

Research Article

Analysis of Occupational Accidents in a Lower-Middle-Income Economy, North Macedonia During the Period 2014 -2019**Michail Chalaris^{1,*}, Orce Popovski², Mitko Bogdanoski² and Nikola Kletnikov²**¹*Department of Chemistry, School of Sciences International Hellenic University, St Loukas, GR-654 04 Kavala, Greece*²*University 'Goce Delcev' – Stip Military academy 'General Mihailo Apostolski' - Skopje- associate member, 16 Orce Nikolov Str., 1000 Skopje, Republic of North Macedonia*

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Abstract

This study aims to analyse the occupational accidents in the Republic of North Macedonia as a “lower-middle-income economy” during the period 2014-2019. In line with the theoretical findings and other similar state cases, the available data, and the subsequent analysis there of demonstrate that North Macedonia possesses a workplace environment that is more vulnerable than that of other countries when it comes to occupational accidents. The case of North Macedonia indeed provides a prominent example of change in the national economy and legal framework, while exhibiting certain deficiencies, common to “lower-middle-income” economies that could potentially be improved or eliminated.

Keywords: Occupational Accidents, North Macedonia, Lower-Middle-Income Economies, Risk Management, 2014-2019

1. Introduction

Several studies have been conducted in order to identify and analyze the causes of hazards and safety risks at work using different methods of accident investigation. In fact, descriptive studies of occupational accidents and their causes are prevalent in bibliography from various disciplines, industries, and parts of the world. Some focus on purely technical approaches and fatalities in the European industrial sector [1], while others present the occurrence of workplace accidents in the environment of smaller construction enterprises in Asia, using descriptive statistics [2]. Also, a few studies analyze the socio-economic impact of certain types of accidents that occur in the workplace and the burden they incur [3], [4].

Occupational accidents have been a topic of interest for the World Health Organization and the International Labour Organization as well. The WHO defines an occupational accident as an unplanned and unanticipated event [5]. “The ILO also defines occupational accidents as unanticipated and unplanned events that cause a certain damage or injury [6]. The occupational accidents and incidents have been enlarging in parallel to developing industries despite of implementing the safety strategies in workplaces. Therefore, their consequences are often unpleasant. The human costs and socio-economic impacts of occupational and industrial accidents are huge around the world. In many cases there's not enough information or the available information concerning these events isn't accessible from all countries within the world [6]. Every year happen over 264 million industrial accidents with over 350,000 mortalities, globally [5].

Interestingly, although more than half of these mortalities occur in developing countries, the estimation of accident costs is especially difficult in these countries. For example,

according to the Iranian Ministry of Labor [3], 43% of all occupational injuries annually occur to workers who are under the supervision of this Ministry. Occupational injuries are mainly the result of poor work conditions as well as of individual faults. In every country, a great amount of money is devoted annually to the compensation of workplace-related disabilities and to the payment of workplace-related diseases. The main causes of occupational accidents include untidiness, noise, too hot or cold environments, old or poorly maintained machines, and lack of training or carelessness of employees [5,6].

The present study aims to analyze occupational accidents in lower-middle income economies, through the thorough examination of the North Macedonia case. Relevant bibliography has failed to effectively categorize “lower-middle income” economies. However, the majority of researchers agree that whichever the term used each time, some state economies possess an industrial environment that is more vulnerable than that of other countries when it comes to occupational accidents. Proper risk management does not always incur direct costs; however, the change management behind it, does. Thus, the case of North Macedonia during the period 2014-2019 was chosen to shed light on the research question, as it provides a prominent example of change in the national economy and the legal framework, while exhibiting certain deficiencies that could potentially be improved or eliminated.

Risk management refers to a cognitive function relying on the inherent perception of danger and on the fact that the human brain is programmed to respond to conscious or unconscious threats. Making decisions, from the greatest to the simplest, means taking risks and taking risks leads to risk management. Several questions are related to taking risks, with regards to the amount someone is willing to take, the amplitude of individuals affected by one's risks, the tolerance rate one has; several questions also rise related to risk management, regarding the objectives, the procedure or the

*E-mail address: mchalaris@chem.ihu.gr

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methods. As the perception of risk is often personal and subjective so are the established criteria related to its management. It has been only recently that initiatives have been taken to perceive risk management practices not only on a universal basis, but also through broader collaboration between different social actors [7].”

As per the EU Community’s established criteria, Trbojevic [8] presents in its paper the different approaches currently in place, with the ultimate scope of establishing universal risk management approaches at international and social level in the same context as Seveso II. To do so, Trbojevic demonstrates the different perceptions regarding risk management practices in different countries as well as their individual or social orientation by choosing the case study of living nearby a potentially hazardous installation and the danger that it implies for human life.

The author presents three main categories of risk criteria that include setting a goal risk level without specifying ways to achieve it, a hybrid of prescriptive and goal-oriented policies and strict prescriptive models’ approach in order to attain zero risks. The categorization relays respectively on the case studies of the UK, the Netherlands, and France, among other countries, whereas the societal risk perception is also taken into account.

Moreover, the writer points out the various levels of risk tolerability moving in-between intolerable level, and negligible level not arising any individual or public concern, which reflect the case of Germany, France or the UK.

Any categorization of Trbojevic relies on cultural differences and various social representations of risks and risk management, including economic parameters that interfere with their value systems.

Another key concept, the risk matrices is stressed out to not be used to determine the ALARP nature of risk. Regarding the latter, this can vary in both quantitative and qualitative ways whether good practice has been exercised against it or by conducting a cost-benefit analysis [9].

However, in a globalized approach, and with the aid of technology progress, new frameworks like Seveso II emerge even though a lot is yet to be achieved, particularly harmonizing legal framework across Europe, or establishing a common risk measurement inventory with harmonized data from various models that would help identification and classification of both quantitative and qualitative features of a known risk, reaching zero casualties due to hazards.

The decisive factor that represents human error is treated by Duffey and Saull’s [10, 11] research on risk assessment in industries. Always present, despite the effort for flawless operations, the human error seems to be responsible for incidents and casualties regardless of the technological evolution one would think that might have lead to a further decrease in casualties.

Based on the Duffey-Saull Method, researchers underline the importance of learning from errors as the most effective measure to reduce them, whether they refer to industry or individual risks [12-15].

Considering all the above, a stable and uniform legal, educational, and economic environment is required for risk reduction, resulting in subsequent occupational accidents reduction. Often, the above incur significant costs, even when an accurate Cost Benefit Analysis (CBA) is performed. As a concluding remark, Carlton [7] pinpointed that low and middle-income countries exhibit higher rates of occupational accidents and fatalities as a result of the constricted sums they devote in risk avoidance learning and the unstable overall

environment that typically accompanies such economies with regards to state and legal organization.

The theoretical background surrounding the workplace environment and the accidents that may occur therein are presented in previous paragraphs. In analogy with the given case, other cases of similarly structured states are mentioned. In the next sections, the case of North Macedonia is going to be thoroughly analyzed in terms of its economic and legal framework. This framework shapes the environment in which occupational accidents occur. The case is complemented by a statistical analysis of raw data by the State Statistical Authority of North Macedonia, using SPSS 27 by IBM. After discussion of the results, a series of conclusions and recommendations are posed, in view of future action and further research.

2. Methods And Materials

2.1. Case Study Background

As of 14 February 2019, the country’s official name is the Republic of North Macedonia (North Macedonia), formerly recognized by the UN as the FYRO Macedonia. North Macedonia joined NATO in March 2020 and is on course to start the accession negotiation process for joining the EU. The latest changes in political governance were made in July 2020 and the newly constituted parliament elected the government in August 2020. The population of North Macedonia has remained relatively stable over the last ten years, rising from 2.03 million in 2004 to 2.08 million in 2020, which represents 0.03% of the total world population. This slow growth is partly due to an ageing population. Based on statistics from the International Monetary Fund’s World Economic Outlook Database, North Macedonia ranks 131st out of 230 countries in the world in terms of GDP. The export of goods and services as a percentage of GDP is 61.69%, compared to the 30.62% global average, based on the World Bank national accounts data, and the Organization for Economic Cooperation and Development (OECD) National Accounts data files for 2019 [16].

Due to its overall somewhat turbulent environment, North Macedonia is considered a “lower-middle” income country for the purpose of the present paper. Actually, “according to ILO [6], North Macedonia is an upper middle-income country with a service-oriented economy that has made great strides in reforming its economy over the last decade, but further efforts are still needed to generate economic growth and improve living standards for all. The industry in North Macedonia significantly contributes to the economic development in the country and is one of the most developed and diversified sectors of the country’s economy in terms of production, employment, and export earnings. For example, the garment industry is the second largest industrial sector after metallurgy, and accounts for 2.3% of the gross domestic product (GDP) [17]. The unemployment rate has been falling for almost 14 years and was projected to reach 16.8% in 2020. In 2019, the economy added almost 40,000 jobs, bringing the activity rate to 54.7%. This represented a major shift compared to the previous decade (2009-2018), when an average of 14,600 jobs were added each year, mainly in manufacturing, construction, hotels and restaurants, and public administration. The employment rate rose from 44% in 2017 to 45% in 2018 and 47% in 2019, with new jobs created in 2018 and 2019 mostly in manufacturing, support services, art and recreation, transport, and trade. Nevertheless, the employment rate remains below the EU27 (the average rate

of the 27 EU Member States) which is 68.4%. Youth unemployment has been falling steadily but slowly over the years, falling by more than 12 percentage points to 34.9% between 2015 and the first quarter of 2020. This is a result of the introduction of the state Youth Guarantee scheme, but also of emigration. Around 80% of the unemployed are long-term unemployed, largely due to the mismatch between skills supply and skills demand [18].

The study database consisted of occupational accidents reported with an outcome defined as death or serious injury during 2014–2019 in the Republic of North Macedonia.

Tables 1, 2 and 3 show the occupational accidents causing death or injury of employees in the Republic of North Macedonia by gender, age, month of the year and day of week during the period of study [19].

North Macedonia is continuously harmonizing its legislation with the EU, with a focus on strengthening democracy and the rule of law. The legal framework for labour in North Macedonia is well developed and the country has ratified related International Labour Organization (ILO) conventions [6].

Table 1. Occupational accidents causing death or injury at employees of Republic of North Macedonia of gender and different ages, 2014–2019.

Gender & Ages	Year												Total	
	2014		2015		2016		2017		2018		2019			
	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths
Male	85	39	105	35	94	18	129	24	124	33	150	24	687	173
Female	3	3	0	4	0	1	5	0	0	0	3	1	11	9
under 18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-24	1	2	4	2	3	0	4	1	8	1	5	0	25	6
25-34	3	8	66	7	9	0	28	1	14	5	27	3	147	24
35-44	7	4	19	11	6	2	14	4	20	3	23	7	89	31
45-54	8	6	2	9	11	7	22	8	19	8	39	8	101	46
55-64	2	10	4	4	7	7	12	4	19	7	28	5	72	37
above 64	1	6	2	1	4	3	4	5	6	4	9	2	26	21
unknown	66	6	8	5	54	0	50	1	38	5	22	0	238	17
Total	88	42	105	39	94	19	134	24	124	33	153	25	698	182

Table 2. Occupational accidents causing death or injury at employees of Republic of North Macedonia by months of the year, 2014–2019.

Month of the Year	Year												Total	
	2014		2015		2016		2017		2018		2019			
	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths
January	2	1	1	2	6	1	3	0	6	2	19	1	37	7
February	17	1	4	3	6	1	9	2	3	0	10	3	49	8
March	6	3	5	1	9	1	7	4	8	5	13	1	48	15
April	2	3	3	3	31	4	33	3	8	3	23	3	100	19
May	1	4	76	12	7	1	10	0	15	3	9	3	118	23
June	11	1	2	5	16	2	12	1	18	3	8	4	67	17
July	7	13	2	4	1	1	11	3	13	2	6	1	40	24
August	8	4	2	3	5	2	8	0	12	4	6	1	41	14
September	15	3	2	1	1	1	8	2	11	2	6	1	43	10
October	8	5	3	1	7	2	14	5	16	3	24	3	72	19
November	8	1	4	2	2	3	7	2	7	1	19	2	47	12
December	3	3	1	2	3	0	12	2	7	5	10	2	36	14
Total	88	42	105	39	94	19	134	24	124	33	153	25	698	182

Table 3. Occupational accidents causing death or injury at employees of Republic of North Macedonia by days of the week, 2014–2019.

Day of the Week	Year												Total	
	2014		2015		2016		2017		2018		2019			
	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths	Injuries	Deaths
Monday	12	5	11	4	14	4	31	5	15	4	23	2	106	24
Tuesday	19	5	40	6	13	5	19	2	14	6	29	5	134	29
Wednesday	7	4	5	4	7	5	18	4	21	6	36	3	94	26
Thursday	11	16	6	5	4	1	26	5	19	4	20	1	86	32
Friday	12	3	4	10	19	2	12	2	28	7	17	2	92	26
Saturday	9	4	12	3	6	1	19	4	14	4	18	9	78	25
Sunday	18	5	27	7	31	1	9	2	13	2	10	3	108	20
Total	88	42	105	39	94	19	134	24	124	33	153	25	698	182

Since 2005, the Labour Law has been amended several times and a number of labour regulations have been amended in recent years. The new Labour Law will be introduced in 2021. Since its independence, the Republic of North Macedonia, by acquiring the EU membership candidate status, and up until now has introduced many amendments in

the legislation relating to defining workers' rights and creating effective mechanisms for their protection. In the given period of transition, the amendments are visibly restrictive for the solutions contained in the legislation of the previous system. However, by amendments of the legislation, aligning the European and global standards contained in the

EU legislation, as well as the legislation of the International Labour Organisation (ILO) and the Council of Europe, in a formal-juridical manner, a positive step forward was made offering relatively higher control and higher protection of recognized workers' rights. The international standards on protection in the workplace are primarily set out by ILO in the form of conventions and recommendations that the member states should ratify and apply in their respective national legislations. In regard to the protection of workers' rights and creation of basic work conditions, ILO has envisaged three basic conventions that are mandatory for the member states. These include: the Occupational Safety and Health Convention No. 155 of 1981, the Occupational Health Services Convention No. 161 of 1985 and the Promotional Framework for Occupational Safety and Health Convention No. 187 of 2006. So far, the Republic of North Macedonia has ratified 80 ILO conventions, including these three basic conventions, and has applied those in its national legislation in the package of laws for protection of workers' rights and work conditions. Also, the Republic of North Macedonia has partially implemented the revised European Social Charter in the areas of employment, social protection, equal opportunities, protection in unemployment, right to collective protection and collective negotiation, as well as in the area of safeguarding the rights of children, young people and female workers on maternity leave.

Although labour legislation tends to be stricter than in other countries, getting the industry to comply with and enforce these regulations is a challenge. A basic problem that the state is facing is that in the majority of cases, the practice does not follow these changes and the transposition of international standards is not manifested in the factual protection of workers' rights, especially regarding occupational safety and health. The transposition of EU directives in the North Macedonian labour legislation is at its outset. Seemingly, already a great part of areas has been covered, but the practice shows a great extent of legal omissions and inconsistencies. The Law on Labour Relations contains gaps and vagueness in regard to the protective mechanisms in the cases of violations relating to the payment of salaries and the right to strike.

On the other hand, the necessary supplementary alignments with the European directives have not been made, as recommended by the EU-OSHA, regarding for instance, the guidelines on higher prevention and protection of workers from occupational diseases, the protection while being exposed on electro-magnetic radiations and chemical agents, as well as the general negative impact of technology on their health. The LLR and LOSP do not take into account the capacities of the small-size and micro enterprises for occupational hazard assessment and improvement of the protection of workers in their workplaces, and of those who are at high risk of occupational diseases. In the laws as such, no manners and entities have been identified that may provide support to these enterprises. Amendments are needed also to the Law on Business Associations so as to ensure: representation of workers in the decisions adopted by enterprises, reduction of the period of systematic medical checks, with a special emphasis given on the work positions where the percentage of injuries is higher and on the adoption of legislation for establishment of workers' councils. Also, no specific solutions are offered within the EU, relating to the protection mechanisms and tools, but there is insistence on the existence of effective and efficient protection means, which implies available and appropriate procedures, quick resolution of disputes and dissemination of information to

workers on the possibilities of protection they have at their disposal. At national level, there are various types of procedures, 40 of which in the legislation, are used either separately, or complementarily. An important aspect in determining effectiveness of protection rests in measuring the protection mechanisms for workers.

Furthermore, lack of fixed working hours, overtime without proper compensation, and tax evasion are common labour risks in the industrial environment. Furthermore, the lack of effective enforcement of labour legislation, social dialogue, and the right to freedom of association are widespread concerns in the sector. Labour productivity has not grown fast enough in recent years to ensure rising wages and improved living standards. Although the World Bank's Regular Economic Report indicates that average gross wages increased by 4.1% in 2019, a large proportion of workers in labour-intensive sectors such as textiles (34.7%) are receiving the minimum wage. From the outset, the introduction of a higher minimum wage, especially in industrial environments in 2017, posed certain challenges [17], [20].

According to a research conducted by the World Bank [17], [20], some employers misunderstood the legislation and considered that the minimum wage covers all payments (complexity of work, work performance, overtime, years of service, etc.) to employees and not just the basic wage. This incoherence creates confusion in the overtime payments employees receive. There is no regulation on the exact calculation of overtime payments for workers paid on a piecework basis. This is a general challenge in this sector. For all the reasons described above, the sector is not seen as attractive by young people, and this fact leads to a mismatch in the labour market. Young people are leaving the country in large numbers to seek better paid jobs elsewhere and the sector faces an ageing workforce. Employers have difficulty in finding young workers and they estimate that if this situation does not change, in 10 years there will not be any workers interested in working in "the industrial" sector.

The World Bank [17], [20] and the State Statistical Authority of North Macedonia [18] have interviewed a number of stakeholders to outline the situation. A series of private interviews has demonstrated various results of interest. The Ministry of Economy, the Ministry of Labour and Social Policy (MLSP), the State Labour Inspectorate (SLI), the Economic and Social Council (ESC), the Organization of Employers of RNMacedonia (OEM), the Federation of Trade Unions of RNMacedonia (SSM), the Confederation of Free Trade Unions of RNMacedonia (KSS), the Business Confederation of RNMacedonia (BCM), the Union of Independent Autonomous Trade Unions of RNMacedonia (UNASM), the RNMacedonian Occupational Safety and Health Association (MOSHA), the Helsinki Committee for Human Rights and the Open Gate' – Association for Action Against Violence and Trafficking in Human Beings (La Strada), have all provided significant insights on the situation that gives rise to occupational accidents in the country. They all tend to agree with the aforementioned realities and do point out that the education towards occupational accident prevention is inadequate; along with the unacceptably low wages that do not cover living standards, as well as the omissions and impedances in the public dialogue in North Macedonia, they create an environment that may inhibit proper risk management towards decrease or even elimination of common occupational accidents.

'Strengthening Social Dialogue', is a project funded by the International Labour Organization (ILO) The project's

goal is to improve social dialogue as a means of creating more and better jobs. It supports the participation of social dialogue institutions in policy making at national and local levels, as well as the practice of regular consultations through the national and local ESCs, through: (1) enhanced participation of ESCs in shaping the national economic and social reform agenda; (2) enhanced participation of LECSs in the formulation and implementation of local employment policies; and (3) increased effectiveness of trade unions and employers' organizations. Also, the Friedrich-Ebert-Stiftung in North Macedonia (FES) FES promotes the dialogue, publication, and open forum programs in North Macedonia that may enable the results of the public dialogue on working conditions to be incorporated in national politics. However, there is always room for improvement, as the statistics in the next section showcase [17], [20].

2.2. Research Methodology

As the present research topic lies in the field of safety in LMICs and the existing limitations to the data quality, the author employed the tools and instruments of the mixed-method methodology to attempt to combine the best of both qualitative and quantitative methodologies to integrate perspectives and create a rich picture. The qualitative analysis focuses on namely data collection, document analysis, and single case study. Furthermore, for the present research, primary, secondary, and tertiary literature sources had been used. Tertiary sources were mainly employed to understand how accident data are usually classified and to examine the classification problems encountered. Secondary sources were used to identify key actors in occupational accidents in lower-middle-income economies as well as to understand the components of the proper risk management and complex legal framework and industrial environment related to it.

As primary sources, the author consulted the webpages on the website of the State Statistical Office and Republic of North Macedonian occupational safety and health association. The previous association, in order to obtain complete data on occupational injuries and deaths in North Macedonia for 2014, 2015, 2016, 2017, 2018, 2019, requested official data from Institute of Public Health (PHI), State Labor Inspectorate, Pension and Disability Insurance Fund of Republic of North Macedonia, PHI Institute of Occupational Medicine of R.N. Macedonia - Skopje, Organization of employers in Republic of North Macedonia, Federation of Trade Unions and Confederation of Free Trade Unions of this country.

3. Results And Discussion

3.1. Sample Description

A Statistical Analysis of relevant figures was provided by the State Statistical Authority of North Macedonia, using SPSS

27 by IBM [18],[19]. The data extracted refer to a number of categorized accidents during the period of 2014-2019. In developing countries, despite the limitations to the data quality, analysis of routine data may still reveal important information [21].

In the same vein, we exclude the possibility of reliable results that reflect the actual reality in North Macedonia. According to ILO [6], North Macedonia suffers from a high level of informal employment, mainly as regards seasonal workers. The accidents that occur during their exposure to the workplace environment often go unreported or insufficiently described. In addition, a proper econometric analysis would be difficult to carry out in such circumstances. High-level informal employment has a negative impact on both the economy and working conditions as on the policy-making process too. Low tax revenues, resulting from non-payment of payroll taxes, reduce considerably the government's ability to pursue an efficient policy in terms of social protection and also for the labor market. The extent of the informal economy, combined with the concealment of the salaries of minors, causes particular gaps in the coverage and financing of social security systems. At the same time, workers involved in this work regime and their families remain vulnerable to significant social risks. Employers experience informal employment in a degree of unfair competition and face all unequal conditions it brings: low productivity, lack of innovation, loss of access to finance, the fact that they cannot market their product and ultimately the fact that they have no chance for growth. For workers, their involvement in the informal economy means that they mainly accept low-paid and without agreed terms jobs (in addition to the fact that occupational safety and health standards often do not exist). Informal work excludes any possibility of training and deprives employees of the opportunity to seek better pay in the formal sector. Generally, in informal economy it is difficult to recognize labor rights.

3.2. Statistical Analysis and Discussions

The analysis of the data (as summarized in Table 4) gathered regarding the matter of occupational injuries showed that since 2014 the rates of injuries have almost doubled. More specifically, in 2014 injuries were 88 whereas in 2019 the number has increased up to 153. In regard to deaths reported in the years examined, it was found that the number has decreased a lot (42 deaths in 2014 and 25 in 2019). The decrease of deaths, as shown in Figure 2, reveals a proper risk management being enforced at an early stage [22]. However, the increase in injuries as shown in Figure 1, implies that risk management practices should still be improved. Additionally, an increase in injuries may go hand in hand with an increased number of formally employed workforce. If the latter is true, then a radical risk management improvement is demonstrated in North Macedonia from 2014 to 2019.

Table 4. Presentation of occupational injuries, deaths, and total number of employees by year

ACCIDENTS RATE 2014-2019			
YEAR	INJURIES	DEATHS	TOTAL EMPLOYEES
2014	88	42	696,046
2015	105	39	715,758
2016	94	19	723,550
2017	134	24	745,206
2018	124	33	759,054
2019	153	25	797,651

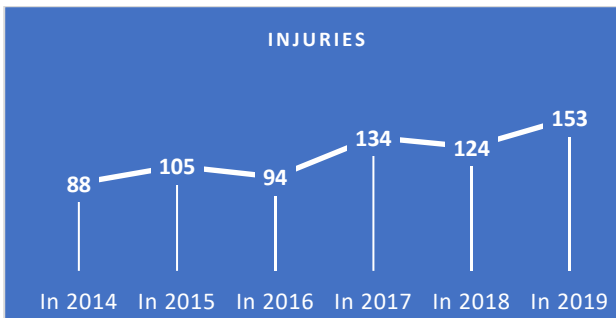


Fig. 1. Presentation of occupational injuries by year.

In the following graph (Figure 3) the same outline of death and injuries rates are presented. Once more, the overall injuries rate seems to be increasing throughout the passing years (2014-2019) whereas death rates seem to be decreasing.

Table 5 shows the overall rate of injuries and deaths regarding the period 2014 to 2019. As it is shown, the rate of injuries increased from 2014 to 2019 whereas the death rates decreased.

Towards this direction, the implementation of more and more EU-related standards, the gradual improvement of public dialogue and perhaps the increase in the national “living wage” may have had a considerable impact.

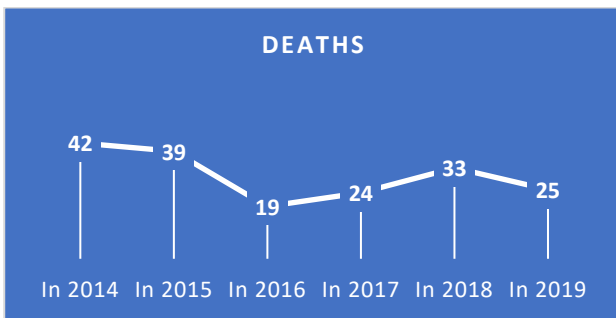


Fig. 2. Presentation of occupational deaths by year

In 2019, according to our data, there were 178 occupational accidents. 25 of which were fatal. Thus, the death rate at work in North Macedonia was 3.13, ie for every 100,000 employees, 3 to 4 employees died. The death rate at work decreased compared to 2018 when it was 4.35. When occupational accidents were taken as a parameter, the occupational injury rate for 2019 was 19.18, which shows that for every 100,000 employees, about 19 employees were injured. Compared to the previous year, when the occupational injury rate was 16.34, the injury rate for 2019 was on the rise.

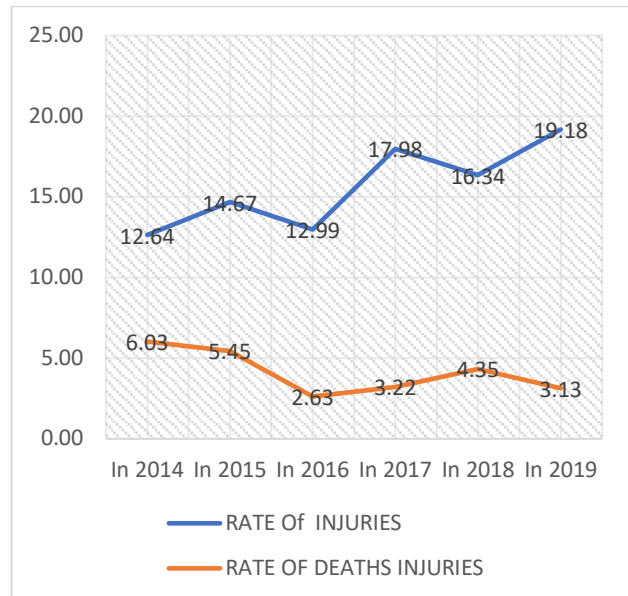


Fig. 3. Presentation of occupational injuries and death rates by year

In 2018, according to our data, there were 124 occupational accidents. Of these, 33 were fatal. Thus, the death rate at work in North Macedonia was 4.35, ie for every 100,000 employees, 4 to 5 employees died. The death rate at work increased compared to 2017 when it was 3.22. When occupational accidents were taken as a parameter, the occupational injury rate for 2018 was 16.34, which shows that for every 100,000 employees, about 16-17 employees were injured. Compared to 2017, when the occupational injury rate was 17.98, the injury rate for 2018 decreased slightly.

In 2017, according to our data, there were 158 occupational accidents, 24 of which were fatal. Thus, the rate of deaths at work in North Macedonia was 3.22, ie for every 100,000 employees, 3 to 4 die employees. The death rate at work increased compared to 2016 when it was 2.63. When the occupational accidents were taken as a parameter, the rate of injuries at work for 2017 is 17.98, which shows that for every 100,000 employees, 18 employees were injured. Compared to 2016, when the occupational injury rate was 12.99, the injury rate for 2017 increased significantly.

In 2016, according to our data, there were 94 occupational accidents, 19 of which were fatal. Thus, the death rate at work in North Macedonia was 2.63, ie for every 100,000 employees, 2-3 employees died. The rate of deaths at work decreased slightly compared to 2015, when it was 5.45. When occupational accidents were taken as a parameter, the occupational injury rate for 2016 was 12.99, which shows that for every 100,000 employees, 13 employees were injured. Compared to 2015, when the occupational injury rate was 14.67, the injury rate for 2016 decreased slightly.

Table 5. Injuries and Death rate from 2014 up to 2019

YEAR	RATE OF INJURIES	RATE OF DEATHS
2014	12.64	6.03
2015	14.67	5.45
2016	12.99	2.63
2017	17.98	3.22
2018	16.34	4.35
2019	19.18	3.13

In 2015, according to our data, there were 144 occupational accidents, 39 of which were fatal. Thus, the death rate at work in North Macedonia was 5.45, ie for every 100,000 employees, 5-6 employees died. The work-related death rate dropped slightly compared to 2014, when it was 6.03. When injuries at work were taken as a parameter, the rate of injuries at work for 2015 was 14.67, which shows that for every 100,000 employees, 14-15 employees were injured. Compared to the previous year, when the occupational injury rate was 12.64, the rate of injuries for 2015 increased significantly (one of the reasons for the increase in the rate of injuries lies in the events that took place during the month of May in which most of the members of the security forces of R. North Macedonia were injured).

In 2014, according to our data, there were 130 occupational accidents. Of these, 42 were fatal. Thus, the death rate at work in North Macedonia was 6.03, ie for every 100,000 employees, 6 employees died. The death rate at work increased compared to 2013 when it was 4.08. When occupational accidents were taken as a parameter, the occupational injury rate for 2014 was 12.64, which shows that for every 100,000 employees, 12 employees were injured. Compared to 2013, when the occupational injury rate was 10.2, the injury rate for 2014 increased significantly.

Moreover, considering the above initial observations, a correlation analysis was conducted in order to examine the possible relationship between the total number of employees and the number of injuries and deaths occurred from 2014 to 2019. As it was found, injuries seemed to be correlated to the total number of employees ($r = .937$, $p = .006$), whereas the rest of the variables did not produce any statistically significant correlations. This strong positive correlation shows that while the total number of employees is increasing in a single workplace the more possible is for injuries to occur. As it is further shown in the Figure 4, the total number of employees since 2014 has also increased significantly.

Thus, based on the data provided, it is proven that the Risk Management practices regarding prevention of Occupational Accidents in North Macedonia does not exhibit the radical improvement suspected initially.

As an extra visualized aid to further conclusions, sample injuries and deaths were grouped as per occupational “branches. Table 6 is shown these branches’ categories and occupational accidents’ distribution. Also, Figure 5 shows the trend of injuries and fatalities according to occupational branch during the period 2014 -2019.

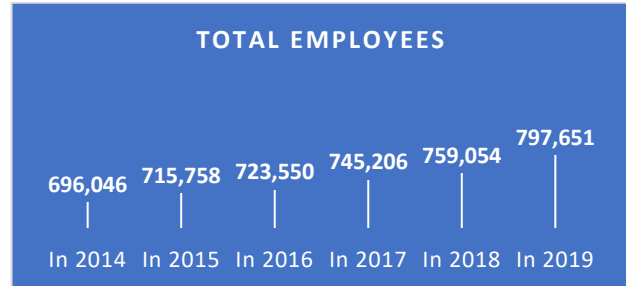


Fig. 4. Increase of the total number of employees from the year 2014 to 2019.

Results indicate an increased incidence of occupational accidents in “Public administration and defense, compulsory social security”, “Mining”, “Household” and “Manufacturing” environments, which indicates that special attention should be given to the above sectors. However, nowhere in the reporting system “Near-Misses” are reported. Thus, there is a real possibility that other sectors prone to incidents are excluded from the analysis involuntarily, due to low quality of data provided, or that simply the real situation regarding occupational accidents is not depicted at its full extent.

Table 6. Accidents by occupational branch (2014-2019)

ACCIDENTS by occupational branch		
	INJURIES	DEATHS
Agriculture, forestry and fisheries	0	0
Mining and quarrying	12	0
Manufacturing industry	1	1
Machine repair	0	2
Electricity, gas, steam and air conditioning supply	1	2
Construction	7	5
Wholesale and retail trade, repair of motor vehicles and motorcycles	3	0
Transport and storage	11	7
Protective and investigative activities	1	2
Public administration and defense, compulsory social security	42	5
Education	0	0
Health and social protection activities	4	1
Gambling and betting activities	0	0
Household activities as employers; activities of households that produce various goods and perform various services for their own needs	6	17
Undefined	0	0
Total in 2014	88	42
Agriculture, forestry and fisheries	1	1
Mining and quarrying	3	3
Manufacturing industry	0	0
Machine repair	0	0
Electricity, gas, steam and air conditioning supply	2	3
Construction	3	4
Wholesale and retail trade, repair of motor vehicles and motorcycles	0	0
Transport and storage	2	3

Protective and investigative activities	0	0
Public administration and defense, compulsory social security	83	11
Education	0	0
Health and social protection activities	0	1
Gambling and betting activities	0	0
Household activities as employers; activities of households that produce various goods and perform various services for their own needs	7	8
Undefined	4	5
Total in 2015	105	39
Agriculture, forestry and fisheries	0	0
Mining and quarrying	1	1
Manufacturing industry	7	0
Machine repair	0	0
Electricity, gas, steam and air conditioning supply	1	0
Water supply, wastewater disposal, waste management and surrounding activities	1	0
Construction	12	6
Wholesale and retail trade, repair of motor vehicles and motorcycles	0	0
Transport and storage	8	3
Protective and investigative activities	0	0
Information and communications	1	0
Public administration and defense, compulsory social security	46	0
Education	0	0
Health and social protection activities	0	0
Gambling and betting activities	0	0
Household activities as employers; activities of households that produce various goods and perform various services for their own needs	14	9
Other service activities	3	0
Undefined	0	0
Total in 2016	94	19
Administrative and auxiliary service activities	12	0
Agriculture, forestry and fisheries	3	0
Mining and quarrying	1	0
Manufacturing industry	14	3
Machine repair	0	0
Electricity, gas, steam and air conditioning supply	1	0
Water supply, wastewater disposal, waste management and surrounding activities	3	0
Construction	25	6
Wholesale and retail trade, repair of motor vehicles and motorcycles	1	1
Transport and storage	12	1
Protective and investigative activities	0	0
Information and communications	3	0
Public administration and defense, compulsory social security	34	1
Education	1	0
Health and social protection activities	0	0
Accommodation facilities and food service activities	3	0
Gambling and betting activities	0	0
Household activities as employers; activities of households that produce various goods and perform various services for their own needs	14	12
Art, entertainment and recreation	2	0
Financial and insurance activities	1	0
Other service activities	4	0
Undefined	0	0
Total in 2017	134	24
Administrative and auxiliary service activities	1	0
Agriculture, forestry and fisheries	4	1
Mining and quarrying	4	2
Manufacturing industry	16	2
Machine repair	0	0
Electricity, gas, steam and air conditioning supply	0	0
Construction	31	8
Wholesale and retail trade, repair of motor vehicles and motorcycles	0	1
Transport and storage	14	5
Protective and investigative activities	0	0
Information and communications	1	0
Public administration and defense, compulsory social security	29	2
Education	0	0

Health and social protection activities	0	0
Gambling and betting activities	0	0
Household activities as employers; activities of households that produce various goods and perform various services for their own needs	12	10
Activities related to real estate	0	0
Other service activities	12	2
Undefined	0	0
Total in 2018	124	33
Administrative and auxiliary service activities	0	0
Agriculture, forestry and fisheries	2	0
Mining and quarrying	5	1
Manufacturing industry	27	0
Machine repair	0	0
Electricity, gas, steam and air conditioning supply	0	0
Water supply, wastewater disposal, waste management and surrounding activities	8	2
Construction	36	6
Wholesale and retail trade, repair of motor vehicles and motorcycles	2	0
Transport and storage	13	4
Protective and investigative activities	0	0
Information and communications	1	0
Public administration and defense, compulsory social security	21	3
Education	0	0
Health and social protection activities	0	0
Accommodation facilities and food service activities	2	0
Gambling and betting activities	0	0
Household activities as employers; activities of households that produce various goods and perform various services for their own needs	21	8
Protection of property and persons	6	0
Other service activities	9	1
Undefined	0	0
Total in 2019	153	25

4. Conclusions

This study's aim was to analyze the occupational accidents in the Republic of North Macedonia as a "lower-middle-income economy" during the period 2014 to 2019. In line with the theoretical findings and other similar state cases, North Macedonia possesses a workplace environment that is more vulnerable than that of other countries when it comes to occupational accidents. The case of North Macedonia indeed provides a prominent example of change in national economy and legal framework, while exhibiting certain deficiencies that could potentially be improved or eliminated. According to Carlton [7], such deficiencies are common in lower-middle-income countries, as learning, key to risk aversion, is not sufficiently reinforced by the surrounding economic climate and underdeveloped legal and reporting framework. Although North Macedonia has made great progress in the field of occupational accidents, the statistical analysis and evaluation of available accident-related data confirm that North Macedonia could benefit from a series of recommendations towards the direction of workplace environment improvement and future research on the topic.

More specifically, the recommendations that we single out could be listed in the following areas:

- Revision of the Law of Safety and Health at Work (SHW) and adoption of a new, clear, and applicable law.
- Revision of the SHW regulations and initiating new rulebooks. Preparation of an Occupational Safety and Health Strategy.
- Introduction of a professional education system for SHW. Introducing a system of lifelong learning (non-formal education) for SHW.

- Creation of a platform for the exchange of knowledge and skills on a national and regional level (international) level.
- Strengthening the overall social capacities for SHW which include: Creation of favourable conditions for active participation of civic organizations (CSOs) in public policies at the national level; Establishing partnerships between civil society organizations and state (public) institutions at the national level; Developing and strengthening the culture of preventive action and Raising SHW awareness through formal education.
- Preparation and development of a unified system for reporting occupational injuries at work according to the European Statistics on Accidents at Work (ESAW) methodology. Strengthening the inter-institutional cooperation between the relevant participants for keeping a single register of occupational injuries at work and occupational diseases. Introducing an initiative for the development of a regional database (database) of experts in the field of SHW.
- Improvement of cooperation, coordination, and exchange of information between all relevant stakeholders in the field of SHW at the national level.
- Establishment of an integrated system for monitoring and reporting occupational injuries and occupational diseases that would enable the recording and registration of all occupational injuries and occupational diseases. It should be noted that the beginning of the reporting of occupational injuries at work and occupational diseases is a precondition for the Institute of Public Health of the Republic of Northern Macedonia to establish the appropriate registers.
- Establishment of a Register for occupational diseases and a Register for occupational injuries at work.

Finally, it should be stressed that summary records on the scope and type of work performed in the authorized institutions for occupational safety and occupational medicine are the basis for determining the situation, as well as for

planning the development of occupational safety and health in the Republic of North Macedonia.

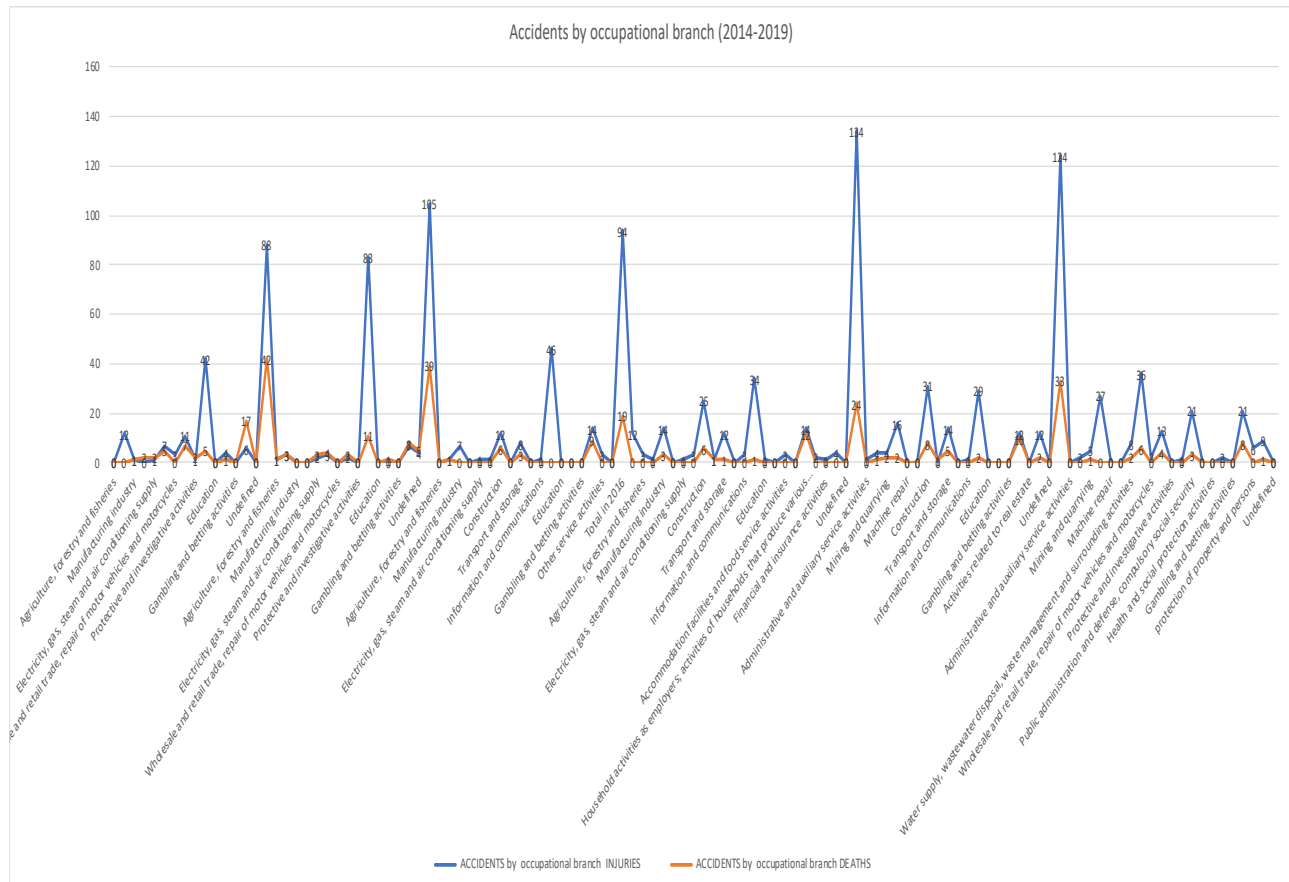


Fig. 5. Accidents by occupational branch (2014-2019).

5. Limitations and future work

The available raw data are limited. Basic statistical analysis was allowed. However, as a limitation, it should be noted that, the quality of data prohibited the extraction of detailed descriptive statistics. In more detail, further analysis could not be carried out until and unless we have sample level data, as the raw data provided is actually in a summarised form. In order for more intricate analysis to be performed (e.g., delta check, various types of ANOVA, risk matrices and CBA using Artificial Neural Networks), a different structure of raw data is required, along with the use of custom-made R, python-based, or Turing-type applications.

This justifies the need for substantial research in the Republic of North Macedonia. Future studies could include other databases to present more comprehensive data.

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References

- B. Vasconcelos and B. B. Junior. The causes of workplace accidents and their relation to construction equipment design. *Procedia Manufacturing*, 3, pp.4392-4399 (2015).
- C.W. Cheng, S.S. Leu, C.C. Lin and C. Fan. Characteristic analysis of occupational accidents at small construction enterprises. *Safety Science*, 48(6), pp.698-707 (2010).
- A. Rahmani, M. Khadem, E. Madreseh, H.A. Aghaei, M. Raei and M. Karchani. Descriptive study of occupational accidents and their causes among electricity distribution company workers at an eight-year period in Iran. *Safety and health at work*, 4(3), pp.160-165 (2013).
- A.E. Dembe. The social consequences of occupational injuries and illnesses. *Am. J. Ind. Med.*, 40, pp 403-417 (2001).
- World Health Organization. Trends in maternal mortality 2000 to 2017: estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division (2019).
- ILO Library. B. Petreski, J. Dávalos and D. Tumanoska (eds). Youth Underemployment in the Western Balkans: A Multidimensional Approach (2021). Web. Available at: ILO.org. Last Access: 15/6/2021
- J.S. Carlton. *Developments in Risk Management*. London: City, University of London Press (2017).
- V. M. Trbojevic. Risk criteria in EU. *Risk*, 10(5), pp 1945-1952 (2005).
- G. Wilkinson & R. David. Back to basics: Risk matrices and ALARP. In Dale, C. & Anderson, T. (Eds.), *Safety-critical systems:*

- Problems, process and practice (chapter 11, pp. 179–182). London: Springer (2009).
10. R.B. Duffey and J.W. Saull. Know the Risk, First Edition, Boston, Butterworth and Heinemann (2002)
 11. R.B. Duffey, J.W. Saull and P. Myers. Learning from Experience: Application to the Analysis of Pipeline and Storage Tank Safety Data and Potential Spill Reduction, Presentation given at National Institute for Storage Tank Management's 7th Annual International Conference in Orlando, Florida, May 12-14 (2004).
 12. R.B. Duffey and J.W. Saull. Managing Risk: The Human Element, West Sussex, UK, John Wiley & Sons Ltd (2008).
 13. R.B. Duffey and A.B. Skjerve. Risk Trends, Indicators and Learning Rates: A New Case Study of North Sea Oil and Gas, Proceedings ESREL 2008, 17th SRA Conference, Valencia, Spain (2008).
 14. F.B. Haber et al, "Independent Assessment of the Davis Besse Organizational Safety Culture, Including Safety Conscious Work Environment", Assessment Number 2004-0104, NRC Docket number 50-346, License number NPF-3, First Energy Operating Company, Ohio, USA (2005).
 15. D. Cooper. Improving Safety Culture: A Practical Guide 1st Edition, John Wiley & Sons Ltd. (2001)
 16. OECD. National accounts data files for 2019 (2020) <https://stats.oecd.org/Index.aspx?DataSetCode=NAAG> Last Access: 15/6/2021 ;
 17. CIA. February. Country Factbook (2015). Retrieved from <https://www.cia.gov/library/publications/the-world-factbook/geos/mk.html> Last Access: 15/6/2021
 18. World Bank. Doing Business 2020, Reforming to Create Jobs, Economy Profile 2020-North Macedonia, 17th Edition, Washington, DC (2020).
 19. State Statistical Office 2014, 2015, 2016, 2017, 2018 & 2019. Active Population in the Republic of North Macedonia Results from the Labour Force Survey (2021). Retrieved from State Statistical Office: <http://www.stat.gov.mk/PrikaziSoopstanie.aspx?rbtxt=98> Last Access: 15/6/2021
 20. R. of N. Macedonian occupational safety and health association. 2014, 2015, 2016, 2017, 2018 & 2019. Occupational injuries report, Annual reports for 2014, 2015, 2016, 2017, 2018 & 2019 Deaths, injuries and accidents at work, web: www.mzzpr.org.mk Last Access: 15/6/2021
 21. World Bank. Assessment of Barriers and Opportunities Using Gender and Roma Lens in North Macedonia: Case of Transport (2020); Trajce Velkovski. Reference Model for Ranking the Level Of Implementation Of Safety And Work Health Systems. PhD thesis, Faculty of Mechanical Engineering, Ss. Cyril and Methodius University. (2019).
 22. G.S. Smith, M.A. Veazie. Accident Prevention: Principles of Prevention: The Public Health Approach to Reducing Injuries In The Workplace. In: ILO Encyclopedia of Occupational Health and Safety, ILO, Geneva 2, pp 1–42 (1998).
 23. D. Maman, and Z. Rosenhek. Responsibility, planning and risk management: moralizing everyday finance through financial education. Br J Sociol, 70, pp 1996-2019 (2019).