recommendations for selecting an agile methodology into public sector in Latvia. To answer the question about of identifying the best elements, the following task was formulated:

1. Completing state - of – the - art.
2. Creating a survey for public sector organizations in Latvia.
3. Analyzing survey results in the conclusion.

The findings culminate in the recommendation of an Agile methodology tailored specifically for software development, deemed most suitable for adoption within Latvia's public sector.

The research is supervised by Dr.sc.ing., Professor Mohammad Soltani.

References

1. Bogdanova, M, Paraskevova, E., Stojanova, M. (2022) Agile Project Management in Public Sector – Methodological Aspects. *Journal of European Economy*, 19(2), 73. DOI: 10.35774/jee2020.02.283
2. Kupi, M., McBride, K. (2021) Agile Development for Digital Government Services: Challenges and Success Factors. *EGOV-CEDEM-EPART*, Granada, Spain May 2021, Springer, 11 pp.
3. Ocampo, W.M., Monsalve, E. S., Calvache, C.J.P. (2021) State of agile contracting in the software industry and the public sector results of systematic mapping of the literature. *Periodicals of Engineering and Natural Sciences*, 9(4), 375. DOI:10.21533/pen.v9i4.2252
4. Mohagheghi, P. Lassenius, C., Bakken, I. O. (2020) *Enabling team autonomy in a large public organization*. Copenhagen, Denmark, Springer, Cham. 396 p.
5. Riesener, M., Doelle, C., Perau, S., Lossie, P., Schuh, G. (2021) Methodology for iterative system modeling in agile product development. In: *Procedia CIRP, 31st CIRP Design Conference 2021, 19 – 21 may, Procedia CIRP*, 100, 439–444 p.
6. Vacari I. Pricladnicki R. (2017) *An Empirical Study on the Adoption of Agile Software Development in Public Organizations*. In: *27th International Conference on Software Engineering and Knowledge Engineering*. Wyndham Pittsburgh University Center, Pittsburgh, USA July 2017. KSI Research Inc. 741 pp.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 26-27
 Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

HILBERT TRANSFORM BASED NON DATA AIDED CARRIER OFFSET ESTIMATION METHOD

Vladimirs Sklarovs

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

Keywords: Carrier frequency offset, Hilbert transform, spectrum

Reliable high speed communications are an important part of the modern information century. Quadrature Amplitude Modulation (QAM) based modems are often used in microwave backhaul links, providing high throughput and reliable communications. As mentioned by (Sklar, 2001), QAM modems use in phase and Quadrature (I and Q) components to represent the data as a complex valued number:

$$x_C = x_R(t) + ix_I(t) = x_I(t) + ix_Q(t), \quad (1)$$

where:

- x_C is a Complex signal,
- x_R is a Real part of the signal,
- x_I is an Imaginary part of the signal,
- x_I is an In-phase part of the signal,
- x_Q is a Quadrature part of the signal.

One of the issues wireless data transmission is the impairments faced by the receiver, which lower the quality of the communication systems, causing errors or even disrupting the communications. One of such impairments is the Carrier Frequency Offset (CFO), with its effects theoretically investigated in (Proakis, 2000).

CFO effects can be seen as continuous drifting of the signal constellation from the ideal symbol place, causing errors on the receiving site.

Mathematically CFO can be formulated as:

$$\hat{x}(t) = x(t)e^{j2\pi\Delta f t}, \quad (2)$$

where:

- \hat{x} is an input signal with CFO,
- x is an input signal of interest.

One of the approaches was presented by (Harris *et al.*, 2012). In their work, authors have proposed a Band-Edge filter approach for CFO estimation and compensation, while there exist many other approaches for estimating CFO as shown in (Proakis, 2000).

The method, proposed by the author is based on the Hilbert Transform. Hilbert transform is an integral transformation as explained by (Oppenheim and Schaffer, 2010), which allows to obtain the analytic or single-sided spectrum signal of the form:

$$x_A(t) = x(t) + j\hat{x}_H(t), \quad (3)$$

where:

- x_A is an Analytic signal,
- \hat{x}_H is a Hilbert Transform of x .

For CFO both negative and positive parts of the signal spectrum are obtained, treating each as an analytic or single sided spectrum signal before comparing the energy of both signals. With negative CFO, the filter will produce the negative result, for the positive CFO, a positive result will be produced, proportional to the CFO. The lack of the CFO produces the result being equal 1, showing the similarity between negative and positive parts of the signal spectrum. This method provides ability to calculate positive or negative CFO, using this information it is possible to next to adjust the CFO.

Hilbert Transformer is developed as a Finite Impulse Response (FIR) filter which provides the 90 degree phase rotation to the half of the signal spectrum, either positive or negative thus giving the ability to separate both negative and positive parts of the signal spectrum.

The length of the filter will correspond both to the higher latency and resource usage due to the longer impulse response, so it is important to determine whether certain filter length is enough or should it be optimized to lower the resource usage and response time of the system while providing the ability to estimate the CFO.

The research is supervised by Dr.sc.ing., Assistant Professor Sergejs Šarkovskis.

References

1. Harris, F., Venosa, E., Chen, X. and Dick, C. (2012) Band edge filters perform non data-aided carrier and timing synchronization of software defined radio QAM receivers. *The 15th International Symposium on Wireless Personal Multimedia Communications*, Taipei, Taiwan, 2012, pp. 271-275.
2. Oppenheim, A. V., & Schaffer, R. W. (2010) *Discrete-time signal processing* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.
3. Proakis, J. G. (2000) *Digital Communications*. McGraw-Hill Education.
4. Sklar, B. (2001) *Digital Communications: Fundamentals and Applications*. Prentice Hall.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 28-29
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

THE INFLUENCE OF BIG DATA-DRIVEN DECISION-MAKING ON FINANCIAL PROJECT SUCCESS

Dairis Usenieks

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

Keywords: Financial project management, decision-making process, big data, project success, impact, survey

Decision-making has always been a crucial component of running a company and executing projects, especially when it comes to the financial sector. Choosing to take action is a part of decision-making, which is also defined as the process of considering and selecting among choices in order to achieve a certain goal or solve a problem (Amrozi *et al.*, 2020). The widespread use of big data tools and methodologies has made it possible for companies to evaluate a wide range of factors that contribute to their business goals. According to Borkovich and Noah (2014), big data began to develop in the middle of the 1990s as a result of the widespread use of the internet. In light of this, big data analysis and evaluation became necessary for extracting insightful information that is used nowadays as part of business intelligence. In order to make decisions based on data, the transformation of data into information and then into knowledge for informed decision-making is emphasised by Davenport and Short (1990) and Rijmenam (2014), who also stress the significance of analysis in the context of project management.

However, poor decision-making techniques and insufficient knowledge of big data analytics may result in grave consequences for the project. There has been a lack of research when it comes to creating and finishing successful projects purely based on decision-making and big data. When it comes to successful projects, five aspects are suggested by Shenhar and Dvir (2007) for defining success criteria in project management: business results, customer impact, team impact, project efficiency, and future readiness of the project. Therefore, it is important to investigate how big data-driven decision-making affects project success in the field of finance. This is particularly relevant when financial institutions aim to make wise and well-constructed decisions without making costly errors.

Taking into account the above mentioned, this research aims to investigate the influence of big data-driven decision-making on financial project success and offer recommendations based on the findings. The research focuses on the decision-making process in project management in the field of finance, with a specific focus on the impact of big data analytics.

To achieve the goal of the research, author focuses on answering the following research questions:

- What are the measurements that can be applied to measure the influence of big data-driven decision-making in a business environment?
- What are the factors of big data analytics and decision-making that contribute to a successful project in finance?
- How to design data-driven decision support systems to increase the comprehension of contingency factors on project success development and implementation?

The results of literature review present various measurements for measuring big data, decision-making, and project success in finance provided by Jugdev and Müller (2005), Shenhar and Dvir (2007), and Kerzner (2022). Big data can be measured by data dimensions such as volume, velocity, variety, value, and veracity. Data-driven decision-making takes into account

the process of how data is transformed to information, then to knowledge and wisdom. External factors and internal factors also play a significant role in the decision-making process and approach that creates the final decision. If the project is to become successful, it needs to contain such success dimensions as financial success, customer-related success, internal success, and future success. Thus, the empirical part of the research uses an explanatory research design, incorporating qualitative and quantitative methods to collect, analyse, and interpret data from a selected finance company leveraging big data analytics.

Since the empirical part of the research is still in process, a face-to-face interview is set to be conducted with a leader of the company so that the questionnaire could be created and distributed to a number of employees in a company that directly work with big data-driven decision-making to gather the data. It is believed that the results of this research will show what kind of influence big data-driven decision-making has on project success in finance, and provide relevant recommendations for the projects to achieve project success. The information gained from the results are summarised to create a framework that can be used for big data-driven decision-making.

In conclusion, this research seeks to contribute to the understanding of big data-driven decision-making in the finance sector, providing insights and recommendations for project success in finance.

Acknowledgements

I would like to express my sincere gratitude to Professor Irina Jackiva for her guidance, support, and constructive feedback while conducting this research. I also want to thank my family and friends for encouragement, support, and understanding while conducting this research.

References

1. Amrozi, Y., Ramdhani, M., Usman, I. (2020) History of decision-making: development and its applications. *Journal of Physics: Conference Series*, 1573, 012010. DOI: 10.1088/1742-6596/1573/1/012010.
2. Borkovich, D. J., and Noah, P. D. (2014) Big data in the information age: exploring the intellectual foundation of communication theory. *Information Systems Education Journal (ISEDJ)*, 12(1), Available at: <https://files.eric.ed.gov/fulltext/EJ1140800.pdf> (Accessed: 13 November 2023).
3. Davenport, T. H. and Short, J. E. (1990) The new industrial engineering: information technology and business process redesign. *Sloan Management Review*, 31(4), 11-27.
4. Jugdev, K., and Müller, R. (2005) A Retrospective look at our evolving understanding of project success. *Project Management Journal*, 36(4), 19–31. DOI:10.1177/875697280503600403.
5. Kerzner, H. (2022) *Project management metrics, KPIs, and dashboards: a guide to measuring and monitoring project performance*. Hoboken, NJ: John Wiley & Sons.
6. Rijmenam, M. (2014) *Think bigger: developing a successful big data strategy for your business*. First edition. USA: Amacom.
7. Shenhar, A. J., and Dvir, D. (2007) *Reinventing project management: the diamond approach to successful growth and innovation*. (6th ed.) Harvard Business School Publishing.

*RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 30-31
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia*

SECURING THE FUTURE OF REMOTE WORK: NOVEL CYBER THREAT MITIGATION STRATEGIES

Jana Kudinova

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
st55812@students.tsi.lv*

Keywords: Cybersecurity, remote work, zero trust, secure access service edge, threat mitigation

The corporate world has been fundamentally transformed by the COVID-19 pandemic, leading to the widespread adoption of remote work as a new standard. This transformation, while advantageous in terms of flexibility and efficiency, has simultaneously increased the cybersecurity risks faced by organizations worldwide (Crossland & Ertan, 2021). Traditional cybersecurity models, which are mostly perimeter-based, have proven inadequate in this new paradigm (Kindervag, 2010), highlighting the need for a re-evaluation of threat mitigation strategies. This thesis, delves into this urgent and complex issue, with a specific focus on the integration of zero trust frameworks, an area that has received limited attention in contemporary studies.

The motivation for this study arises from a significant gap identified in contemporary literature: the sparse application and discussion of zero trust models in remote work environments, despite their endorsement and successful implementation by major technology corporations and the U.S government (Cunningham, 2020). The thesis argues that the unique challenges posed by remote work – including increased attack surfaces, reliance on cloud services, and the blurring of personal and professional digital environments – can be effectively addressed through the principles of zero trust (Deshpande, 2021).

This research builds upon a comprehensive literature review that examines the evolution of cyber threats in the context of remote work, highlighting the limitations of conventional security strategies. It then introduces the concept of zero trust, a security model that operates on the principle of "never trust, always verify." Unlike traditional models that focus on defending a defined perimeter, zero trust assumes that threats can exist both outside and within the network, thus necessitating continuous verification of all users and devices (He, Y. et al., 2022).

Integral to this approach is the concept of zero trust secure access service edge technologies, which are pivotal in enabling geographic independence for remote workers. These technologies facilitate secure access to organizational resources from any location, thus reinforcing the principle of "never trust, always verify" regardless of geographic boundaries. By decentralizing security enforcement and focusing on securing each access request, regardless of the user's location, these technologies ensure robust security in a geographically dispersed workforce (Deshpande, 2021). This aspect of zero trust architecture not only enhances security but also supports the operational agility and flexibility that is fundamental to modern remote work environments.

The thesis outlines the methodology for investigating the effectiveness of zero trust in mitigating cyber threats in remote work contexts. It employs a mixed-method approach, combining qualitative analyses – including expert interviews and document analysis of reports from leading companies and market researchers – with quantitative data obtained through surveys. This approach allows for an in-depth exploration of the current state of cyber threat mitigation strategies and the potential role of zero trust models.

Preliminary findings suggest that zero trust frameworks, particularly when enhanced with secure access service edge technologies, can significantly enhance an organization's security

posture in a remote work environment. By eliminating the concept of a trusted internal network and enforcing strict access controls and continuous monitoring, zero trust can effectively mitigate risks such as data breaches, phishing attacks, and other cybersecurity threats exacerbated by remote work dynamics. The challenges of implementation, which encompass the necessity for cultural shifts within organizations and the technical requirements for establishing a zero-trust architecture, are also discussed.

This research is positioned to make a substantial contribution to the field of cybersecurity, particularly in the context of the evolving work environment. By identifying best practices and upcoming trends in mitigating cyber threats, its goal is to provide practical, actionable strategies for organizations navigating the complexities of remote work. The thesis emphasizes the urgency of adopting more advanced and robust security measures, like zero trust, to protect against the increasingly sophisticated landscape of cyber threats.

Acknowledgements

Special thanks to Michael Thiessmeier, Executive Director U.S. National AI and Cybersecurity ISAO for his invaluable guidance and expertise in shaping the research for this thesis.

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

References

1. Crossland, G., & Ertan, A. (2021) *Remote working and (in)security*. Belfer Center for Science and International Affairs.
2. Cunningham, C. (2020) *A look back at zero trust: never trust, always verify*. Forrester Research.
3. Deshpande, A. (2021) 'Relevance of Zero Trust Network Architecture amidst and its rapid adoption amidst work from home enforced by COVID-19', *Psychology and Education Journal*, 58, 5672–5677. doi: 10.17762/pae.v58i1.2190.
4. He, Y., Huang, D., Ni, Y., Ma, X. (2022) A survey on zero trust architecture: challenges and future trends. *Wireless Communications and Mobile Computing*. Hindawi, 2022, p. 6476274. doi: 10.1155/2022/6476274.
5. Kindervag, J. (2010) *Build security into your network's DNA: The Zero Trust Network Architecture*. Forrester Research.



Session 2

Transport and Logistics

Transports un logistika

*RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 34
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia*

CONTEMPORARY LOGISTICS SERVICES PROCUREMENT PROCESS: INDUSTRY DATA BASED MODEL

Aleksandrs Kotlars¹, Valerijs Skribans²

*^{1,2}Riga Technical University
Kalnciema 6, Riga, LV-1048, Latvia
¹Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
aleksandrs.kotlars@gmail.com*

Keywords: Logistics service providers, decision-making, neural networks, model

Nowadays the approach of outsourcing logistics operations to third parties is becoming widely used among businesses that find it more efficient to concentrate on and allocate own resources to core business activities. Taking this into consideration, the need for effective collaboration and partnership strategy is becoming vital for many businesses and logistics service providers. In scope of this study, industry data was collected from road freight service tender documents issued by various production companies in Europe between 2019 and 2023. There were in total 277 tender projects studied issued by 184 companies. While analyzing tender documents, particular statements were extracted that describe following elements: the goal of a tender, logistics service provider selection criteria, requirements towards logistics service providers, key performance indicators, and green logistics-solution-related statements.

Collected data is organized in hierarchical structure in the table. The aim of the study is to use dataset to train neural network to predict most suitable logistics service providers evaluation criteria and key performance indicators based on company's industry, goals, green initiatives, and requirements towards logistics service providers. Because relationships between goals, requirements, criteria, and other elements are complex and interconnected, a graph structure is beneficial, therefore graph neural network (GNN) structure to be designed. Suggested architecture involves a combination of traditional dense layers for tabular data and GNN layers for capturing relationships. Designed network could be useful for businesses to adopt it to their decision-making process and models for selection of logistics service providers.

Acknowledgements

This research was funded by the Latvian Science Council's fundamental and applied research programme, project "Development of Model for Implementation of Sustainable and Environmentally Friendly Last Mile Distribution Transportation Services in Latvia" (TRANS4ECO), project No. lzp-2022/1-0306, 01.01.2023.- 31.12.2025.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 35-36
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

ARTIFICIAL INTELLIGENCE IN SUPPLY CHAIN MANAGEMENT IN INDIA

Ahmed Shaheen Alangadan

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
ahmedshaheen112@gmail.com*

Keywords: Artificial intelligence, supply chain management, technology, machine learning, algorithms

The primary object is "Artificial Intelligence in Supply Chain Management." This means investigating how India uses AI in supply chain management. The geographical viewpoint, which is India, is vital since infrastructure, rules, and business practices vary among nations when using AI in supply chain management. The research may examine AI adoption in Indian supply chain businesses and its use cases and obstacles. Total supply chain business process is emphasised. This includes raw material procurement, manufacture, distribution, and client delivery.

The goal of this study is to identify the application of artificial intelligence in Supply chain management.

The application of artificial intelligence (AI) to the management of supply chains has emerged as a paradigm shift, promising unparalleled levels of efficiency, precision, and adaptability. This study investigates the particular circumstances of India with the objectives of determining the effect that AI has had on supply chain management and recommending individualized approaches to its enhancement. According to Paul, Riaz and Das the implementation of AI technology has brought about a significant change to the organizational landscape of supply chain management on a worldwide scale. There is the potential for enormous gains in India, which is a country that has a supply chain network that is both diversified and complicated (Paul *et al.*, 2021). The purpose of this research is to explain the key areas where artificial intelligence can transform the procedures of supply chain management and improve overall efficiency.

Dora, Kumar, Mangla, Pant, and Kamal analyzed that the management of the supply chain could potentially benefit in a variety of ways from the application of AI. Utilizing historical data in conjunction with machine learning techniques (such as regression models and time series analysis) to make accurate forecasts of future demand, thereby lowering the risk of stock-outs and excess inventory, implementing optimization technologies such as genetic technologies or ant colony optimization for effective route design has the goal of reducing both transportation costs and delivery times as much as possible (Dora *et al.*, 2022). In addition, Sharma, Shishodia, Gunasekaran and Min identified that, the application of machine learning algorithms for real-time quality control has the goals of guaranteeing that goods satisfy the necessary standards and reducing the number of faults (Sharma *et al.*, 2022). In addition, Modgil, Singh, and Hannibaal identified that, the utilization of natural language processing to evaluate unstructured data and derive useful insights from that data enhances both communication and collaboration with suppliers (Modgil *et al.*, 2022).

Based on a review of secondary data from previously conducted research of Mugajee, Baral and Nagariya; it appears that the implementation of AI technologies results in a significant improvement in supply chain performance measures (Mukherjee *et al.*, 2023). According to Patel, Thakur and Gupta an increase in customer satisfaction that comes with cost savings and shorter lead times is one of the most obvious outcomes. For example, when compared to more conventional techniques of forecasting, the predictive analytics model revealed a 15 percent boost

in accuracy (Thakur *et al.*, 2023). This report highlights the necessity for a planned and adaptable approach as artificial intelligence continues to infiltrate supply chain management in India. The findings highlight the potentially revolutionary role that AI may play across a variety of supply chain components. Shah, Gardas and Narwane identified that not only can the optimization algorithms streamline processes, but they also contribute to attempts to be more sustainable by reducing the amount of resources that are used. Improved communication, transparency, and teamwork are all outcomes of incorporating NLP into the process of managing relationships with suppliers (Shah *et al.*, 2023). This research contributes to the expanding discourse on AI in supply chain management, presenting insights and practical consequences for stakeholders in India's dynamic business climate. In conclusion, this research makes a contribution to the evolving discourse on AI in supply chain management.

The research is supervised by Dr.sc.ing., Associate Professor Genadijs Gromovs.

References

1. Dora, M., Kumar, A., Mangla S.K., Pant, A. (2022) Critical success factors influencing artificial intelligence adoption in food supply chains. *International Journal of Production Research*, 60(14), 4621- 4640.
2. Modgil, S., Singh, R. K. & Hannibal, C. (2022) Artificial intelligence for supply chain resilience: learning from Covid-19. *The International Journal of Logistics Management*, 33(4), 1246-1268.
3. Mukherjee, S., Baral M.M., Nagariya, R., Chittipaka, V. (2023) Artificial intelligence-based supply chain resilience for improving firm performance in emerging markets. *Journal of Global Operations and Strategic Sourcing*.
4. Paul, S. K., Riaz, S. & Das, S. (2021) Adoption of Artificial Intelligence in Supply Chain Risk Management: An Indian Perspective. *Journal of Global Information Management (JGIM)*, 30(8).
5. Shah, H. M., Gardas, B. B., Narwane, V. S. & Mehta, H. S. (2023) The contemporary state of big data analytics and artificial intelligence towards intelligent supply chain risk management: a comprehensive review. *Kybernetes*, 52(5).
6. Sharma, R. Shishodia, A., Gunasekaran, A., Min, H., Munim, Z.H. (2022) The role of artificial intelligence in supply chain management: mapping the territory. *International Journal of Production Research*, 60(24), 7527- 7534.
7. Thakur, M., Patel, P., Gupta L.K., Kumar, M., SathishKumar, A.S. (2023) Applications of Artificial Intelligence and Machine Learning in Supply Chain Management: A Comprehensive Review. *Eur. Chem. Bull*, Volume 8.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 37
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

ASPECTS OF SUSTAINABLE TRANSPORTATION IN MILITARY LOGISTICS

Inga Lencēviča

*Transport and Telecommunication institute
Lomonosova 1, Riga, LV-1019, Latvia
karmaprija@gmail.com*

Keywords: Sustainable development, military logistics, aspects of sustainable transport, qualitative analysis

An army develops in peacetime, and incorporating the principles of sustainable development into military operations is essential to support civil society's sustainability efforts. The concept of sustainable development, as we understand it today, was defined in 1987 by the Brundtland Commission (World Commission on Environment and Development) as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Military actions are often seen as actions that jeopardise sustainable lifestyles. In peacetime, military activities include preparing for the state's defence, providing humanitarian assistance, and participating in peacekeeping missions.

The research seeks to analyse only one aspect of military activities from the perspective of sustainable development - transport related to the movement of materiel and personnel. The aim is to identify the aspects of sustainable transport in military logistics and determine the degree of awareness of sustainable development in military transport activities.

The research methodology consists of a literature survey on the topic, and data collection will be organised by interviewing military transport and transportation experts within NATO (The North Atlantic Treaty Organization) to gain a deeper understanding of sustainability in military transport. The combination of data collection methods ensures a robust and comprehensive research process. The research will present conclusions and recommendations based on the primary data analysis collected through web surveys and face-to-face interviews.

The research is supervised by Dr.sc.ing., Associate Professor Evelina Budiloviča.

References

1. Baum, R. (2021) Sustainable development – a modern understanding of the concept. *Annals of the Polish association of agricultural and agribusiness economists*, XXIII (2), 9–29. doi: <https://doi.org/10.5604/01.3001.0015.0026>.
2. Díaz-López, C., Martín-Blanco, C., De la Torre Bayo, J.J., Rubio-Rivera, B. and Zamorano, M. (2021) Analyzing the scientific evolution of the sustainable development goals. *Applied sciences*, [online] 11(18), 8286. doi: <https://doi.org/10.3390/app11188286>.
3. Irwin, J.F. (2022) The emergency service: evaluating the role of militaries in humanitarian operations, disaster relief, and other nonconflict crises. *Journal of advanced military studies*, 13(1), 5-13.
4. Martins, V.W.B., Anholon, R. and Quelhas, O.L.G. (2018) Sustainable transportation methods. encyclopedia of sustainability in higher education, 1–7. doi: https://doi.org/10.1007/978-3-319-63951-2_192-1.
5. Smaliukiene, R. (2018) Sustainability issues in the military: genesis and prospects. *Journal of security and sustainability issues*, 8(1), 19-32. [https://doi.org/10.9770/jssi.2018.8.1\(2\)](https://doi.org/10.9770/jssi.2018.8.1(2)).

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 38-39
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

IMPACT OF DATA PROCESSING AND INTERPRETATION OF SMART CONTAINERS ON ENHANCING SUPPLY CHAIN EFFICIENCY

Jelena Kudrjavceva

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

Keywords: Smart containers, data processing and interpretation, technologies

Smart containers refer to shipping containers used in freight and logistics that combine advanced technologies such as Internet of Things (IoT) systems, sensors, GPS tracking, and solar panels (The United Nations Centre for Trade Facilitation and Electronic Business, 2019). Any container can become a smart container. It has been described (The International Market Analysis Research and Consulting Group, 2022) that the global smart container market is categorized based on technology into GPS (Global Positioning System), Cellular, LoRa Wan (Long Range Wide Area networks), BLE (Bluetooth Low Energy), and others. These elements facilitate real-time monitoring of cargo conditions, including temperature, humidity, location, and security. By continuously collecting and transmitting data, smart containers enhance supply chain visibility, allowing stakeholders to closely monitor the status of goods during transit according to Becha (2020). Smart containers revolutionize the traditional shipping model by transforming containers into data-rich assets, introducing an era of heightened transparency, reliability, and operational effectiveness within the global supply chain network.

The smart container solution relies on distinct technical components (The United Nations Centre for Trade Facilitation and Electronic Business, 2019): 1) an active smart device affixed to or integrated within the container, 2) a platform responsible for gathering, processing, and distributing the data to various stakeholders, and 3) diverse communication protocols, encompassing wireless technologies facilitating multi-hop communication and interaction between devices.

As of the close of 2022, smart technology devices were integrated into approximately 5.6% of containers (The Container Management magazine, 2023). The report (Drewry Shipping Consultants Limited, 2023) predicts that the global count of smart containers will exceed 10 million units in the coming five years, making up approximately 30% of the total worldwide container inventories.

Smart Container data processing and interpretation methodologies encompass the collection, analysis, and utilization of data derived from sensor-equipped containers (The United Nations Centre for Trade Facilitation and Electronic Business, 2019). These methodologies begin with the continuous collection of various metrics through embedded sensors. Then, advanced algorithms and analytics tools process this data in real time, converting raw information into actionable insights. Interpretation techniques involve decoding patterns, identifying anomalies, and extracting valuable intelligence from the accumulated data sets. Visualization tools further aid in presenting comprehensive and easily readable information. This approach takes advantage of machine learning, artificial intelligence, and robust communication protocols.

Traxens, is a leading player in smart container technology (Traxens, 2023). Their approach integrates a compact device, outfitted with an array of sensors, seamlessly within containers. Traxens uses state-of-the-art platforms for real-time data collection, processing, and analysis, enabling a continuous flow of information to stakeholders. Advanced algorithms are implemented

to interpret and extract actionable insights from this data, facilitating predictive maintenance, route optimization, and enhanced cargo monitoring.

The current manual tracking system for containers often leads to outdated information being shared with customers and port operators. Hence, this can lead to disruptive bottlenecks in the supply chain. Many of the issues can be mitigated by timely input of data into digital shipment records (Fast Company, 2021).

The research explores data processing and interpretation techniques within smart container technology, aiming to identify their impact on supply chain efficiency (Global Infrastructure Hub, 2020). The study focuses on exploring the methodologies used by Traxens, and its collaboration with client companies to analyze and optimize supply chain operations.

The findings aim to provide insights into the potential efficiency gains and challenges faced, contributing to a deeper understanding of how smart containers can positively impact supply chain efficiency in a rapidly evolving global marketplace.

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

References

1. Becha, H., Frazier, T., Lind, M., Schroder, M., Voorspuij, J. (2020) Smart containers and situational awareness, *The Maritime Executive*
2. Drewry Shipping Consultants Limited. (2023) Container Census & Leasing Annual Report 2023/24, available at: <https://www.drewry.co.uk/maritime-research-products/maritime-research-products/container-census--leasing-annual-report-202324> [accessed: 20 October 2023]
3. Drewry: Smart container fleet to expand six- fold over the next five years (2023) *The Container Management Magazine*, available at: <https://container-mag.com/2023/07/13/drewry- smart-container-fleet-to-expand-six-fold-over-the-next-five-years/> [accessed: 20 October 2023]
4. Fast Company. (2021) Sensor ships: Why smart containers are the future of shipping, available at: <https://www.fastcompany.com/90690277/sensor-ships-why-smart-containers-are-the-future-of-shipping> [accessed: 28 September 2023]
5. Global Infrastructure Hub (2020) Smart containers, available at: <https://cdn.github.org/umbraco/media/3174/2-smart-containers-use-case.pdf> [accessed: 1 October 2023]
6. The International Market Analysis Research and Consulting Group. (2022) Smart Container Market Report, available at: <https://www.imarcgroup.com/smart-container-market> [accessed: 15 October 2023]
7. The United Nations Centre for Trade Facilitation and Electronic Business (2019) Business Requirements Specification, available at: https://unece.org/fileadmin/DAM/cefact/brs/BRS- SmartContainer_v1.0.pdf [accessed: 10 September 2023]
8. The United Nations Centre for Trade Facilitation and Electronic Business (2019) White Paper on Smart Containers, available at: https://unece.org/sites/default/files/2023-10/WhitePaper_ECE_TRADE_446E_SmartContainers.pdf [accessed: 10 September 2023]
9. Traxens. (2023) Traxens container tracker, available at: <https://www.traxens.com/products/permanent-container-tracker> [accessed: 15 October 2023]



Session 3

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

**Tirgus: pētījumi, projekti,
tehnoloģijas un mūsdienu
ekonomikas un biznesa
problēmas**

*RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 42-43
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia*

DEVELOPMENT OF BUSINESS MODEL FOR LOW-COST CARRIER UTILIZING REGIONAL CARGO AIRCRAFT

Toms Sakalausks

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1015, Latvia
toms.sakalausks@gmail.com*

Keywords: Aviation, cargo transportation, low-cost carrier, freighters, network, aviation economics

The chosen topic is the low-cost carrier model as applied to regional cargo aircraft operation. As of today such a cargo airline does not exist. Some passenger airlines have proved profitability and advantages of LCC (low-cost carrier) model which has changed the air transportation market over last two decades. Current problem in regional cargo transportation is very high operating costs. The main reason why the transportation is expensive is low aircraft utilization, as per research results, on average regional cargo aircraft are flying around 50 hours a month. In comparison LCC on passenger market utilize their aircraft few hundred hours a month.

First method applied for research is interviews of industry professionals. It allows to understand the background of current regional air cargo transportation and give a glimpse into future challenges. From interviews main findings are that there is no LCC cargo carrier in Europe and there is great potential for such business model. Second and the most voluminous method was to examine the current financial and operational data from cargo airlines and freight forwarders, as the most popular aircraft type is ATR72 (65 freighters of such type being used in Europe's cargo network) and there are few operators with different business models and specifications.

The research aim was to analyze current regional air cargo transportation market and to understand what can be changed to reduce transportation costs, which would allow the airlines and logistic companies to reduce transportation and service price. Object of the research is the low-cost carrier model by utilizing regional cargo aircraft. It refers to the specific concept or model being investigated and analyzed in the research study.

Subject of the research is regional cargo aircraft themselves, which are being utilized in the low-cost carrier model. The subject encompasses the characteristics, capabilities, operations, and potential benefits of these aircraft within the context of the low-cost carrier model.

All findings obtained in the research in line with its aim and tasks are processed based on the selected methodologies. The said approach seeks a constructive feedback and potential collaborations from all the participants. Further consideration in ensuring cost reduction could be given by market entry of hydrogen or electric powered aircraft. That development could significantly change the whole industry, this could be a potential and new research topic, as the technologies continue to improve day by day.

Major findings and conclusions for the topic include the development of business model for low-cost carrier utilizing regional cargo aircraft, considering financial and operational data. Main findings are the following:

- Weak airfreight network;
- Increasing demand in e-commerce transportation;
- Very low aircraft utilization;
- High transportation cost;
- By applying LCC model to cargo airline, cost per available cargo kilometer can be decreased by three to five times than current price.

As per interviews with industry experts, LCC cargo airline model with regional aircraft has a great potential in growing cargo transportation market.

The research is supervised by Ph.D. Aleksandrs Pļjats.

References

1. Alderighi, M., Nicolini, M., Piga, C.A. (2015) *Combined Effects of Capacity and Time on Fares: Insights from The Yield Management of a Low-Cost Airline*, The MIT Press
2. Forgas, S., Moliner, M., A., Sánchez, J., Palau, R. (2010) Antecedents of airline passenger loyalty: low-cost versus traditional airlines. *Journal of Air Transport Management*.
3. Jones, L. (2007) *EasyJet, the story of Britains biggest low-cost airline*. Great Britain: Aurum Pr Ltd., 2nd edition.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 44-45
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

IMPROVEMENT OF FATIGUE MANAGEMENT METHODOLOGIES RELATED TO FLIGHT CREW

Sofija Alomara

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

Keywords: Fatigue, flight crew, safety

Nowadays the aviation industry is an integral part of globalization. Nevertheless, due to the nature and high responsibility of work, it brings multiple challenges like fierce competition, rapid technological changes, endless operations, keeping up with global demand, climate change, regulatory hurdles, heavy flight schedules, and other things. These tasks and the required amount of work and responsibility lead to flight crew fatigue. All these operations require highly skilled professionals to keep everything intact.

Fatigue is diffusive and critical in aviation, with potential implications for the safety of both passengers and crew members. Disturbed sleep patterns, duty hours, flying through time zones, the demand for high levels of concentration and alertness, and the potential consequences of fatigue, like compromised decision-making, decreased concentration and impaired cognitive function represent a serious concern for flight safety.

This research focuses on a comprehensive exploration of the versatile facts and issues of flight crew fatigue, seeking not only to understand its reasons and consequences but also to find better ways to deal with them and shed light on the existing flight crew fatigue management system and enhance it. The aviation industry's commitment to passenger safety and operational efficiency demands a rigorous approach to mitigate the ever-present specter of fatigue.

The aim of the research:

This research aims to develop fatigue management methodologies and recommendations for airlines.

The main research tasks are:

- Analysis of the relevant literature affiliated with flight crew fatigue and fatigue risk management.
- Interviewing with industry experts and performing of survey among affected parties
- Analysis of the results of the survey and interview feedback
- Develop a procedure for reducing fatigue.

Research subject:

The subject of this research is the flight crew fatigue and fatigue management.

Research object:

The object of this research is aircraft flight crews (flight deck crew only).

Anticipated result:

The anticipated result is to improve risk management methodologies related to flight crew fatigue, make suggestions, and provide useful recommendations for airlines to increase the safety of flight operations and the general welfare of flight crew members.

The research questions are:

- How does flight crew fatigue impact aviation safety, and what are the key contributing factors to fatigue-related incidents and accidents?
- What are the current methods and practices employed by airlines and aviation organizations to manage and mitigate flight crew fatigue?

- What are the regulatory frameworks and guidelines regulating flight crew duty and rest requirements, and how effectively do they address the issue of fatigue risk management?

Research methodology:

The research approach for this thesis is a combination of both qualitative and quantitative research methods. This approach was chosen to provide a comprehensive understanding of flight crew fatigue and its implications on pilots. This dual approach gives the chance to explore more deeply the effectiveness of existing risk management methods.

The research methodology used in this research includes:

- Literature review- done by gathering existing scientific data.
- Graphic methods- Illustrations, diagrams, charts, and graphs allow for a better and easier perception of the provided data.
- Statistical data analysis to process surveys and Interviews with stakeholders.
- Analysis of the acquired quantitative data using “SPSS Statistics”

The research is supervised by Dr.oec., Professor Inna Stecenko.

References

1. Caldwell, J. (2012) Crew Schedules, Sleep Deprivation, and Aviation Performance. *Current Directions in Psychological Science - CURR DIRECTIONS PSYCHOL SCI*, 21. 85-89. 10.1177/0963721411435842.
2. Dawson, D., and McCulloch, K. (2005) Managing fatigue: it's about sleep. *Sleep Med. Rev.*, 9, 365–380. doi: 10.1016/j.smrv.2005.03.002.
3. Demerouti, E., Veldhuis, W., Coombes, C., & Hunter, R. (2019) Burnout among pilots: psychosocial factors related to happiness and performance at simulator training. *Ergonomics*, 62(2), 233-245.
4. IATA, ICAO, IFALPA. (2015) *Fatigue management guide for airline operators*. 2nd. Edition.
5. National Transportation Safety Board. (2010) Accident Report NTSB/AAR-10/01. PB2010-910401.

*RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 46-47
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia*

THE INTEGRATION OF ARTIFICIAL INTELLIGENCE IN MANAGEMENT OF AIRLINE OPERATIONS CONTROL CENTER(OCC) PROCESSES

Christy Oommen Jacob

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

Keywords: Resource optimization, operational performance, airline, artificial intelligence

This research explores the impact of integrating Artificial Intelligence (AI) in the management of Airline Operations Control Center (OCC) processes. As the aviation industry is currently undergoing rapid advancements, leveraging the available AI technologies becomes a paramount factor for enhancing operational efficiency, reducing costs, and ensuring passenger safety. This study investigates the specific applications of AI within the core OCC environment, focusing on its role in decision-making, predictive analysis, and resource optimization inside the day-to-day operations control centre (OCC) activities.

The Main research question is:

Will the integration of Artificial Intelligence impact the management of operational efficiency and overall performance of SmartLynx, and what are the key factors influencing the successful implementation and adaptation of AI technologies in the airline's operational processes?

The research tasks are:

- To conduct a theoretical review of the current situation on Artificial Intelligence in the aviation industry.
- To study specific particularities of SmartLynx airlines and its integration of the AI industry.
- To identify key elements of the integration of AI in Smartlynx and compare it with current advanced AI-supported systems.
- Identification of the key factors influencing the successful implementation and adaptation of AI technologies in the airline's operational processes.

The research subject is utilizing AI technologies in the management of Airline Operations Control Center (OCC) processes. The research object is SmartLynx Airline Operations Control Center.

The research has begun with a comprehensive overview literature study of the traditional OCC processes and also identifying the challenges faced by airlines in the current dynamic aviation operations. Further studies into the different ways of utilizing AI technologies, such as machine learning algorithms and data analytics that can revolutionize these traditional processes is looked into. Real-world case studies and examples have highlighted that it will be successful in implementation of AI in OCCs. The results are showcasing tangible improvements in decisions on route planning, predicting fuel efficiency, resource optimization maintenance scheduling and Airport Slot Coordination.

The research also discusses the ethical considerations and potential hurdles that might possibly be associated with AI integration. This has emphasized the need for responsible implementation and continuous monitoring. Moreover, the study explored the impact of AI on the current operations roles and how advanced skills are required within OCC teams, emphasizing the importance of workforce adaptation and training. The findings of the survey and interviews

have underscored the significant benefits of incorporating AI in airline OCC processes, ultimately leading to enhanced operational performance, reduced environmental impact, and improved overall customer satisfaction. This research aims to contribute valuable insights to both academic and industry professionals, fostering a deeper understanding of the opportunities and challenges associated with the integration of AI in the aviation sector.

The research is supervised by Dr.sc.ing., Associate Professor Iyad Alomar.

References

1. Abubakar, M., EriOluwa, O., Teyei, M. and Al-Turjman, F. (2022) AI application in the aviation sector. In: *2022 International Conference on Artificial Intelligence of Things and Crowdsensing (AIoTCs)*, 52-55. IEEE.
2. *Artificial Intelligence in Aviation Market Report 2022-2030: (2023)* As on date 13 Oct 2023. <https://www.precedenceresearch.com/artificial-intelligence-in-aviation-market>.
3. Emanuilov, I. and Dheu, O. (2021) Flying high for AI? Perspectives on EASA's Roadmap for AI in aviation. *Air and Space Law*, 46(1).
4. Pérez-Campuzano, D., Morcillo Ortega, P., Rubio Andrada, L. and López-Lázaro, A. (2019) Artificial intelligence potential within organizations: airline strategy. In: *XX AECA International Congress*, Retrieved from <https://xxcongreso.aeca.es/wp-content/uploads/2019/09/36g.pdf>

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 48
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

IMPORTANCE OF CUSTOMER COMMUNICATION IN E-COMMERCE: IMPROVING CUSTOMER SATISFACTION

Taley Muhammad

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

Keywords: E-commerce, customer, digital communication, digital marketing, Chatbot technology

Effective customer communication is essential for e-commerce businesses to succeed in the competitive digital landscape and the rise of e-commerce has transformed the way businesses operate, and consumers are engaged in commercial transactions. The e-commerce market has been significantly shaped by customer communication channels, which have been made possible by advances in information and communication technologies (ICTs). Through the setting up of customer communication channels, businesses can enhance their customer service, increase sales, build more effective marketing strategies, and better understand their customers' needs. In e-commerce, real-time communication is also crucial because it enables companies to meet the ever-increasing demands of their audience while retaining customer engagement. The spread of mobile phones and improvements in information and communication technologies contributed to this growth. Nowadays, digital communication is an integral part of businesses aimed at connecting with customers. Chatbot technology allows for the personalization of customer interactions and can be leveraged to increase the speed, quality, and efficiency of customer service. Through digital marketing, products and services are promoted with the help of various digital technologies (Grewal *et al.*, 2022).

Today's businesses have access to a wide range of customer communication channels, such as social media, email, Chatbots, messages, websites, and more. An e-commerce company's ability to communicate with customers through multiple channels is essential to its success. The main *aim of this research* is to assess the importance of customer communication in e-commerce growth. The study specifically addresses the following *research question*: "How can e-commerce businesses effectively communicate with customers to improve trust, issue resolution, and overall user satisfaction, build brand loyalty and visibility?"

The *object* of the study is e-commerce, and the *subject* of the study is digital tools employed for customer communication. The research *methodology* includes a combination of qualitative and quantitative methodologies (a survey and expert interviews) used to collect data and process the results through data analysis tools.

This study intends to contribute to the field by giving new insights into the impact of digital communication on e-commerce growth, which would be beneficial for policymakers, researchers, and industry practitioners.

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

References

1. Grewal, D., Herhausen, D., Ludwig, S., Villarroel Ordenes, F. (2022) The future of digital communication research: considering dynamics and multimodality. *Journal of Retailing*, 98, 224–240.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 49-50
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

TRAINING AND DEVELOPMENT FOR ENHANCING EMPLOYEE PERFORMANCE IN THE HOTEL INDUSTRY

Sandeep Verma

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
sandy.verma307@gmail.com*

Keywords: Hotel industry, training and development programme, employee performance

In the scope of human resource management, the concepts of training and development are often discussed with distinct yet complementary definitions. According to Somasundaram and Egan (2004), as cited in a study published in ERIC, training is defined as the process of teaching specific knowledge and skills that are pertinent to an individual's current job role. Conversely, development is described as a process aimed at the overall growth of the individual, preparing them for roles of higher responsibility. The study is driven by a number of considerations critical to the hotel industry's competitiveness and success.

With the help of this research the author primarily *aims* to assess the training and development practices in the context of Five Star Hotels, with the goal of improving employee performance and contributing to the sustainability of the industry. A study by Professor (Dr.) Pankaj Kumar Agarwal and Mr. Kartik Naidu (2021) states that human resource training and development is of paramount importance as guest pleasure and satisfaction is a primary goal of all jobs in Hotel Industry. Another study recognized by Chanin Yoopetch, Suthep Nimsai, Boonying Kongarchapatara (2021) explains the correlation between the growth of tourism industry and the demand for hotel and restaurant services, necessitating a sharp focus on employee efficiency and performance. Keeping the service-intensive nature of the hotel industry in consideration and to maintain its competitiveness in the face of rapid worldwide expansion and technological improvements, the hotel sector, a vital contributor to the global economy, requires an efficient training and development system for the human resources.

The *subject* of this research is Training and Development Procedures in the Hotel Industry and *object* is Hotel operating in the Five Star Hotel Market.

The research seeks to accomplish the following *objectives*:

- To identify best training and development practices used in the hotel industry to improve employee skills and competences.
- To categorize and describe the main steps in the training and development process, and the basic procedures involved in terms of improving employee performance.
- To identify the main issues that the hotel industry faces in delivering successful training and development programs.
- Based on the research findings to give recommendations for improving training and development initiatives in the hotel industry

The study is carried out using comprehensive *methods*, including theoretical literature and secondary source analysis to provide a foundational understanding of hotel training and development. In addition, case studies are used to establish best practices in the field. Expert interviews with the managers in the industry add to the research's richness by providing qualitative opinions on the challenges and barriers to successful training and development projects. Also, correlation analyses are performed using statistical methods, which improves the depth and accuracy of the research findings. This methodological blend ensures a thorough analysis of hotel training and development procedures and issues.

The research would be beneficial, because it could potentially advise 5-star hotels and the broader hospitality sector on the beneficial outcomes resulting from training and development programs for both individuals and organizations, including enhanced organizational performance, efficiency, and employee effectiveness characteristics.

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

References

1. Pankaj Kumar Agarwal, M. K. (2021) Impact of training on performance of employees: evidence from hotels of Haridwar, Uttarakhand, India. *The International Journal of Business and Management Research*, 10.
2. Somasundaram, U. and Egan, T. (2004) *Training and development: an examination of definitions and dependent variables*. [online] Available at: <https://files.eric.ed.gov/fulltext/ED492440.pdf>.
3. Yoopetch C, Nimsai S, Kongarchapatara B. (2021) The effects of employee learning, knowledge, benefits, and satisfaction on employee performance and career growth in the hospitality industry. *Sustainability*, 13(8), 4101, 2021. [online] Available at: <https://doi.org/10.3390/su13084101>.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 51-52
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

PROCESS OPTIMIZATION THROUGH LEAN MANAGEMENT IN AN AIRCRAFT MAINTENANCE ORGANIZATION

Nikita Lairand

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

Keywords: Lean practices, aircraft maintenance, process, safety

It is determined by the fact that for staying competitive on the global aircraft maintenance market, it is important to maximize efficiency of the company's operations, and optimize internal processes in order to get the maximum return for the least cost. Aircraft maintenance is a very costly business, and any opportunity to reduce expenses and enhance efficiency is appreciated. Through optimizing maintenance processes, it is possible not only to decrease costs, but to ensure the highest levels of safety and reliability. Implementing Lean thinking, principles and practices can help to organize maintenance procedures while ensuring the highest standards of safety and quality in the extremely complex and safety-critical Aviation Industry, where dependability, precision, and timely execution are vital. Lean Management provides proven strategies for organizing processes and boosting resource usage. By implementing Lean Management principles, aircraft maintenance organizations (MRO) could accomplish better productivity, lower costs, improved quality and safety, less downtime, and higher customer satisfaction (Stadnicka & Litwin, 2019; Ramori *et al.*, 2021). However, it requires a systematic approach, active employee involvement, and a culture of continuous improvement. The research presented in this paper focuses on exploring innovative Lean approaches to aircraft maintenance could contribute to improving maintenance operations and increasing safety, as well as enhancing the company's competitiveness in the turbulent business environment.

The *aim* of this research is to examine the best practices of Lean Management used today, and to identify those, which can be applied in the Aircraft Maintenance sector for boosting productivity, reducing costs and increasing operational effectiveness. The *object* of the research is aircraft maintenance processes. The *subject* of the research is Lean Management tools used for optimizing processes in the aircraft maintenance company. The main research *tasks* are the following:

- To study main concepts, principles and tools of Lean Management.
- To examine best practices related to applying Lean Management approach in the Aircraft Maintenance sector.
- To determine what error-proofing approaches are more productive and successful in the context of engine repair.
- To develop recommendations for MROs managers. The research *questions* are as follows:
 - How can Lean Management various tools be used for process optimization in an aircraft maintenance company?
 - How to make the engine repair process more productive and cost-efficient?
 - What error-proofing approaches are more productive and successful in the context of engine repair?

The research *methodology* used in this research includes the following methods:

- Theoretical literature and secondary sources review.
- Case studies of aircraft maintenance companies for examining best practices related to applying Lean Management approach.

- Customers survey.
- Expert interviews for obtaining expert opinions on the processes optimization through LeanManagement.

The anticipated results of this research would be the development of some recommendations on the ways for aircraft maintenance organizations to optimize their operational processes in order to get the maximum return for the least cost.

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

References

1. Ramori, K. A., Cudney, E. A., Elrod, C. C. & Antony, J. (2021) Lean business models in healthcare: a systematic review. *Total Quality Management & Business Excellence*, 32
2. Stadnicka, D. & Litwin, P. (2019) Value stream mapping and system dynamics integration for manufacturing line modeling and analysis. *International Journal of Production Economics*, 208.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 53-54
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

RISK AND THREAT MITIGATION FOR CIVIL AVIATION FLIGHTS OVER AND NEAR CONFLICT ZONES

Beksultan Zhailybayev

*Transport and Telecommunications Institute
Lomonosova 1, Riga, LV-1019, Latvia
beksultan10@gmail.com*

Keywords: Risk, threat, mitigation, conflict zone, civil aviation

The global political landscape is characterized by instability leading to conflicts rooted in economic, political, religious, ethnic and ideological differences. Such conflicts, characterized by the use of weapons and violence, have serious consequences, including loss of life, destruction of infrastructure, human rights violations, refugee crises and economic decline. A striking example is the armed conflict between Russia and Ukraine, which led to the closure of airspace to civil aircraft in many countries (Akbarli *et al.*, 2022). In addition to the economic consequences, the safety of civil aviation requires attention, since conflict zones pose significant risks to aviation safety. Historical cases of civilian aircraft being mistargeted or deliberately shot down highlight the vulnerability of these flights to armed attack, highlighting the ongoing threat (Kelly, 2021).

International Civil Aviation Organization (ICAO) recommendations stipulate that countries experiencing political instability and conflict should take responsibility for closing their airspace when aviation safety is at risk (ICAO, 2018). However, the failure of some Member States to comply with this obligation, driven by political, diplomatic and financial interests, has led to conflicting assessments of the threats to civil aviation (ECA, 2021). This study highlights the need for international aviation authorities, led by ICAO, to take action to reduce the risks arising from political conflicts, wars and armed conflicts affecting civil aviation.

This study aimed at developing strategies, formulating approaches and recommendations to reduce risks and threats to civil aviation over and near conflict zones, with particular attention to incidents involving the downing of civilian aircraft misidentified as hostile or intentionally shot down by surface-to-air missiles and military fighters, as exemplified by recent incidents downed civilian airliners. The object of the research is the safety of civil aviation flights over and near conflict zones. The research subject is a risk and threat mitigation strategies for civil airliners in the vicinity of conflict zones. This study answers the following questions: (1) Are existing civil aviation regulations sufficient to guarantee the safety of civil aviation aircraft in conflict environment? (2) What are strategies to reduce risks and threats to civil aviation operations in the air over and near conflict zones?

The research methods used in this study are based on qualitative methods:

- Literature review to review scientific papers, articles and studies related to the research topic regarding the theoretical foundations of threats to civil aviation, especially threats to flights resulting from armed conflicts;
- Case study – includes a case study of recent well-known incidents where civil aviation aircraft were shot down in the air over and near conflict zones;
- Expert Interview – interviews with experts to obtain their views on reducing the risks and threats to civil aviation operations in the air over and near conflict zones.

The results show how strategies are prominent for protecting civil aviation aircraft from being shot down over and in armed conflict environment. States, ANSPs and air carriers can use these results to reduce the risk and threat of aircraft being shot down and ensure the safety of civil aviation in areas affected by armed conflict.

Acknowledgements

This article and the research underlying it would not have been possible without the exceptional support of my supervisor, Professor Ph.D. Olga Zervina. Her enthusiasm, knowledge and keen attention to detail inspired me and supported my work from choosing the right topic to the final draft of the research paper. Special thanks to my colleagues in the aviation industry who participated as experts, shared their wealth of experience and knowledge and contributed to the invaluable results of this study.

The research is supervised by Ph.D., Assistant Professor Olga Zervina.

References

1. Akbarli, A. *et al.* (2022) The Impact of the Ukraine-Russia Conflict on the aviation sector: February-May 2022. *Journal of Aviation* [Preprint]. Available at: <https://doi.org/10.30518/jav.1125560>.
2. ECA. (2021) *Flights into and over conflict zones*, European Cockpit Association Position Paper.
3. ICAO. (2018) *Doc 10084 “Risk assessment manual for civil aircraft operations over or near conflict zones”*, Second Edition, ICAO, Quebec, Canada.
4. Kelly, L. (2021) *Threats to civilian aviation since 1975*. Institute of Development Studies (IDS). Available at: <https://doi.org/10.19088/K4D.2021.019>.

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No. 2, 55
Transport and Telecommunication Institute, Lomonosova 1, Riga, LV-1019, Latvia

RESILIENCE IN THE AIRLINE INDUSTRY: KEY FACTORS FOR A SUCCESSFUL AIRLINE BUSINESS IN CRISIS

Stefan Bonhardt

*Transport and Telecommunication Institute
Lomonosova 1, Riga, LV-1019, Latvia
st78026@students.tsi.lv, stefan.bonhardt@googlemail.com*

Keywords: Aviation, airlines, crisis, resilience, successful business

The airline industry operates in a dynamic environment characterised by uncertainty, geopolitical tensions, economic volatility and, more recently, global pandemics. In general, categorised as crisis.

The goal of the thesis is to analyse the key factors of an airline operation and management that contribute to resilience of the airlines in times of various crises. By analysing case studies, industry reports and expert interviews, the study aims to identify the strategic elements that enable airlines to not only survive but also thrive in adverse circumstances.

The object of the study is managerial decisions within the aviation industry. The subject of the study is the resilience of the airline industry. The research focuses on the analysis of how airlines strategically adapt to navigate, securely and successfully through crisis. The thesis will cover linked to that leadership strategies, technological innovations, risk management and also regulatory and governmental decisions possibly helping affected airline companies.

A comprehensive literature review is used to establish a theoretical framework for understanding organisational resilience, drawing on concepts from the management, strategy and crisis management literature.

The decision-making processes of airline executives in crisis situations is considered and the effective influence corporate culture, agility and the ability to capitalise on new opportunities are examined. Case studies of successful airline turnarounds and adaptation strategies shed light on the leadership styles that contribute to resilience in this dynamic business environment.

Finally, the study examines the regulatory environment and government interventions in times of crisis to determine how a supportive regulatory environment can increase airline resilience. By analysing the responses of different governments to past crises, it aims to identify best practices and policy recommendations for creating a favourable environment for the industry.

The research is supervised by Dr.oec., Associate Professor Jelena Popova.

References

1. Bridger, R., (2013) *Plane truth - aviation's real impact on people and the environment*. Plutopress, London, 30-31.
2. WCED. (1985) *Our common future*, August 1985, p.16.
<https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf>
[web page access date: 21.11.2023].

RESEARCH and TECHNOLOGY – STEP into the FUTURE

ISSN 1691-2853 & ISSN 1691-2861 (online)

EDITORIAL BOARD:

Prof. Igor Kabashkin (Editor-in-Chief), *Transport & Telecommunication Institute, Latvia*

Prof. Irina Yatskiv (Issue Editor), *Transport & Telecommunication Institute, Latvia*

Assoc. Prof. Darius Bazaras, *Vilnius Gediminas Technical University, Lithuania*

Dr. Zohar Laslo, *Sami Shamoon College of Engineering, Israel*

Dr. Enno Lend, *College of Engineering, Estonia*

Prof. Andrzej Niewczasz, *Lublin University of Technology, Poland*

Prof. Lauri Ojala, *Turku School of Economics, Finland*

Prof. Irina Kuzmina-Merlino, *Transport & Telecommunication Institute, Latvia*

Prof. Alexander Grakovski, *Transport & Telecommunication Institute, Latvia*

Editor:

Irina Alekseeva, *Transport & Telecommunication Institute*

Supporting Organization:

Latvian Transport Development and Education Association

Latvian Operations Research Society

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 and Latvian (at the option of authors).

This volume is published without publisher editing.

EDITORIAL CORRESPONDENCE

Transporta un sakaru institūts (Transport and Telecommunication Institute)

Lomonosova 1, LV-1019, Riga, Latvia. Phone: (+371)67100586

E-mail: rutkovska.j@tsi.lv, [http:// www.tsi.lv](http://www.tsi.lv)

RESEARCH and TECHNOLOGY – STEP into the FUTURE, 2023, Vol. 18, No 2
ISSN 1691-2853, ISSN 1691-2861 (online: www.tsi.lv)

The journal of Transport and Telecommunication Institute (Riga, Latvia)

The journal is being published since 2006

Copyright © Transport and Telecommunication Institute, 2023