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Araştırma Makalesi/Research Article

ANALYZING THE RISKS OF TRANSPORTATION OF DANGEROUS GOODS BASED ON THE ADR

TEHLİKELİ MADDE TAŞIMACILIĞINDA ADR'YE GÖRE RİSKLERİN ANALİZ EDİLMESİ

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ABSTRACT: The transport of dangerous substances is an important issue that needs to be emphasized and requires expertise in terms of the safety of human life. In order to minimize the risks that may arise during the logistics of hazardous materials and to prevent damages and hazards, regulations have been introduced that enable them to be realized in a standardized and systematic whole world. Among these arrangements, the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) is the convention that sets out the rules required in the road transport process. The aim of this study is to analyze the factors obtained by carrying out a scale study for the logistics companies carrying out dangerous goods transportation with ADR point of view. First, a comprehensive list of potential risk factors that may occur during transport of dangerous goods from the literature has been established. Thirty-five risk factors were evaluated by 188 persons specialized in hazardous goods transport. The 22 main risks obtained by the exploratory factor analysis are classified under five main factors. These titles; human factor, company factor, material and packaging, vehicle status, environment and traffic factor.

Keywords: ADR, Dangerous Goods, Dangerous Goods Transportation, Risks

ÖZ: Tehlikeli madde taşımacılığı, insan yaşamının güvenliği açısından üzerine düşülmesi gereken ve beraberinde alanında uzmanlığı gerektiren önemli bir konudur. Tehlikeli madde lojistiği sırasında meydana gelebilecek riskleri minimize etmek, tehlikeleri ve zararları önlemek amacıyla, dünya genelinde standardize edilmiş ve sistematik hale getirilmiş bir bütün olarak gerçekleştirilmesine olanak tanıyan düzenlemeler sunulmuştur. Bu düzenlemeler içinde, karayolu taşımacılığı sürecinde gereken kuralları ortaya koyan düzenleme ADR konvansiyonudur. Bu çalışmanın amacı, tehlikeli madde taşımacılığı yapan lojistik firmalar için bir ölçek çalışması yapılarak elde edilen faktörlerin ADR bakış açısı ile analiz etmektir. İlk olarak, literatürden tehlikeli madde taşımacılığı sırasında meydana gelebilecek potansiyel risk faktörlerinin kapsamlı bir listesini oluşturulmuştur. Tespit edilen otuz beş risk faktörü, tehlikeli madde taşımacılığı konusunda uzmanlaşmış 188 kişi tarafından değerlendirilmiştir. Açıklayıcı faktör analizi sonucu elde edilen 22

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temel risk, beş ana faktör altında sınıflandırılmıştır. Bu başlıklar; insan faktörü, şirket faktörü, malzeme ve ambalajlama, aracın durumu, çevre ve trafik faktörü olarak adlandırılmıştır.

Anahtar Kelimeler: ADR, Tehlikeli Madde, Tehlikeleri Madde Taşımacılığı, Riskler

1. INTRODUCTION

In developed countries, a big amount of material transportation is harmful for human health and the environment (Çalışkan et al., 2017). Materials in these characteristics are called hazardous materials (hazmats) or dangerous goods. Dangerous goods are liquid, solid or gaseous substances which can put in jeopardy or cause damage the environment and human safety as a result of carelessness or accidents during their production, handling, usage, storage or transportation (Oggero et al., 2006). They contain explosives, flammable liquids and solids, gases, poisonous and infectious substances, oxidizing substances, corrosive substances, and hazardous wastes (Verter and Kara, 2001:12).

Dangerous goods are articles or substances that cause a hazard to people, living creatures or the environment in an instant, because of their corporal, chemical or acute toxicity characteristics. (Hazardous Materials Management Handbook, 2016). Dangerous goods are substances or products that may pose a risk in terms of health, property, safety, the public or the environment. (Ding et al. 2016).

Each day, there are a lot of radioactive, explosive or poisonous materials are involved many living in space from industrial cities where the population is concentrated to small settlements in the transition road in various transportation types, especially in the road. These substances are substances that can cause enormous damage to the environment and human safety as a result of an accident caused by many risks carried out during production, transport, use or storage (Macciotta et al., 2018). For this reason, the transport of dangerous substances is an important issue that requires expertise and should be emphasized in terms of the safety of human life.

In order to minimize the risks that may arise during the logistics of hazardous materials and to prevent damages and hazards, regulations have been introduced that enable them to be realized in a standardized and systematic whole world. In the global world, this system is extremely important in terms of polluted environment, human life, and other factors. For this purpose, international regulations and legislation that have been specialized for each mode of transportation have been brought into force. Among these arrangements, ADR is the convention that sets out the rules required in the road transport process. With the ADR Agreement, the transportation of dangerous goods has changed and it is required to analyze this process.

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Although ADR is so important for transporting dangerous goods, there are a few academic studies have been done on this subject until now. None of these studies mentioned to the potential risks of the logistics sector. The aim of this study is to identify and classify potential risks for companies carrying out dangerous goods transport from an ADR point of view. For the identified potential risks, a factor analysis was performed and a scale study was conducted for the risks.

The paper is organized into five sections. The next section gives information about dangerous goods transportation and ADR rule. The research methodology section reports the descriptive statistics and the exploratory factor analysis. Lastly, Conclusion section summarizes the conclusions of the study about list of potential risk factors of dangerous goods transportation.

2. DANGEROUS GOODS TRANSPORTATION

The needs of translocation of dangerous goods has increased depends on the use of hazardous materials in many sectors and increasing transportation activities with the developing technology. Every year, millions of tons of dangerous goods are transported with all transport modes. Khan and Abbasi (1999) 3222 accidents involving hazardous chemicals, of which 54% are fixed installations, 41% are transportation accidents and 5% miscellaneous accidents. In İtalian example, Viareggio accident (2010), which involved a train with tank cars containing liquefied petroleum gas (LPG) which caused more than thirty deaths (Rada et al. 2010). To prevent any hazard of these transportations special rules have been generated throughout the world. The purpose of these rules is to enable a safe process for dangerous goods logistics; in other words, delivery, storage, and packing, stowage, labeling and handling of dangerous goods (Sabegh et al. 2016). At the same time, these rules inform us about what to do in a stage of emergency. The main purpose of the whole of these rules is eliminating potential risks before an accident occurs. For this reason, preventive approach is mainly based on the dangerous goods logistics process. The regulatory approach is the secondary plan in this process. The reason of being of secondary importance of the regulatory approach is that making improvements or taking measures will not eliminate environmental pollution and compensate possible loss of lives after the accident. Therefore, preventive & predictive approach is based on the whole world (Rooney et al., 2008). Fabiano et al. (2002) studied the risk from dangerous goods transport by road and strategies for selecting road load/routes. They developed an original site-oriented framework of general applicability.

Hazardous materials (hazmats) transportation is a significant problem in industrialized countries, due to being prevalent of these substances. For most members of industrial countries, life without hazardous materials is unthinkable. Unfortunately, most hazardous materials are not put to use at their point of

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manufacture, and they are transferred over remarkable distances (Ozturkoglu et al. 2018). Therefore, hazardous material haulers have upward of accident recordings than other haulers. At the same time, even if they are exceptional eventuating, accidents take place during the transportation of hazardous materials (Erkut and Verter, 1998:625). Torretta et al. (2017) developed a decision support system, which provide solutions to prevent and manage accidents.

The European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR) was drawn up at Geneva on 30 September 1957 under the watch of the United Nations Economic Commission for Europe (UNECE), and it came in force on 29 January 1968. The Agreement itself was changed by the Protocol changing article 14 (3) done at New York on 21 August 1975, which came in force on 19 April 1985 (ECE/TRANS, 2013). ADR convention rules are applied by associated countries, but the countries which are not in the scope of ADR convention apply their domestic legislation predominantly.

The purpose of the ADR contract is to increase the safety of international road transport. It also includes provisions on the classification, labeling and testing of dangerous substances, including hazardous wastes, responsible for the classification of dangerous goods and the introduction of standards for the transport of dangerous goods. Besides, it is under the scope of ADR to define trainings for related parties and staff. The names of the specialized agencies and international regulations by type of transport (Şencan and Yavuz, 2018) are given in Table 1.

Table 1: *International Conventions and Responsible Specialized Agency*

Transportation Type	Responsible Specialized Agency	International Convention
Road	UN Economic Comission for Europe (UNECE)	ADR
Maritime	International Maritime Organization (IMO)	IMDG-Code
Railway	Office Central Transport Internationaux (OCTI)	RID
Airway	International Air Transport Association (IATA)	DGR
Inland Waterway	**Accord Européen relatif au Transport International des Marchandises Dangereuses par voie de Navigation du Rhin**	**ADNR/ADN**

45 countries were signatory party to the ADR agreement up to 2010. Turkey became the signatory country to the ADR Convention as forty-sixth country on February 22, 2010. Today, number of competent authorities is 49. Saat et al. (2014) described a quantitative, environmental risk analysis of rail transportation of a group of light, non-aqueous-phase liquid (LNAPL) chemicals commonly transported by rail in North America based on ADR agreement.

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Dangerous goods transportation is a chain of incidents containing multiple elements (for example; shippers, consignees, haulers, packaging producers, container over haulers, distributers, freight forwarders, government regulators, enforcement personnel, emergency responders) having several roles in the operation of securely moving dangerous goods from their center point to their destination. The transportation of dangerous goods is one of the most complicated spheres of transport and the one that requires the most safety measures because if there is an accident, dangerous goods can get into the environment and cause grave consequences (Batarliene, 2008:8).

Organizing dangerous goods transportation and establishing informational-technological models, it is very important that the dangerous goods were distributed according to appropriate features. This may help to gather concrete information for separate parameters of transportation process.

Although there are many studies on the transport of hazardous materials, there are very few studies based on ADR approach with the sample of different countries. Zisiopoulou et al. (2018) presented and analyzed the state of hazardous materials road transports in Greece in a business environment characterized by a severe economic crisis based on ADR approach. Therefore, this study is the first study with ADR approach using data from Turkey for transport of hazardous materials.

3. METHODOLOGY

The contribution of the study is to provide a comprehensive list of potential risk factors of dangerous goods transportation and real world insights by explaining the most effected elements on risk factors.

This study suggest a new conceptual model of risk assessment of dangerous goods, that we developed by categorizing the elements in a different way to the literature in order to emphasize elements. After detailed literature review, 35 risk factors under these principal factors of dangerous goods transportation are identified. Therefore, this paper examines the relationship of mentioned factors for dangerous goods transportation by applying exploratory factor analysis.

Table 2 shown the comprehensive list of potential risk factors of dangerous goods transportation.

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Table 2: *List of Potential Risk Factors of Dangerous Goods Transportation*

No	Factors	No	Factors
E1	Education	E18	Marking and labeling
E2	Psych.and sentim. state of	E19	Tech. quali.& calib. of equip.
E3	person.	E20	Inform. Flow & GPS tracking
E4	Experience	E21	Vehicle mainten. (brake, tire, etc.)
E5	Complying with the rules	E22	Vehicle age
E6	Commun. and coord.	E23	Vehicle capacity
E7	Age	E24	Vehicle placement
E8	Physical condition	E25	Emergency equipment
E9	Dangerous goods safety advisor	E26	Vehicle placement
E10	Compl.with the regula.	E27	Population density
E11	Documentation and reporting	E28	Temperature
E12	sytem	E29	Humidity
E13	Emergency plan	E30	Wind
E14	Safety and quality rating system	E31	Light
E15	Tech. utilization	E32	Road conditions
E16	Quantity of hazard. Material	E33	Accident rate
E17	Precedence of hazard of	E34	Environmental structure
	substance	E35	Traffic Density
	Container & packaging		
	Preventive of response equip.		

This research has been carried out in a different logistics companies that transport any type of the dangerous goods in anyplace of the Turkey. The data were collected from employees in various departments at the company by using the survey method. For the assessment of 35 identified risk factors, a self-administered questionnaire is developed. Developed questionnaire form consists of two parts. The first part was used to determine the demographic characteristics of the participants. In the second part, five-point Likert scale was used to determine the order of importance of 35 items on the scale. "1 is strongly disagree, and' 5 'was the strongly agree. Questionnaire distributed via email to 11 different logistics firms, targeting respondents working in the transportation department of each company. Surveys were completed voluntarily from all participants. 188 completed questionnaires were returned from the 200 targeted questionnaires. IBM SPSS Statistics 20 for Windows program was used to analyze the data.

The survey has two parts. In the first section, there are five questions related with the descriptive statistics of the respondents. The other section has some questions which is analyzing the relationships between selected elements and risk factors. Questions are prepared to recognize the risk levels of dangerous goods transportation. Table 3 presented the descriptive analysis of the study.

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Table 3: *Introductory Information of Research Participants*

Depart.	**#**	**Age**	**Gender**	**#**	**Experience time (year)**	**#**
OHS	46	20-30	Male	116	1-5	16
Safety Advisor	41	31-40	Female	72	6-10	20
Forwarder	30	41-50			11-15	26
Export	25	51-60			16-20	22
Import	22	61-up			21-30	78
Production	18				31-up	26
Quality Control	6					
Total	**188**	**188**	**188**			**188**

Since exploratory factor analysis is used in this study, the values of skewness and kurtosis should be considered in order to examine the assumption of normal distribution assumption of data (Hair et al., 1998: 604). Skewness is a value between -1.5 and +1.5 (Tabachnick and Fidell, 2007), and Kurtosis is between -2 and +2 (George and Mallery, 2010). All values mentioned in the table are suitable for these ranges, so we can specify that our data is normally distributed and that it is suitable for regression analysis by factor analysis.

The statistical internal consistency of the study was calculated using Cronbach's Alpha coefficient. The Alpha value takes values between 0 and 1, and an acceptable value must be at least 0.7. However, it is also foreseen by some researchers that this value can be reasonably accepted up to 0.5 in studies of examination type (Altunışık, et al. 2010: 122-124). Cronbach's Alpha value (Table 4) was found as 0.784 in the survey, and it has been seen that the scale expressions have provided internal consistency.

Table 4: *Reliability Analysis*

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
,845	,784	35

4.EXPLORATORY FACTOR ANALYSIS

Exploratory factor analysis is a statistical technique that tries to explain the measurement with a small number of unconnected and conceptually meaningful new factors by collecting variables that measure the same structure or same qualification (Arslantürk, 2006: 123). Factor analysis may not be appropriate for all data obtained. For this reason, the results of KMO and Bartlett sphericity test

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should be examined in order to determine whether the data set is suitable for factor analysis (Dalgakıran and Ozturkoglu, 2017).

Table 5: *KMO and Bartlett's Test*

KMO		,672
Bartlett's Test of Sphericity	Chi square	1548,354
	sd	215
	Sig.	,000

It has been seen that the KMO coefficient is close to 1 and the test for sphericity has a p <0.05 significance level. Taking into account of these, it can be said that the data set is suitable for factor analysis.

Table 6: *The Results of Exploratory Factor Analysis*

	Components				
	1	2	3	4	5
E1	,735				
E3	,684				
E4	,634				
E6	,565				
E7	,562				
E8		,650			
E9		,645			
E11		,624			
E12		,595			
E14			,840		
E15			,788		
E16			,750		
E19			,645		
E21				,735	

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E22	,7	
E24	42	
E25	,7	
E26	05	
E27	,6	,6
E28	35	25
E32	,6	,6
E35	02	14
		,6
		08
		,5
		84

The 5 factors obtained at the end of the analysis have been able to explain 82.46 % of the total variance. As a result of factor analysis, it has been ensued that there is no factorability for the statements of E2, E5, E10, E13, E17, E18, E20, E23, E29, E30, E31, E33, and E34. Therefore, the number of expressions to be included in the analysis has dropped from 35 to 22.

Table 7: *Factors Excluded from the List at the End of the Analysis*

KEY FACTORS	NO	SUB-FACTORS
Human factors	E2	Psychological and sentimental state of personnel
	E5	Communication and coordination skill
Factors associated with company	E10	Documentation and reporting system
	E13	Technology utilization
Material and packaging	E17	Preventive or following response equipment
	E18	Marking and labeling
Condition of vehicle	E20	Information flow and GPS tracking
	E23	Vehicle capacity
Environment and traffic	E29	Humidity
	E30	Wind
	E31	Light
	E33	Accident rate
	E34	Environmental structure

It has been observed that the hazardous material transportation process has been given great importance to the relevant company and that it has been observed in accordance with the rules contained in the ADR Convention. For this reason, Table 8 shown that some of the non-factorizing elements as a result of the calculation do not have to be taken as a criterion when risk analysis is carried out in general for the dangerous goods transportation process. It was determined that the factor out of calculation were already included by the relevant factors at the end of

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calculation as a result of the analysis. Factors determined by this model show that it is not necessary to be assessed.

The names given to the factors and the statements they contain after the analysis are listed in the table below.

Table 8: *The Factors Resultant of Exploratory Factor Analysis*

KEY FACTORS	NO	SUB-FACTORS
Human factors	E1	Education
	E3	Experience
	E4	Complying with the rules
	E6	Age
	E7	Physical condition
Factors associated with company	E8	Dangerous goods safety advisor
	E9	Complying with the regulations
	E11	Emergency plan
	E12	Safety and quality rating system
Material and packaging	E14	Quantity of hazardous material
	E15	Precedence of hazard of substance
	E16	Container and packaging
	E19	Technical qualification and calibration of equipment
Condition of vehicle	E21	Vehicle maintenance (brake, tire etc.)
	E22	Vehicle age
	E24	Vehicle placement
	E25	Emergency equipment
	E26	Vehicle loading and unloading
Environment and traffic	E27	Population density
	E28	Temperature
	E32	Road conditions
	E35	Traffic density

5. CONCLUSION

Although dangerous goods are transported in different modes of transportation, they are often transported by road in our country. Therefore, furthest risk is seen on road transportation. Despite the declaration of acceptance of the ADR conventions in hazardous goods transportation by road, there are still many dangerous substances that are consciously or not being transported from one point to another without any risk management and out of regulations.

In this study, we suggest a new conceptual model of risk assessment of dangerous goods. Based on the literature review, we identified 35 risk factors, under principal factors of dangerous goods transportation. In order to test the 35 risk factors, we conducted a survey in the logistics industry in Turkey to examine

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the perceived importance of different risk elements. All these factors were evaluated by 188 responds to investigate relationships among risk factors. The factor analysis revealed five underlying factors with 24 risk elements. According to the factors loaded under them, we called these main factors as; human factors, factors associated with company, material and packaging, condition of vehicles, environment and traffic. When the risk analysis is carried out in general for the process of transport of dangerous goods, it is determined that some of the factors that are not factorized as a result of the calculation need not be considered as a criterion. As a result of the analysis, it was determined that the non-computational factors were already included by the relevant factors at the end of the calculation. With this result, it is aimed to increase the performance of companies in risk analysis of hazardous material transportation processes and to save time and unnecessary work.

As a result of this study, it is aimed to inform the logistics sector as one of the starting points in terms of being able to transportation of dangerous goods in full accordance with international agreements, rules and regulations, to voice the problems in the sector and to support the sector representatives who will do this business. Even though the carrier, the sender and other business partners and the local authorities who make this land in our country have rough edges, with studies and regulations in recent years show that it has been covered distance significantly and has been brought his sector into the forefront. Therefore, this scale gives valuable insights for transportation of the dangerous goods for the logistics companies.

KAYNAKÇA

Altunışık, R., Coşkun, R., Bayraktaroğlu, S. ve Yıldırım, E. (2010). *Sosyal Bilimlerde Araştırma Yöntemleri - SPSS Uygulamalı*. Sakarya: Sakarya Yayıncılık.

Arslantürk, Z. (2006). *Sosyal Bilimler İçin Araştırma Metot ve Teknikleri*. İstanbul: Marmara Üniversitesi İlahiyat Vakfı Yayınları.

Batarliene, N. (2008). Dangerous Goods Transportation: New Technologies and Reducing of the Accidents. *Journal of Konbin*, 8(1), 211-222.

Caliskan, A., Kalkan, M., and Ozturkoglu, Y. (2017). City Logistics in Izmir: Problems and Recovery Proposals. *International Journal of Logistics Systems and Management*, 26 (2), 145-162.

Dalgakiran, A. B., & Öztürkoğlu, Y. (2017). Scale and Relationship Analysis for Turkish Furniture Sector. *Business & Management Studies: An International Journal*, 5(1), 147-161.

DOI: 10.26468/trakyasobed.411953
Ding, L., Chen, Y. and Li, J. (2016). Monitoring Dangerous Goods in Container Yard Using the Internet of Things. *Scientific Programming*.

ECE/TRANS/225 (2013). *European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR)*.Geneva: UNECE.

Erkut, E and Verter, V. (1998). Modeling of Transport Risk for Hazardous Materials. *Operation Research*, 46(5), 625-642.

Fabiano, B., Curro, F., Palazzi, E., & Pastorino, R. (2002). A Framework for Risk Assessment and Decision-Making Strategies in Dangerous Good Transportation. *Journal of hazardous materials*, 93(1), 1-15.

George, D. and Mallery, M. (2010). *SPSS for Windows Step by Step: A Simple Guide and Reference*, Boston: Pearson Education India.

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E. and Tatham, R. L. (1998). *Multivariate Data Analysis*. 5(3), 207-219.

Hazardous Materials Management Handbook (2016). *Leading Practice Sustainable Development Program for the Mining Industry*, Australia: Department of Resources, Energy and Tourism.

Khan, F.I. and Abbasi, S.A. (1999) Major accidents in Process Industries and an Analysis of Causes and Consequences. *Journal of Loss Prevention in the process Industrie*s, 12(5), 361-378.

Macciotta, R., Robitaille, S., Hendry, M. and Martin, C. D. (2018). Hazard Ranking for Railway Transport of Dangerous Goods in Canada. *Case Studies on Transport Policy*, 6(1), 43-50.

Oggero, A., Darbra, R. M., Munoz, M., Planas, E. and Casal, J. (2006). A Survey of Accidents Occurring During the Transport of Hazardous Substances by Road and Rail. *Journal of Hazardous Materials*, 133(1-3), 1-7.

Ozturkoglu, Y. and Esendemir, E. (2014). ERP Software selection using IFS and GRA methods. *Journal of Emerging Trends in Computing and Information Sciences*, *5*(5), 363-370.

Ozturkoglu, Y., Ozbiltekin, M., Gozacan, N. and Surgec, (2013). City Logistics: Sample Implementation of Izmir City. *Journal of Management Marketing and Logistics*, 5(3), 206-213.

Rada, E. C., Ferronato, N., & Torretta, V. (2017). Individual Risk Evaluation and Interventions for Mitigation in the Transportation of Hazardous Goods: A Case Study. In MATEC Web of Conferences (Vol. 121, p. 06008). EDP Sciences.

Haziran 2019 Cilt 21 Sayı 1 (1-13)
DOI: 10.26468/trakyasobed.411953
Rooney, T., Podger, G. and Hackitt, J. (2008). *The Role of the Health and Safety Commission and the* Health and Safety Executive in Regulating Workplace Health and Safety: Third Report of Session 2007-08. London: The Stationery Office.

Saat, M. R., Werth, C. J., Schaeffer, D., Yoon, H., & Barkan, C. P. (2014). Environmental Risk Analysis of Hazardous Material Rail Transportation. *Journal of Hazardous Materials*, 264, 560-569.

Sabegh, M. H. Z., Ozturkoglu, Y., & Kim, T. (2016). Green Supply Chain Management Practices' Effect on the Performance of Turkish Business Relationships. *International Journal of Supply and Operations Management*, 2(4), 982.

Şencan, M. and Yavuz, H. (2018). Transportation of Dangerous Goods: Turkey Model. *Journal of International Trade, Logistics and Law*, 3(2), 65-74.

Tabachnick, B.G. and Fidell, L.S. (2007). *Using Multivariate Statistics*. Boston: Pearson Education.

Torretta, V., Rada, E. C., Schiavon, M., & Viotti, P. (2017). Decision Support Systems for Assessing Risks involved in Transporting Hazardous Materials: A Review. *Safety Science*, 92, 1-9.

Verter, V. and Y. Kara, B. (2001). A GIS-Based Framework for Hazardous Materials Transport Risk Assessment. *Risk Analysis*, 21, 1109–1120.

Zisiopoulou, A., Vrysagotis, V., & Geronikolou, A. (2018). Managerial Proposals for the ADR Transport Industry in Greece during the Crisis Period of 2015. *Advances in Management and Applied Economics*, 8(2), 13-31.

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