CHARACTERISTICS OF THE LOGISTICS SYSTEM FOR THE NEEDS OF MINIMIZING SPECIFIC AIR TRANSPORT EVENTS

[1]Olga VEGSOOVA, [2]Peter KACMARY, [3]Peter GALLO, [1]Miroslav BETUS

[1]Technical University of Kosice, Institute of Earth Resources, Slovakia, EU, olga.vegsoova@tuke.sk, m.betus@centrum.sk

[2]Technical University of Kosice, Institute of Logistics and Transport, Slovakia, EU, peter.kacmary@tuke.sk

[3]University of Presov, Faculty of Management, Slovakia, EU, peter.gallo.1@unipo.sk

Abstract

The presented paper deals with the characterization of the logistics system created to introduce a comprehensive approach to safety management, namely the safety management system and its individual elements, which in cooperation lead to maintaining the desired level of air safety. Air transport is a very specific transport sector with high safety requirements. To maintain the necessary level of safety, it is essential to follow established and best practices. At the same time, it is also necessary to respond and to adapt to constant development of air transport. Logistic support is part of the activities of all IRS units, without which the consequences of an emergency event in the required time and quality could not be remedied. The topic discussed is related to the efficient set-up of logistics for the need for interoperability of the integrated rescue system when dealing with air traffic emergencies. The elimination of the consequences of an emergency by the rescue services results from the management of the rescue units. In the absence of logistical assurance, shortcomings in the event of the required speed and quality could not be removed. Therefore, it is necessary that all IRS components have the necessary comfort for the quality performance of their activities, which are usually performed in very demanding conditions of intervention. The logistic support of the basic and other components of the IRS should not be underestimated in emergencies and the entire area of logistical support should always be the centre of attention of all competent authorities.

Keywords: Logistics, air transport, security, Integrated Rescue System, emergency event

1. INTRODUCTION

Air transport is one of the youngest transport mode. Since its formation, it has undergone far more rapid development than other types of transport. Aircraft are still able to make greater and greater transport speed than other means of transport and carry larger number of passengers [1,2]. Air transport excels in the speed of the transport process in comparison to all other modes of transport [3]. However, the disadvantage is that the time of transport and thus the speed of the transport process also include a considerable time loss when moving from a city to airport and vice versa, as well as loss times at check-in and clearance at an airport [4].

Increasing aviation safety is influenced by the modern equipment of new aviation technology, the rapid technical development of ground facilities, the automation of air traffic control and the increasing professional level of flight personnel, that allow air traffic to become less and less dependent on weather [5,6]. However, aviation safety is still affected by the human factor, which appears to be the weakest element in air transport and its failure is still the cause of most accidents [7,8]. There are the risks associated with aviation in **Figure 1**. On the other hand, air transport is the safest transport in comparison to other modes of transport [9,10].

The environmental impact of aviation is currently one of the most serious problems. Worldwide, aviation uses only a fraction of the world's energy consumption. Aviation contributes minimally to global pollution and global warming [11]. New technologies used in the production of aircraft and especially power units lead to a reduction

of the overall noise in civil aviation operations. Also, the requirements for noise reduction in civil aviation are negligible compared to road and rail transport [12].

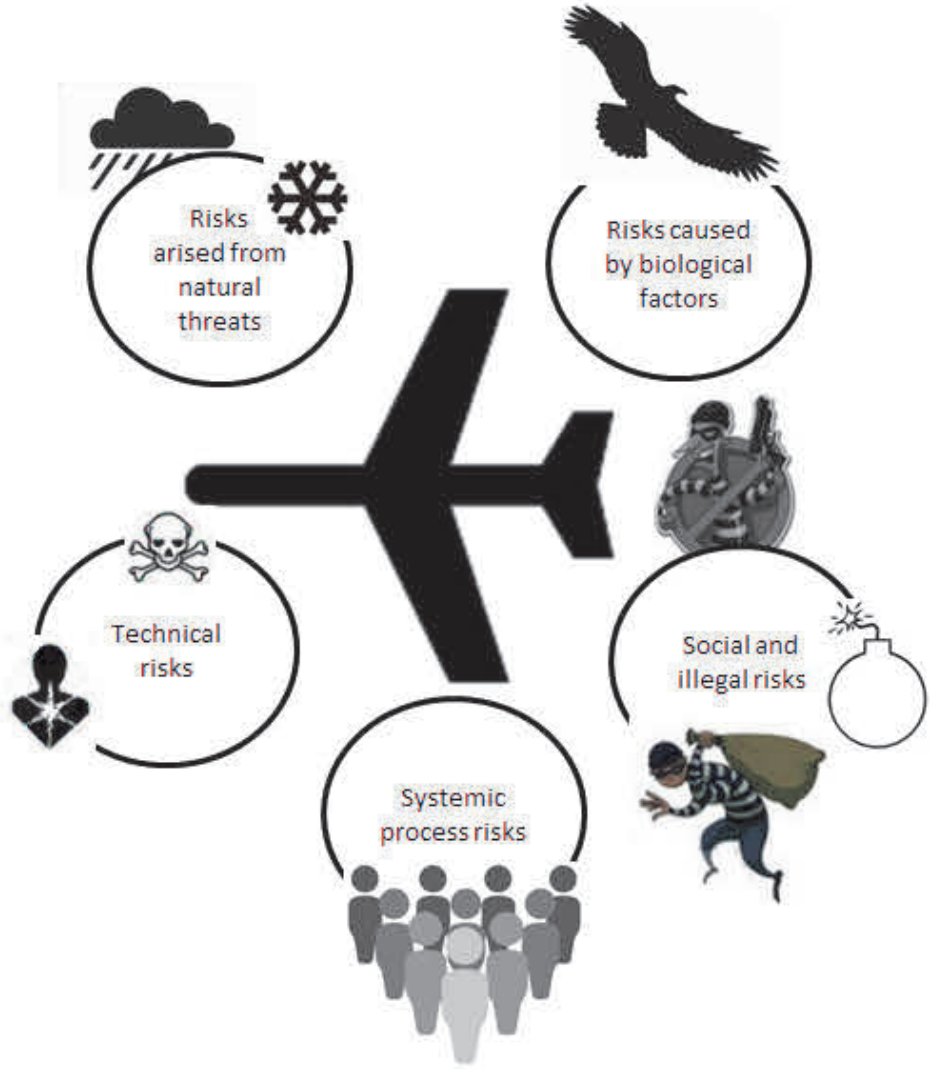

Figure 1 Risks concerning the air transport, author

2. AIRPORT SECURITY THREADS

An airport is an object that provides various services, while the primary service is the providing of transport between two traffic junctions. Nowadays, the air transport is considered to be the fastest mode of transport, and although the air transport can be said to be the safest, there are many accidents associated with it [13,14]. From the point of view of a possible accident within the air transport, the vulnerable areas are mainly airports and the vicinity areas of airports and so-called flight paths. Therefore, the interaction of airports and especially the units of the integrated rescue system (hereinafter abbreviated as IRS) is very important. It is important that the IRS units are able to cooperate together well and quickly at emergency rescue after air accidents [15,16].

IRS consists of individual rescue units, which, in case of danger to life, health, property or environment, ensure quick informativeness, effective use and coordination of forces and resources of individual rescue entities, which provide necessary assistance [17]. IRS represents a system of mutual relations and given rules of cooperation, which runs among state administration authorities, self-government, natural or legal persons as well as rescue services, which is presented in the diagram in **Figure 2**.

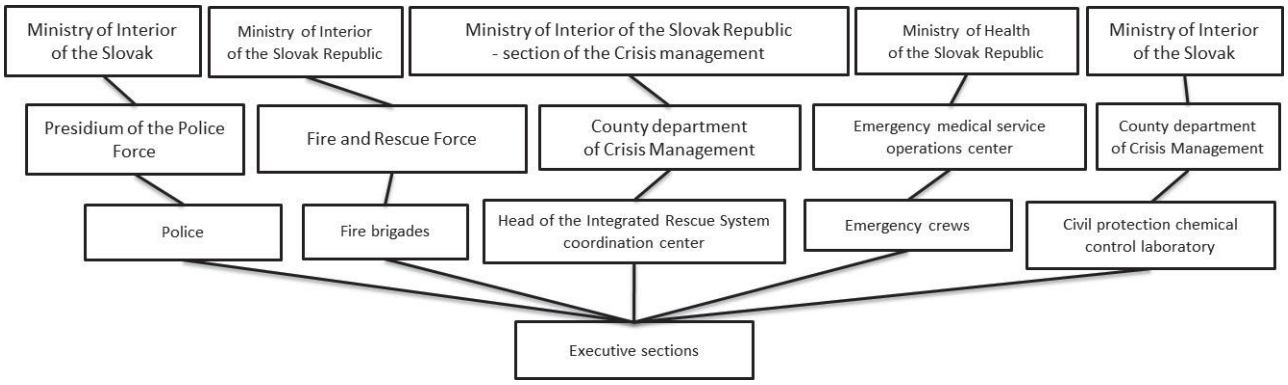

Figure 2 The structure of the integrated rescue system relations, author

Threat is, nowadays, a very often used term related to the ability to harm the interests and values that are protected by the state. The value of this threat is changing, and there is a certain amount of damage, which is determined by the amount of the potential damage and the distance [18].

Natural threats solution at the airport is one of the basic duties of an airport management, where the objective is to maintain the condition for a safe and clean surface of the movement areas of an airport. In case of stronger climatic phenomena in winter, a layer of snow and ice is occurred on the surface. Another adverse natural phenomenon associated with natural threads at the airport is the wind [19,20].

In terms of the greatest threat of biological factors to an airport area, birds or other animals need to be considered. Although the surroundings of an airport are monitored, it is not always completely successful in relation to the detection of a danger. The main problem is the movement of animals when an aircraft takes off [21].

Leakage of dangerous substances, objects, disruption of water or fuel supply, damage to technical equipment, communication network, poor management of safety equipment and many others can be also included to the technical threats group [22].

Human-related threats include a number of activities, such as: bombing, robbery, various kinds of spying, stealing important data, assaults, extortions, thefts, bluffs, inadequately qualified security personnel, leak of classified information and other activities related to the physical factor. Social threats are associated with human factors such as accidents, absence of employees, disturbances, migration waves, various conflicts and more [23,24].

Systemic process threats are also differed. These threats include poor workflow efficiency, such as management and planning defaults, poorly utilized new technologies, poorly managed human resources, many different departmental communication errors, and many others [25].

The operation of an airport is associated with threats, whether natural, technical or human. Today, there are more of these threats than in the past. Therefore, there is an increased effort to maximize security against these threats. Security and elimination these threats are constantly improved [26].

3. REMOVING THE CONSEQUENCES OF EMERGENCY EVENTS BY UNITS OF THE INTEGRATED AVIATION RESCUE SYSTEM

The management and coordination of IRS rescue services at the place of intervention in Slovak Republic is regulated by Act No. 129/2002 Coll. about an integrated rescue system. It states that the commander of the intervention of the Fire and Rescue Corps manages and coordinates the entire operation of the rescue services of the integrated rescue system at the place of the intervention [27,28].

In the case of an air accident or assistance in the event of an air accident or search for an aircraft, it shall be the authority responsible for searching for the aircraft and saving human lives. In general, rescue units are managed at three levels: tactical, operational and strategic [29].

Operations that are included in the operational management from the moment of an emergency has been reported are characterized by a logistics system to minimize air traffic accidents in the following diagram (**Figure 3**).

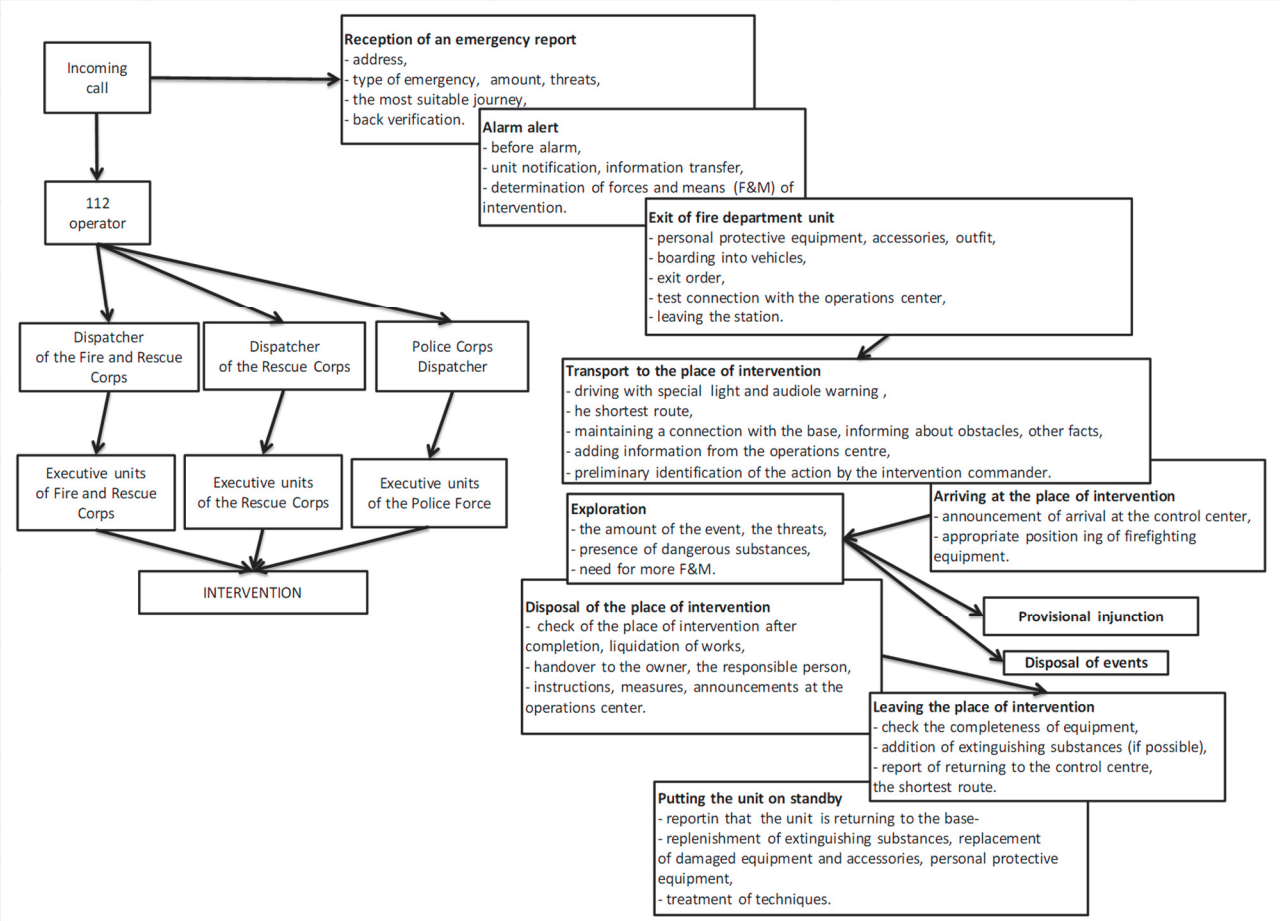

Figure 3 Logistics management at the level of the IRS Coordination Centre to minimize accidents in air transport, author / [30]

When dealing with an emergency event, we can expect:

- the need for a large number of forces and resources, at the beginning of the intervention lack of forces and resources of the IRS units,
- searching and rescuing of people on a large area,
- the need to coordinate the IRS units and other entities in the place of the accident,
- high organizational requirements for the management of the intervention of IRS units,
- poor accessibility of the accident site,
- presence of hazardous substances within the aircraft structure (e.g. fuel, pressure vessels, etc.),
- the need for initial psychological assistance to persons affected by an emergency,
- the need to coordinate the transmission of information to the families of victims or injured persons,
- the great media interest and undisciplined behaviour of survivors at the site of the incident,
- language barriers among people affected by an emergency and IRS units.

The procedure of IRS units in rescue and liquidation works includes the following activities:

- an aircraft searching,
- exploration of the place of an air accident,
- exploration of the impact trace; i.e. in places, where the parts of an aircraft are impacted,
- reduction of risk at the place of an emergency,
- searching and rescuing of persons from an aircraft wreck and other places where endangered persons can occur due to the accident,
- evacuation of persons from an emergency area or from the area where an emergency may spread,
- providing pre-hospital emergency care to injured people, sorting wounded and transporting to hospital,
- identification of the number of persons affected by an emergency and their identification,
- psychosocial assistance to affected persons by an emergency,
- the role of forensic medicine,
- warning the population of the effects of an accident related to an air accident,
- establishment of an information centre for the public,
- investigating the causes of an accident.

Each IRS unit performs tasks as a team. However, each team has a determined manager, who has also other duties because he is the first qualified specialist at the place of an air accident [31,32].

4. CONCLUSION

Air transport is a very specific transport sector with very high safety requirements. It is essential to follow well-established and standing procedures to maintain the necessary level of safety. At the same time, it is also necessary to respond and to adapt to constant development of air transport. This submitted paper deals with the system, which is created to introduce a comprehensive approach to safety management, namely the safety management system and its individual elements, which, in cooperation, lead to maintaining the desired level of aviation safety.

Logistic support is a part of the activities of all IRS units, without which the consequences of an emergency event in the required time and quality could not be remedied. The essential part of the activities of all units within the IRS is their logistic support. In the absence of logistical assurance, shortcomings in the event of the required speed and quality could not be removed. Therefore, it is necessary that all IRS units have the necessary comfort for the quality performance of their activities, which are usually performed in very demanding conditions of intervention. The logistical support of basic and other units of the IRS should not be underestimated in emergencies and the whole area of logistical support should always be the centre of attention of all competent authorities.

ACKNOWLEDGEMENTS

“The submitted work is a part of the project VEGA 1/0317/19, "Research and development of new smart solutions based on principles of the Industry 4.0, logistics, 3D modeling and simulation for production streamline in the mining and building industry.", funded by the Scientific Grant Agency of the Ministry of Education, science, research and sport of the Slovak Republic and the Slovak Academy of Sciences.”

REFERENCES

[1] RASUL, Azad. An Investigation into the Location of the Crashed Aircraft Through the Use of Free Satellite Images. *PFG - Journal of photogrammetry remote sensing and geoinformation science*. 2019. vol. 87, no. 3, pp.119 - 122. Available from: DOI: 10.1007/s41064-019-00074-z.

[2] ROSOVA, Andrea, BALOG, Michal, SIMEKOVA, Zofia. The use of the RFID in rail freight transport in the world as one of the new technologies of identification and communication. *Acta Montanistica Slovaca.* 2013. vol. 18, no. 1, pp. 26-32.

[3] ČECH, Jozef, ŠOFRANKO, Marian. Economic projection and evaluation of mining venture. *E & M Ekonomie a management.* 2018. vol. 21, no. 2, pp. 38- 52. Available from: DOI: 10.15240/tul/001/2018-2-003.

[4] KIBA-JANIAK, Maja, KOLAKOWSKI, Tomasz. Cooperation between japanese companies and local authorities in terms of life cycle of organization. *Carpathian Logistics Congress (CLC' 2016)*. Ostrava: TANGER, 2017, pp. 49-55.

[5] KOWAL, Barbara, RANOSZ, Robert, KARKULA, Marek, KOWAL, Dominik. Process Management in Hard Coal Mining Companies. *Inzynieria mineralna - journal of the polish mineral engineering society*. 2018. no. 2, pp.111-116. Available from: DOI: 10.29227/IM-2018-02-14.

[6] LYU, Sujia, ZHU, Wei, WANG, Xiaojuan, XU, Ling. Multiple regression analysis based on carbon emissions from aviation logistics in Henan Province. *2019 2nd International Conference of Green Buildings and Environmental Management, GBEM 2019*. 2019. vol. 310, no. 5.

[7] WOZNIAK, Joanna, ZIMON, Dominik, CHUDY-LASKOWSKA, Katarzyna. Analysis of the influence of the selected aspects of organisation of a mass event upon the security of participants in it. *International journal for quality research*. 2019. vol. 13, no. 1, pp. 95-114. Available from: DOI: 10.24874/IJQR13.01-06.

[8] STRAKA, Martin, HURNA, Sona, BOZOGAN, M., SPIRKOVA, Daniela. Using continuous simulation for identifying bottlenecks in specific operation. *International journal of simulation modelling*. 2019. vol. 18, no. 3, pp. 408-419, Available from: DOI: 10.2507/IJSIMM18(3)477.

[9] MOUSSAID, Abderrahmane, AGGOUR, Abdelmounaim, ABOU EL HASSAN, Ahmed. Impact of the Leagility Concept on the Logistics Flows Optimization: The Moroccan Aeronautic Industry Case. *10th International Colloquium on Logistics and Supply Chain Management (LOGISTIQUA).* 2017. pp. 129-134.

[10] HUK, Katarzyna. Solutions in the field of city logistics and the influx of new inwestors based on the example of the lubuskie province. *Carpathian Logistics Congress (CLC' 2016).* Ostrava: TANGER, 2017, pp. 486-490.

[11] BLISTAN, Peter, KOVANIC, L'udovit. Verification of usability of low-cost uav photogrammetry in comparison with close-range photogrammetry in the context of documentation of earth's surface. *Geographic information systems conference and exhibition (GIS ODYSSEY 2017).* 2017. pp. 43-51.

[12] STAS, David, LENORT, Radim, WICHER, Pavel, HOLMAN, David. Green Transport Balanced Scorecard Model with Analytic Network Process Support. *Sustainability*. 2015. vol. 7, no. 11, pp. 15243-15261. Available from: DOI: 10.3390/su71115243.

[13] BUKOWSKI, Lech, FELIKS, Jerzy. Assessment of supplier's risk in logistics networks. *Carpathian Logistics Congress (CLC' 2016)*. Ostrava: TANGER, 2017, pp. 12-19.

[14] FERENCOVÁ, Jana, HURNÁ, Soňa. Logistics technologies in aviation. *Acta Logistica.* 2017. Vol.4, iss. 2, pp. 11-17, ISSN 1339-5629.

[15] FENG, Miao, ZHOU, Dan, YANG, Yang. SWOT Analysis and Countermeasure of Jilin Province Aviation Logistics Industry Development Strategy Based on Low Carbon and Environmental Protection. *2018 4th international conference on environmental science and material application*. 2019, vol. 252. Available from: DOI: 10.1088/1755-1315/252/4/042043.

[16] KIBA-JANIAK, Maja, WITKOWSKI, Jaroslaw. Sustainable Urban Mobility Plans: How Do They Work?. *Sustainability.* 2019. vol. 11, no. 17. Available from: DOI: 10.3390/su11174605.

[17] KOVANIC, Ľudovít, BLISTAN, Peter, ZELIZNAKOVA, Vladislava, PALKOVA, Jana, BAULOVIC, J. Deformation investigation of the shell of rotary kiln using terrestrial laser scanning (TLS) measurement. *Metalurgija*. 2019. vol. 58, no. 3-4, pp. 311-314.

[18] SANIUK, Sebastian, SANIUK, Anna. Challenges of industry 4.0 for production enterprises functioning within cyber industry networks. *Management systems in production engineering*. 2018. vol. 26, no. 4, pp. 212-216. Available from: DOI: 10.1515/mspe-2018-0034.

[19] KHOURI, Samer, CEHLAR, Michal, HORANSKY, Karol, SANDOROVA, Klaudia. Expected life expectancy and its determinants in selected European countries. *Transformations in business & economics*. 2017. vol.16, no. 2B, pp. 638-655.

[20] KLOS, Slawomir, TREBUNA, Peter. Using the ahp method to select an erp system for an sme manufacturing company. *Management and production engineering review*. vol. 5, no. 3, pp. 14-22, 2014. Available from: DOI: 10.2478/mper-2014-0023.

[21] SOFRANKO, Marian, ZEMAN, Robert. Simulation of pipeline transport backfill mixtures.*15TH International carpathian control conference (ICCC)*. 2014. pp. 578-583.

[22] GALLO, Peter, TOMCIKOVA, Ľuba. The Analytical View of the Methods of Strategy Creation and Involvement of Managers of Individual Control Levels in the Production of Strategies in Strategic Management in Manufacturing Companies in the Conditions of the Slovak Republic. *Quality-access to success*. 2019. vol. 20, no. 170, pp. 3-8.

[23] STRAKA, Martin, ROSOVA, Andrea, LENORT, Radim, BESTA, Petr, SADEROVA, Jana. Principles of computer simulation design for the needs of improvement of the raw materials combined transport system. *Acta Montanistica Slovaca*. 2018. vol. 23, no.2, pp. 163-174.

[24] HUBER, Carmen, RINNER, Claus. Market Area Delineation for Airports to Predict the Spread of Infectious Disease. *22nd AGILE Conference on Geographic Information Science 2019*. 2020, pp. 263-289. Available from: DOI: 10.1007/978-3-030-14745-7_15.

[25] MALKUS, Tomasz. The influence of trust on reduction of cooperation risk in logistics. *Acta Logistica*. 2018. vol. 5, no.3, pp.93-99, ISSN 1339-5629.

[26] WITKOWSKI, Jaroslaw, CHEBA, Katarzyna, KIBA-JANIAK, Maja. Cooperation in a supply chain on the example of japanese companies located in Poland. *Carpathian Logistics Congress (CLC' 2016)*. Ostrava: TANGER, 2017, pp. 43-48, 2017.

[27] HUDECEK, V., URBAN, P., ZAPLETAL, P. KOSNOVSKY, V. Elimination of safety risks at mined Coal faces in the paskov mine, Staric plant- OKD, a.s. Czech Republic. *Acta Montanistica Slovaca*. 2013. vol. 18, no. 3, pp. 172-179.

[28] ŠTEFANICKÝ, Branislav. Riadenie hasičských jednotiek pri zdolávaní požiarov. *Krízový manažment*. 2011. no 1., pp. 1-10.

[29] FLEGNER, Patrik, KACUR, Jan, TERPAK, Jan, LACIAK, Marek, DURDAN, Milan, An Advanced Method of Recognizing the State of the Technological Process in Technical Diagnostics. *2019 20TH INTERNATIONAL CARPATHIAN CONTROL CONFERENCE (ICCC). 2019, pp.* 74-78.

[30] PETERKA, Pavel, KACMARY, Peter, KRESAK, Jozef, SIMONAK, Jan, BINDZAR, Peter, MITRIK, Dusan Prediction of fatigue fractures diffusion on the cableway haul rope. *Engineering failure analysis*. 2016. vol. 59, pp. 185-196. DOI: 10.1016/j.engfailanal.2015.10.006.

[31] MALINDZAK, Dusan, BACIK, Radovan, GAZDA, Andrzej, KACMARY, Peter, PACANA, Andrzej. Improvement of polyethylene film manufacturing by using a capacity planning model. *Przemysl chemiczny*. 2014. vol. 93, no. 7, pp. 1136-1138.

[32] LENORT, Radim, BESTA, Petr. Hierarchical Sales Forecasting System for Apparel Companies and Supply Chains. *Fibres & Textiles in eastern Europe*. 2013. vol. 21, no. 6, pp. 7-11.