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A Quantitative Analysis of the Factors That May Cause Occupational Accidents at Ports

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Abstract

In recent years, the concept of sustainability has come to the forefront as a requirement of strategic management in ports. The safety component which has an important place in the social dimension of sustainability, is very valuable in terms of minimizing occupational accidents at the port area. In order to take precautions against the threat of occupational accidents, understanding the risks causeing occupational accidents are as important as knowing how these accidents occur. The aim of this study is to identify risks in port area that cause Occupational Health and Safety (OHS) violations and to reveal prominent risks as a result of expert reviews. Fuzzy AHP method is employed to analyze priority perception of the experts. Accordingly, risks; 'Overconfidence and Disengagement', 'Inter-Department and In-Department Communication Gap', 'Lack of Attention', 'Failure to Take Required Precautions during Repair and Maintenance' have come into prominence in comparison to other factors. It can be concluded that human factor and communication level have vital role to provide OHS in port area.

Keywords: *Occupational Health and Safety, Port Area, Fuzzy AHP, Human Factor.*

Limanlarda İş Kazalarına Neden Olabilecek Faktörlere İlişkin Nicel Bir Analiz

Öz

Son yıllarda limanlarda, stratejik yönetimin bir gereği olarak sürdürülebilirlik kavramı ön plana çıkmaktadır. Sürdürülebilirliğin sosyal boyutu içerisinde önemli bir yer tutan emniyet unsuru, liman sahasında iş kazalarının minimize edilmesi kapsamında oldukça değerlidir. İş kazası tehdidine karşı önlem alabilmek adına iş kazalarına neden olan riskleri kavramak, bu kazaların nasıl gerçekleştiğini bilmek kadar önemlidir. Bu çalışmanın amacı liman sahasında iş sağlığı ve güvenliği ihlallerine sebep olabilecek riskleri tanımlamak ve uzman değerlendirmeleri sonucu öne çıkan riskleri ortaya koymaktır. Uzmanların öncelik algısının analiz edilmesinde Bulanık AHP yöntemine başvurulmuştur. Buna göre, 'Aşırı Güven ve İşi Boş Verme', 'Birimler Arası ve Birim İçi İletişim Kopukluğu', 'Dikkat Eksikliği' ve 'Bakım ve Onarım Sırasında Gerekli Önlemlerin Alınmaması' gibi riskler diğer kriterlere nazaran çok daha fazla ön plana çıkmıştır. Böylece insan faktörü ve iletişim düzeyinin liman sahasında İş Sağlığı ve Güvenliğinin sağlanmasında çok önemli bir role sahip olduğu sonucuna varılmıştır.

Anahtar Kelimeler: *İş Sağlığı ve Güvenliği, Liman Sahası, Bulanık AHP, İnsan Faktörü.*

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1. Introduction

The man-machine interaction gained momentum with the Industrial Revolution and as a result of this situation, OHS hazards emerged. With the emergence of these hazards, the requirement to take legal precautions has also occurred and many studies have been carried out in this context. The first legal studies and arrangements on the subject were started to be legislated in the late 19th century [1].

Approximately 85% of the goods or cargoes subject to the world trade have been shipped between ports [2] and this rate will continue to increase or protect its position as long as cargo owners get benefits from the economies of scale. Accordingly, widening of the world trade day by day puts pressure on the ports at operational speed. For this reason, heavy machines and equipment is intensively operated in port areas. Therefore, increasing the factor of OHS violations are becoming inevitable. In the previous studies related to factors at maritime transport, events that threat occupational health might occur en route are generally considered. However, significant occupational accidents may occur caused by ships on the port side, such as collision, grounding, ramming, spills and closures [3]. In maritime industry, occupational accidents not only give harm to the environment but also threat the human life [4]. Further, the impact area of the most accidents can be wider due to the port locations near by the downtown. Risk management focuses on defining the source and nature of the risk and tries to prevent occurrence again by evaluating previous accidents with empirical techniques [5; 6; 7]. Therefore, process of the OHS in ports should continuously be controlled, deficiencies should be identified and required precautions should be taken [8]. When it is evaluated by the prevention-based perspective, it would be important to determine the negligence causing the accidents and its priority level.

The academic studies on the subject of the OHS in logistic systems are usually aimed at preventing accidents or determining the indicators that describe the OHS. *Kleindorfer and Saad* [5] examined the accidents during the logistics activities between the years of 1995 and 2000 at the chemical industry in the United States by basic statistical tests and concluded that the cost of precaution against the risk did not pass over the cost of damages incurred after the risk occurred. It is known that the prescriptive role of the governments in promoting the precautions against possible OHS risks is undeniable. On the other hand, *Yang and Wei* [9] who advocate that the actors of the market should be in coordination with each other, revealed in their study that knowledge management and partner relationship management have positive impact on safety performance in supply chain with the help of the multiple regression analysis. Such that, *Walters et al.* [10] evaluated aforementioned coordination in the work environment at sea, displayed that supply chain relationships facilitate implementation of the OHS regulations on commercial ships by interviewing with the seafarers. Gutierrez and Hintsa [11] emphasized the importance of OHS in logistics system and the importance of educating employees in this direction. They made an archive study for providing the OHS in supply chain and focused on 5 main factors: Facility Management, Cargo Management, Human Resources Management, Information Management and Company Management. In order to determine the level of threat to remove the factors that threaten OHS, *Antao el al.* [8] revealed indicators on OHS performance in port areas and listed them with frequency analysis. *Uğurlu et al*. [12] investigated the reasons of collision and grounding accidents on tanker ships and additionally they stated the significance level of the losses after the accidents with the help of the Fault Tree Analysis (FTA). Accordingly, the most prominent reason of the accidents is human faults and the most prominent results are economic losses. Likewise, *Özdemir et al.* [13] after determining the factors affecting the health status of seafarers, they analysed these criteria with the Fuzzy Analytic Hierarchy Process (FAHP) method, and it is revealed that the human factor has more effect on the occupational accidents than the others. *Nielsen and Panayides* [4] approached the occupational accidents in ships with a causal viewpoint and stated that it has been insufficient to focus on the causes of incidents in the previous studies. Ilbahar et al. [14] employed the methods integrated approach of the Fine Kinney, Pythagorean fuzzy AHP (PFAHP) and Fuzzy Inference System (FIS) to evaluate hazards stem from environmental factors, staff management, non-secure behaviours, heavy equipment, construction yard management during excavation process in construction yard. Gul et al. [15] used FAHP method to align potential risks which are severity, occurrence, undetectability, sensitivity to maintenance non-execution, and sensitivity to personal protective equipment non-utilization that threaten OHS in the hospitals in Turkey. Yilmaz and Senol [16] prioritize either OHS factors or precautions against OHS by using FAHP and Fuzzy TOPSIS methods. In this study, factors which may constitute a problem on the OHS in logistics systems are evaluated. These factors are exhibited by taking ports as a model and also are sorted as a result of Fuzzy AHP analyses. In the next part of this study, the Fuzzy AHP method and its formulization steps will be introduced. Afterwards, the factors mentioned in the study and the experts evaluating these factors will be detailed. And then, application steps will be shown via tables. Thereinafter, as a result of the analysis, the prominent elements will be evaluated and finally, the precautions against the prominent elements and suggestions for the future studies will be presented.

2. Fuzzy Analytic Hierarchy Process

The Analytical Hierarchy Process (AHP) method, advanced by *Saaty* [17], has been gained acceptance by the reason of the fact that it is apparent and applicable for researchers and decision analysts around the world to propose solution for multi-criteria decision-making problems. However, as in every multi-criteria decision making method, the subjective opinions of the experts can be revealed by the help of AHP method analysis. To avoid these subjective and strict judgements, it is generally employed the fuzzy logic in literature which is developed by *Zadeh* [18]. The Fuzzy AHP method, which is the result of synthesizing the Analytic Hierarchy Method with a fuzzy logic, was first exhibited by *Laarhoven and Pedrycz* [19], and thereafter progressed by *Buckley* [20] and *Chang* [21]. The Extended Analysis Method which was developed by Chang, has been widely implemented in the literature is used. In this study, Chang's Extended Analysis Method is used for avoiding the subjective assessments of the OHS experts and for expressing the comparisons more accurately with the range values instead of exact values. The following steps of the method are followed.

2.1. Application Steps

Step 1: In the first step, the evaluation matrices are formed by making pairwise comparisons between the criteria. Evaluations with real numbers are converted to triangular fuzzy numbers [22] using the values in the Table 1.

According to perceptual expert evaluations, pairwise comparison matrix of the key criteria has been generated as in the Table 2.

Table 1. *Triangular Fuzzy Numbers*

Real Numbers	Linguistic Variables	Triangular Fuzzy Numbers	Reverse Triangular Fuzzy Numbers
1	Equal Importance	(1,1,1)	(1,1,1)
2	Weak	(1,2,3)	(1/3, 1/2, 1)
3	Moderate Importance	(2,3,4)	(1/4, 1/3, 1/2)
4	Moderate Plus	(3,4,5)	(1/5, 1/4, 1/3)
5	Strong Importance	(4,5,6)	(1/6, 1/5, 1/4)
6	Strong Plus	(5,6,7)	(1/7, 1/6, 1/5)
7	Demonstrated Importance	(6,7,8)	(1/8, 1/7, 1/6)
8	Very, Very Strong	(7,8,9)	(1/9, 1/8, 1/7)
9	Extreme Importance	(8,9,9)	(1/9, 1/9, 1/8)

Table 2. *Pairwise Comparison Matrix of the Key Criteria*

	Labor Induced	Vehicle, Equipment Induced	Facility Induced	Coordination Deficiency Induced
Labor Induced		(1.89, 2.78, 3.67)	(1.78, 2.67, 3.56)	(1.06, 1.46, 1.88)
Vehicle, Equipment Induced	(0.34, 0.42, 0.59)		(1.26, 1.94, 2.67)	(0.75, 1.11, 1.50)
Facility Induced	(0.35, 0.44, 0.65)	(0.53, 0.72, 1.06)		(0.67, 0.81, 1.00)
Coordination Deficiency Induced	(0.98, 1.24, 1.56)	(1.11, 1.50, 2.00)	(1.37, 1.83, 2.33)	

Step 2: If the object set is represented as X={X_1, X_2, ... X_n} and the goal set as, Q={q_1, q_2, ..., q_m} according to the Chang's concept of extent analysis each object is taken and extent analysis for each goal Qi is performed respectively. The m extent analysis for each object donated asM^1_{gi}, M^2_{gi}, ..., M^m_{gi}, i= 1, 2,...,n. Every M^j_{gi} (j = 1, 2,...,m) numbers are triangular fuzzy numbers. The value of fuzzy synthetic extent with respect to the ith object is defines as:

$$S_i = \sum_{j=1}^{m} M_{gi}^{j} \otimes \left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]^{-1} \quad (1)$$

The value of $\sum_{j=1}^{m} M_{gi}^{j}$ can be found by performing the fuzzy addition operation of *m* extent analysis values from a matrix such that:

$$\sum_{j=1}^{m} M_{gi}^{j} = \left(\sum_{j=1}^{m} l_i, \sum_{j=1}^{m} m_j, \sum_{j=1}^{m} u_j\right), \; i = 1, 2, \dots n$$

In order to calculate this equation, $\left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]^{-1}$ it is done fuzzy addition of *m* number of extended analysis values $\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j} = \left(\sum_{i=1}^{n} l_i, \sum_{i=1}^{n} m_i, \sum_{i=1}^{n} u_i\right)$ and $M_{gi}^{j} (j = 1,2,\dots,m)$ fuzzy addition is done for this equation. Thereafter,

$\left[\sum_{i=1}^{n}\sum_{j=1}^{m} M_{gi}^{j}\right]^{-1} = \left(\frac{1}{\sum_{i=1}^{n} u_i}, \frac{1}{\sum_{i=1}^{n} m_i}, \frac{1}{\sum_{i=1}^{n} l_i}\right)$ for calculating this vector

$\left(\sum_{i=1}^{n} l_i, \sum_{i=1}^{n} m_i, \sum_{i=1}^{n} u_i\right)$ the inverse of the vector.

Step 3: $M_2 = (l_2, m_2, u_2) \geq M_1 = (l_1, m_1, u_1)$'s probability degree;

$$V(M_2 \geq M_1) = \sup_{x \geq y} \left[min\left(\mu_{m_1}(x), \mu_{m_2}(y) \right) \right], \quad (2)$$

is defined above and might be stated as below.

$V(M_2 \geq M_1) = hgt(M_1 \cap M_2) = \mu_{m_2}(d)$

$V(M_2 \geq M_1) = 1$ if $m_2 \geq m_1$

$V(M_2 \geq M_1) = 0$ if $l_1 \geq u_2$

$V(M_2 \geq M_1) = hgt\,(M_1 \cap M_2) = \frac{l_1 - u_2}{(m_2 - u_2) - (m_1 - l_1)}$ other situations.

The value of the d is the highest point of intersection between μ_{m_2} and μ_{m_1}.

Step 4: The degree possibility for a convex fuzzy number to be greater than k convex fuzzy numbers M_i (i=1,2,….,k) can be defined by:

$$V(M \geq M_1, M_2, \ldots, M_k) = V[(M \geq M_1), \ldots, (M \geq M_k)] = \min V(M \geq M_i)$$

Possibility degrees which was measured before,

$d'(A_i) = \min V\ (Si \geq Sk)$ if it is expressed in this manner,

k=1,2,….,n for $k \neq i$, W' the weight vector is given as below,

$W' = (d'\ (A_1), d'(A_2), \ldots, d'\ (A_n))$ T and where consist of n elements.

Step 5: It is revealed the significance level of decision elements' after normalizing the weight vector and it is represented as below:

$$W = (d(A_1), d(A_2), \ldots., d(A_n))\ T \quad (3)$$

3. Application

In this study, it is aimed to reveal the factors that threaten OHS at the ports and to determine the level of cognitive significance of these elements by using Fuzzy AHP method. In this section it will be evaluated what the factors of the subject are. In addition, the qualifications of the experts that we consulted will be tried to express. Finally, findings will be evaluated.

3.1. Problem Description

Occupational accidents at the ports slow down the density of the load flow along the port area and may even stop for a short time. In this research, the factors that affect these accidents were determined by exploiting both the literature [3; 4; 8; 9; 10] and the opinions of the port employees who work in OHS department of the Turkish major ports, as a result of preliminary interview. Among the whole factors, homogeneous ones were brought together same main factors. Accordingly, the labor factor which is regarded as one of the vital factors in the port area, may cause these accidents. Behavioural or educational deficiencies and unconformity with job of employee may threat the OHS at ports. Moreover, the lack of periodic maintenance and control of equipment and vehicles that play a significant role in cargo, also cause occupational accidents. Various precautions that are not taken against occupational accidents at the port area which are irregular stowage, the roads that have not traffic signs, etc may cause occupational accidents. On the other hand, all the deficiencies that may negatively affect the coordination among all stakeholders within port area, is a vital threat for OHS. In this paper, the main and sub-factors that induced occupational accidents at the ports are considered and are presented in Table 3.

It is quite important to define set of factors which can cause the occupational accidents in ports. So the factors threaten OHS at ports which are determined by exploiting both the literature and the opinions of the port OHS department employees, were defined in detail and showed in Table 4.

***Table 3.** Factors That Threaten the OHS at Ports*

Labor Induced	Vehicle, Equipment Induced	Facility Induced	Coordination Deficiency Induced
• Unconscious Behaviours	• Lack of Periodic Maintenance	• Undivided Roads in Port	• Inter-Department and In-Department Communication Gap
• Unconformity with the Job Description	• Over Capacity Usage	• Irregular Stowage in Area	• Communication Gap Between Harbour Pilot and Master
• Non-compliance with the Job Hierarchies	• The Condition of the Handling Equipment	• Intersection of Road and Railway	•cDeficient or Wrong Job Description Declaration
• Lack of Attention	• Failure to Take Required Precautions during Repair and Maintenance	• Failure to Clean Slippery Roads	• Lack of Regular Training
• Inexperience of the Employees	• Failure to Control the Lashing Stage	• Failure to Consider Dangerous Goods Separation	• Inadequate Information on Port Operations of Subcontractor Companies
• Overconfidence and Disengagement	• Failure to Control the Leaky Cargoes	• On-going Construction in Port	

***Table 4.** Factors and Its Definitions*

	Factor Name	Definition
Labor Induced Factors	Unconscious Behaviours	Non-compliance with OHS protocols
	Unconformity with the Job Description	Employee-job mismatch
	Non-compliance with the Job Hierarchies	Superior-subordinate miscommunication
	Lack of Attention	Disregard for work
	Inexperience of the Employees	Inexperience to port specific works
	Overconfidence and Disengagement	Lack of concentration due to overconfidence
Vehicle, Equipment Induced Factors	Lack of Periodic Maintenance	Late or irregular maintenance
	Over Capacity Usage	Load exceeding vehicle capacity
	The Condition of the Handling Equipment	Operation adequacy of the handling equipment
	Failure to Take Required Precautions during Repair and Maintenance	Non-compliance with OHS protocols while repairing loading – unloading cranes
	Failure to Control the Lashing Stage	Problems due to unsupervised lashing operations
	Failure to Control the Leaky Cargoes	Oil spill or any other leaks, pollutions due to lack of control
Facility Induced Factors	Undivided Roads in Port	Complexity due to lack of appropriate roadside sign
	Irregular Stowage in Area	Irregular stowage that blocks the roads
	Intersection of Road and Railway	Problems due to intersecting roads of different modes
	Failure to Clean Greasy Roads	Problems due to inability to take precautions against leakage of port equipment and vehicles
	Failure to Consider Dangerous Goods Separation	Non-compliance with IMDG Code protocol while stowing dangerous goods
	On-going Construction in Port	Problems due to inability to insulate the construction area
Coordination Deficiency Induced Factors	Inter-Department and In-Department Communication Gap	Plan-practice discrepancy due to miscommunication in stowage area
	Communication Gap Between Harbour Pilot and Master	Nautical problems due to miscommunication between shore side and ship
	Deficient or Wrong Job Description Declaration	Lack of complete notification related to operation to interested employees
	Lack of Regular Training	Ignoring in-company training courses
	Inadequate Information on Port Operations of Subcontractor Companies	Conflicts between subcontractor companies and terminal operator on port-specific operations

3.2. Determining of the Experts

A questionnaire form was developed to compare main factors with each other and the sub factors with homogeneous ones occupy in same group. This questionnaire was implemented to the OHS Experts of the 8 ports which are located in various regions of Turkey. Ports where the experts worked, are located in key points of the Turkey, they have also active role in both bulk cargo and container trade. According to the Turkish Port Sector Report published by Turklim [23], ports approached as a sample in this study constitutes 7.19% share of the total bulk cargo handling market and also constitutes 45.3% share of the container handling market. Approximately 45% of the experts who involved in study have A class license of OHS and the same rate goes for experts have B license. 55 per cent of the experts have master's degree as well. In this research, the experts were tried to be expressed their qualifications by the help of the profile features mentioned above.

3.3. Application of Proposed Method

Factors that affect the occurrence of the accidents are revealed and shown in Table 3 by considering the occupational accidents in the ports. A questionnaire form was generated based on the comparison of these factors. This form was implemented to the OHS Experts that work in the leading ports of Turkey. According to the opinions of the experts, it is obtained the pairwise comparison matrices of the factors were solved by Chang's Extended Analysis Method which is most widely used in the literature as a version of Fuzzy AHP. Accordingly, the factors that threat OHS in the ports are compared by their perceptual importance. This situation gives an idea of which negligence or deficiencies in Turkish ports may evoke accidents. In this study, the perceptual priority level of the factors is evaluated by the determined experts. As a result of the evaluation, priority analysis among the main factors, either in-group scores and ranking or general scores and ranking of the sub-factors are shown in Table 5.

When examining Table 5, it is seen that 'Labor Induced' factors stand out with 0.386-point score and 'Coordination Deficiency Induced' factors followed it with 0.246-point score among the main factors. On the other hand, when the priority status of the sub-factors considered, it is understood that 'Overconfidence and Disengagement' and 'Lack of Attention' factors come into the prominence which are included in 'Labor Induced' factors. Besides, it is also seen that the sub-factors named as 'Inter Department and In-Department Communication Gap' is perceived as more important than the others among the 'Coordination Deficiency Induced' factors. When the sub-factors of the 'Vehicle, Equipment Induced' are examined, it is revealed that the factors named as 'Failure to Take Required Precautions during Repair and Maintenance' is more dominant than the other sub-factors. However, any of the sub-factors under the main criterion named as 'Facility Induced' was not perceived significantly more important than the others. As a result of the calculation which is made by taking into consideration on the main factors weights of the sub-factors, the overall weight scores of the sub-factors and their ranking within all the factors are revealed. Thus, factors which are 'Overconfidence and Disengagement', 'Inter-Department and In-Department Communication Gap', 'Lack of Attention' and 'Failure to Take Required Precautions during Repair and Maintenance', were perceived as much more prior reason causes accidents in port area.

4. Conclusion

OHS performance of the ports is the rising value today's logistics world. *Antao et al.* [8] investigated 526 ports'

Table 5. *Perceptual Priority Level of the Factors*

Key Criterion Name	Key Criterion Score	Code	Sub Criterion Name	Weight among Group Members		General Weight	
				Score	Rank	Score	Rank
Labor - Induced	0,386	L1	Overconfidence and Disengagement	0,517	1	1,196	1
		L2	Lack of Attention	0,469	2	1,085	3
		L3	Unconscious Behaviours	0,014	3	0,032	13
Coordination Deficiency Induced	0,246	C1	Inter-Department and In-Department Communication Gap	0,892	1	1,097	2
		C2	Incognizance of the Subcontractor on Port Operation	0,108	2	0,133	9
Vehicle, Equipment Induced	0,209	V1	Failure to Take Required Precautions during Repair and Maintenance	0,753	1	0,944	4
		V2	Lack of Periodic Maintenance	0,134	2	0,168	8
		V3	Over Capacity Usage	0,089	3	0,112	11
		V4	The Condition of the Handling Equipment	0,023	4	0,029	14
Facility Induced	0,159	F1	Irregular Stowage in Area	0,297	1	0,284	5
		F2	Undivided Roads in Port Area	0,242	2	0,232	6
		F3	Failure to Clean Slippery Roads	0,237	3	0,227	7
		F4	Failure to Consider Dangerous Goods Separation	0,135	4	0,129	10
		F5	On-going Construction in Port	0,089	5	0,085	12

OHS performance from the perspectives of occupational health, safety, security and environment together. They listed relevant indicators that focus on casualties and accidental damages to reveal OHS performance metrics of the ports. However, this study focused on particularly pre-accident process. Accordingly, this study tried to present foresight to develop OHS performance of the ports by asking for advice from very experienced OHS experts.

The place of human factor in OHS applications is undeniable. Hence, overconfidence, lack of attention and lack of communication may cause critic problems for OHS. In this research, it is obviously seen that the most effective factors are human induced. In this context, it is also seen that 'Overconfidence and Disengagement' is the most probable factor. In addition to this, communication between the departments have vital role to sustain the port operations. It is known that communication gap between departments, sudden deficiencies may induce important occupational safety problems. According to the results, the experts especially draw attention to this aspect of port coordination. Apart from this, it is stated that many occupational safety problems are encountered due to facility and equipment deficiency.

In this research, the human factor and communication factor came into prominence among the whole factors that threaten OHS at ports. At this point, in order to reduce the impact of the human factor in occupational accidents at the ports, it is very important to pay attention to the concept of ergonomics, which describes the presentation of a business environment that conforms to human physical and psychological characteristics. In this sense, it is necessary to offer an individual job description, suitable equipment for employees and work environment motivating employees in a psychologically. On the other hand, considering the global trade flow in these days, the importance of speed either in port operations within the port or through the hinterland is increased significantly. Therefore, inter-department and in-department instant communication has vital role for safe implementation of accelerated port operations, as emphasized in this study. In order to decrease these deficiencies, it can be considered the use of information technologies and moreover artificial intelligence may be used for optimization. Besides, each criterion stated in this paper should be considered as a factor and the precautions against these factors should be taught to employees through regular trainings. Furthermore, inspecting and auditing these regular training is as important as the provided training.

This study brings a new perspective towards OHS at ports. Instead of focusing on accidents or accident precautions within the port area, the factors that may cause accidents were focused on. Factors that revealed in this study provide a framework in regard to causes of the port area accidents and come into prominence as a main contribution of the study. This study also reflects the opinions of OHS experts, who are specialized in ports, on the causes of occupational accidents. Therefore, the results of the study can directly express the challenges that threaten OHS in the port area. This study provides a basis for further studies in order to combine the opinions of OHS experts and taking precautions process against occupational accidents in the port area. In further studies, the number of factors and the number of experts can be increased and thus the subject can be evaluated in a wider framework.

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