

SAFETY PERFORMANCE INDICATORS IN THE METALLURGICAL INDUSTRY USING WEB PROGRAMMING

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Sustainable development has a significant impact today in Romania and worldwide. In this context, risk assessment becomes mandatory for enterprises. This paper analyzes the situation of occupational risks in the metallurgical industry in the European Union, Romania, and the United States and highlights the main causes for work accidents in Romanian metallurgical industry. The analysis covers the period 2010 - 2016. The data collected from Romania is compared to the data related to the European Union and the United States. Moreover, the paper aims to present an occupational risk assessment tool, which is customizable for each area of activity. The last section of the paper discusses the research results and limitations.

Key words: metallurgical industry, risk, accidents, Romania, world

INTRODUCTION

The complexity of the activities carried out in the metallurgical industry requires the use of a risk assessment framework [1,2]. There are several tools and methodologies for this purpose, such as DACAR, CARE, OIRA [3 - 5]. Even if the first step in artificial intelligence was taken in 1961, using cloud computing has gained widespread popularity in industry and academia [4]. Therefore, this paper aims to identify the trajectory of metallurgical industry in terms of occupational risks, for the period 2010 - 2016. The collected data for 2016 are for the first 6 months.

OCCUPATIONAL RISKS IN ROMANIA BETWEEN 2010 - 2016

Current statistics estimate that there are about 160 million occupational disease cases every year worldwide, 30 – 40 % of these evolving towards chronic conditions, and 10 % causing permanent incapacity for work. Starting from the total number of work accidents in Romania, this section presents below evolution of accidents in the metallurgical industry, in order to highlight the rate of occupational risks in this sector. Figure 1 shows the evolution of work accidents in Romania.

The figures for 2015 are 12 % lower than those for 2010. This may be due to the evolution of technology; currently, there is a permanent concern for the development of healthy work places that contribute to sustainable development (SD). In terms of the frequency index, the situation in Romania is shown in Figure 2 [3]. In 2014, F_i was 0,75 ‰ for the total number of injured

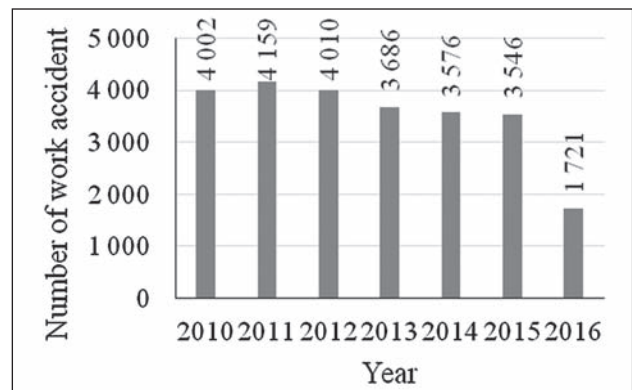


Figure 1 The evolution of work accidents in Romania between 2010 - 2016 [3]

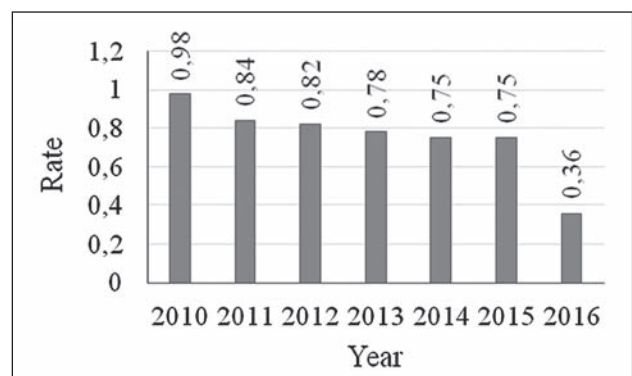


Figure 2 The frequency index of accidents in Romania between 2010 - 2016 [3]

people, 23 % lower than in 2010, when it was 0,98 ‰. The decrease in F_i is due to a fall in the number of accidents, but also in the number of workers.

The frequency index, F_i , is defined as the number of injured people per 1 000 workers:

$$F_i = \frac{\text{"Work accident"}}{\text{"Number of workers"}} * 1\ 000 \quad (1)$$

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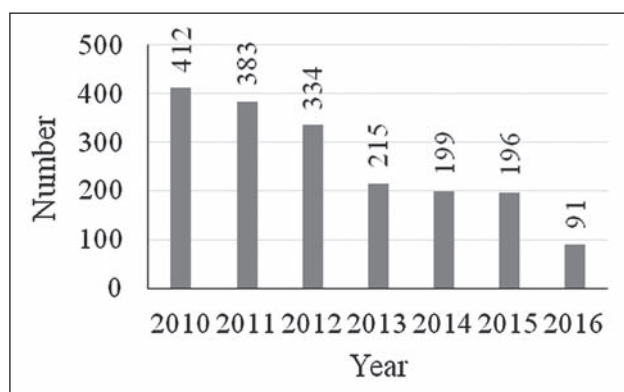


Figure 3 The evolution of fatal accidents at work in Romania between 2010 – 2016 [3]

The number of fatalities decreased, reaching a value of 196 in 2015. In 2013, there were 215 fatalities, 35,6 % less than in 2012, when there were 334 fatalities, Figure 3. The frequency index of fatal incidents, F_{i_f} , has been defined as the number of fatalities per 1 000 workers:

$$F_{i_f} = \frac{\text{“Incident fatalities”}}{\text{“Number of workers”}} * 1\ 000 \quad (2)$$

Table 1 shows an overview of work accidents in the metallurgical industry. The data highlights that the number of accidents at work has been decreasing as of 2012. In 2015, there were fewer work accidents than in 2012 by 33,6 %. Most work accidents occurred in 2011, i.e. 111. In terms of fatal work accidents, there is no downward trajectory, but a series of irregular variations; the highest figure was recorded in 2013, i.e. 6 deaths. In 2013, there were 6 fatalities, accounting for 2,8 % of the total number of fatalities in the entire Romanian economy, 100 % more than in 2012, when the number of fatalities was 3. For the first six months of 2016 the number of fatalities is 1.

OCCUPATIONAL RISKS IN THE WORLD

European work places are undergoing constant development under the influence of economic, social and environmental changes. The situation of work accidents in the European Union (EU) metallurgical industry is shown in Table 2, section A [6].

In the United States (U.S.), severe occupational injuries and illnesses decreased to a rate of 108,7 cases

Table 2 Work accidents in the metallurgical industry in the European Union and United State between 2014-2016 [1, 6]

Section A - European Union			
Dimension	2014	2015	2016
NAW / No	13 300	13 280	6 213
NAW / %	13,1	12,9	5,7
F_i / ‰	2,5	2,45	1,46
NAF / No	600	601	-
NAF / %	2,55	2,57	-
F_{i_f} / ‰	0,11	0,12	-
Section B – United State			
	2014	2015	2016
NAW / No	6 533	6 509	3 116
F_i / ‰	17,1	16,8	7,34
NAF / No	267	256	-
NAF / %	0,06	0,05	-
F_{i_f} / ‰	0,7	0,65	-

Table 3 OnRisk Platform

Settings	<input type="checkbox"/> Edit hazard			
New category	Category	Hazard		
New question	Interaction	1100111		
New statistics	Mechanical	1011111		
Edit statistics	2th version	New version		
Description				
Hazard 1100111	-The company does not assess the hazards in each department			
Hazard 1011111	- The company presents defective procedures regarding the use of metallurgical equipment			

per 10 000 full-time workers for the private sector and state/local government in 2014. The situation of occupational risks U.S. metallurgical industry is shown in Table 2, section B.

COMPUTATIONAL MODEL

In a previous research project [5], it was conducted a comparative analysis of the risk assessment methods used today. For the development of the OnRisk Web platform, was used the WampServer and Xampp development web environment. The OnRisk platform integrates the following scripts: identification, evaluation, treatment, report and innovation (Table 3). The applications are hosted by a cloud service provider.

Table 1 Work accidents in the metallurgical industry in Romania between 2011 – 2016 [3]

Dimension / Value		2011	2012	2013	2014	2015	2016
NAW	Value	111	107	100	74	71	28
NFA	Value	4	3	6	5	5	1
	Percentage / % of NAW	3,6	2,80	6	6,75	7,04	3,57
F_i / ‰		1,87	1,74	2,80	2,30	2,21	0,91
F_{i_f} / ‰		0,06	0,05	0,17	0,16	0,16	0,032
Total number of employees in the metallurgical industry		59 213	61 259	35 757	32 050	32 015	30 540
Total number of employees in Romania		-	4 840 322	4 693 585	4 753 821	4 749 799	4 821 131

Legend: F_i - frequency index, F_{i_f} - frequency index of fatal incidents, NAW - Number of accidents at work, NFA - Number of fatal accidents

RESULTS AND LIMITATIONS

The downward trajectory of work accidents is the result of the SD actions adopted [5 - 8]. In 2014, the number of accidents at work is significant in the three areas analyzed (Romanian, the EU, and the USA). F_i , does not follow a downward trajectory in the areas analyzed, but an irregular one, with ups and downs. Romanian's trajectory is similar to the one of the EU in term of the values of F_i and F_r . During the past few years, EU has seen a decline in the number of fatalities, but there still remain many severe accidents at work [9,10].

The limitations in the analysis are restricted to the lack of data related to Romania and to cases of undeclared work.

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Note: The responsible translator for English language is Ioana Matiu, Sibiu, Romania