

## Article

# The Development Trend of the Occupational Health and Safety in the Context of ISO 45001:2018

Marek Šolc <sup>1,\*</sup>, Peter Blaško <sup>1</sup>, Lenka Girmanová <sup>1</sup> and Juraj Kliment <sup>2</sup>

<sup>1</sup> Institute of Materials and Quality Engineering, Faculty of Materials, Metallurgy and Recycling, Technical University of Kosice, Letná 1/9, 04200 Kosice, Slovakia; peter.blasko@tuke.sk (P.B.); lenka.girmanova@tuke.sk (L.G.)

<sup>2</sup> Lloyd's Register Quality Assurance, Táborská 940/31, Nusle, 140 00 Praha, Czech Republic; juraj.kliment@lrqa.com

\* Correspondence: marek.solc@tuke.sk; Tel.: +421-55-602-2703

**Abstract:** The main task of safety and health at work is to protect the most important thing we have, the health of each of us. Employers are able to anticipate and prevent risks by properly implemented occupational safety and health management systems. The basic task of the article is to describe the history of safety management systems to identify the state of implementation of the ISO 45001 system in the world. Subsequently, the article describes the ISO 45001 standard from the perspective of the PDCA cycle and describes the benefits and importance of implementing the ISO 45001 standard. The conclusion of the article deals with the development trend of the occupational health and safety management system according to STN ISO 45001:2019 in the context of occupational accidents in the conditions of the Slovak Republic.

**Keywords:** safety; management; ISO 45001; health; injuries



**Citation:** Šolc, M.; Blaško, P.; Girmanová, L.; Kliment, J. The Development Trend of the Occupational Health and Safety in the Context of ISO 45001:2018. *Standards* **2022**, *2*, 294–305. <https://doi.org/10.3390/standards2030021>

Academic Editor: João Carlos de Oliveira Matias

Received: 13 May 2022

Accepted: 28 June 2022

Published: 2 July 2022

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

More than 6300 people die every day as a result of an accident at work or an occupational disease, which is a huge burden on organizations and society as a whole [1,2]. It is an alarming number and is proof that measures need to be taken in the area of occupational safety and health management (OH&S), which will ultimately lead to a reduction in overall accidents and morbidity. One of the important steps is the implementation of the ISO 45001 standard, which employers can apply in order to ensure more effective health and safety.

New approaches in the occupational safety and health management system require that everyone be aware of the risks they face in the workplace and in their daily lives [3,4]. The employer's obligation is to identify the risks associated with the work process, to implement risk elimination or minimalization measures, and familiarize its employees with residual risks [5,6].

The implementation of the ISO 45001 standard is expected to give priority to an overall improvement in occupational safety and a reduction in accidents at work and occupational diseases [1,7].

## 2. History of Occupational Safety and Health

Historically, developments in the field of occupational safety and health (OH&S) have been mainly based on efforts to prevent accidents arising from the use of technical equipment in the work process. In general, it is possible to outline the periods in the development and understanding of safety and its scope as follows (Figure 1).

Thus, the current period in particular has seen an intensive increase in requirements for the application of risk management theory in such a way that management at different levels and in different activities is effective and takes into account the visions of possible so-called catastrophic scenarios. Their probability is rated very low, but the consequences can

have socially serious effects. These are, for example, activities related to spatial planning (risk assessment in planning the production or use of hazardous substances), construction of new facilities (determining the type and extent of zones in terms of explosion hazard), transport of hazardous substances (setting safety programs), etc. [5].

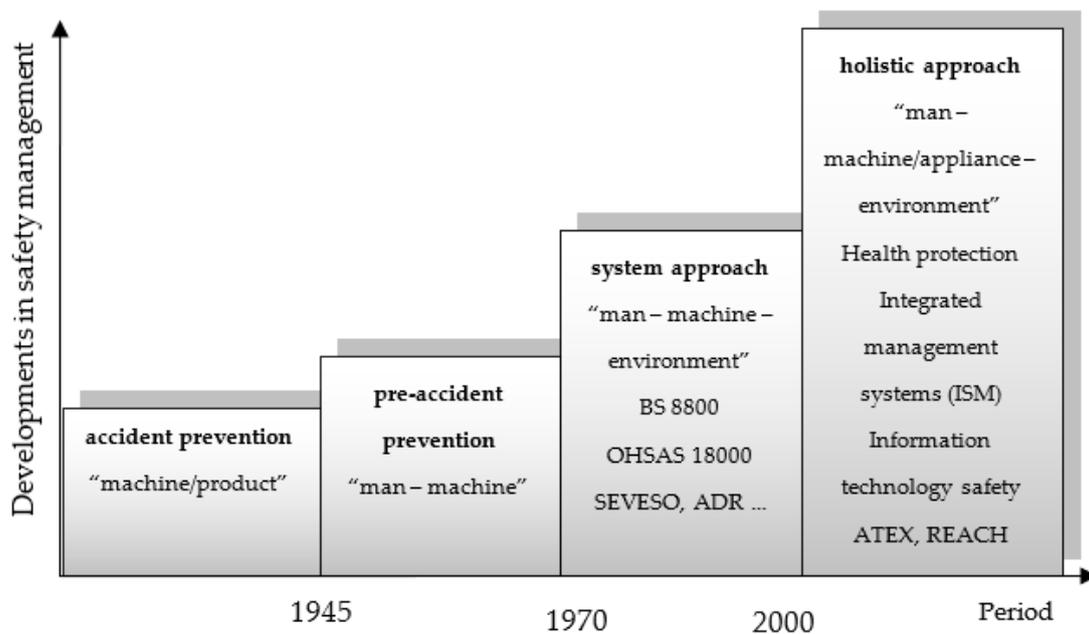


Figure 1. Development of safety management [5].

The protection of human beings at work is understood as one of the basic political principles based on the Declaration of Fundamental Human Rights and Freedoms. However, it is not just about maintaining life and health. The protection of workers and others against the adverse effects of work and the working environment must be managed in such a way as to take account of all aspects relating to work. Thus, part of the management is also the creation of conditions for satisfactory work, well-being at work, social protection of employees, and legal protection of other persons, as well as protection of material values, work, and environment. Therefore, in connection with the protection of employees, it is also necessary to address such factors as stress, workload, work monotony, working conditions, labor relations, social equipment of workplaces, fair remuneration, etc. [5].

The European Union's (EU) health and safety policy focuses in particular on a broad understanding of these principles of managing human protection against adverse effects, applying the new rules in practice. According to the "Community strategy" in the field of health and safety, the policy was based on the so-called holistic approach. The call for a holistic approach is, in a sense, a call for the integration of all aspects of work. The Community strategy has thus given impetus to the wider application of integrated management systems [5,8].

### 3. Historical Development of Occupational Safety and Health Management Systems

With the growing number of many different management systems, the issue of their successful implementation and continual meeting of the requirements has been increasingly coming to the foreground [9]. All activities of any organization involve risks [10]. A management system must ascertain that a manufacturing process satisfies its defined usage without any undesirable failures or risks [11].

The history of health and safety management systems (Table 1) is connected with the development in the field of management, especially the quality management systems (ISO 9000) and environmental management systems (ISO 14000).

**Table 1.** An overview of some occupational health and safety management systems [5].

Marking	Title	State/Org.	Year
ISO 45001	Occupational health and safety management systems. Requirements with guidance for use	United Kingdom	2018
BS OHSAS 18001	Standard for occupational safety and health management system	United Kingdom	2007
ILO OSH 2001	Handbook for health and safety management systems	MOP	2001
OHSAS 18001, 18002	Occupational health and safety management system—guidance	international institutions	1999, 2000
MLN 1999	Safety and health management system manual	Japan	1999
PN-N-18000	Polish standard for occupational health and safety management system	Poland	1999
BTP 0011/98	Internal safety management system in the company	Czech Republic	1998
VCA	Work safety system—checklist for suppliers	Benelux	1997
NPR 5001	Guidance on occupational health and safety management system	Netherlands	1997
Australia standard DR 96311	Health and safety management system—a general guide to the principles, system and tools	Australia New Zealand	1996
AIHA OHSMS 96/3/26	Occupational health and safety management system	USA	1996
MALWA	Occupational safety and risk management program	Poland	1996
BS 8800	Standard for occupational safety and health management system	United Kingdom	1996
ISA 2000	Requirements for safety and health management systems	SGS Yardley ICS	1996
ASCA	Work safety control program in companies	Germany	1996
Internal control AFS 1996	Binding regulation for the safety, health and environmental management system	Sweden	1996
ISRS	International occupational safety assessment and certification system	AGA/DNV Norway	1995
TUTTAVA	Evaluation and motivation program for safe work and health protection	Finland	1994
MIL-STD-882C	Safety program system requirements	USA	1993
Internal control	Binding regulation for the safety, health and environmental management system	Norway	1991
Fed.reg. 59:3904-3916	Safety and health management system manual	USA	1989

More than two decades ago, legislative requirements for risk control through systematic management and the emergence of Occupational Health & Safety Management System (OH&SMS) standards and respective certifications contributed to the development and broad use of various OH&SMS models [12,13].

Until 2018, the OH&S management system did not take the form of an ISO standard, although the publication of the OH&SMS manual as an English standard (BS) created a uniform framework for the implementation and certification of OH&S management systems. Since 2018, the new standard ISO 45001:2018 has been in force, which already has its standardized form.

ISO 45001:2018 “Occupational health and safety management systems—Requirements with guidance for use” specifies the requirements that an OH&SMS must own to allow an organization to effectively control its own risks and opportunities within this scope [14,15].

#### 4. Overview of the State of the Health and Safety Management System ISO 45001:2018 in the Context of ISO Standards in the World

In 2020, a survey of the number of ISO standards was carried out, which contains data on valid certificates issued by accredited certification bodies around the world. From this data, we have gained some valuable insights regarding the currently available ISO standards. The survey reports data on the total number of valid certificates from accredited certification bodies as of 31 December 2020. Over 1.5 million valid certificates against the 12 Type A (requirements) management systems standards surveyed have been reported, an increase of 235,790 from the previous year. In percentage terms, this was an increase of 17%. Thus, the global trends in ISO certification are shown in Tables 2 and 3.

**Table 2.** Number of valid certificates worldwide (comparison of 2018, 2019, and 2020) [16].

Standard	Total Number of Valid Certificates (2018)	Total Number of Valid Certificates (2019)	Total Number of Valid Certificates (2020)
ISO 9001	878,664	883,521	916,842
ISO 14001	307,059	312,580	348,473
ISO/IEC 27001	31,910	36,362	44,499
<b>ISO 45001</b>	<b>11,952</b>	<b>38,654</b>	<b>190,481</b>
ISO 22000	32,120	33,502	33,741
ISO 13485:2003&2016	19,472	23,045	25,656
ISO 50001	18,059	18,227	19,731
ISO 20000-1	5308	6047	7846
ISO 28000	617	1874	520
ISO 22301	1506	1693	2205
ISO 37001	389	872	2065
ISO 39001	547	864	972
<b>Total</b>	<b>1,307,603</b>	<b>1,357,241</b>	<b>1,593,031</b>

**Table 3.** Total and percentage increase/decrease in the number of valid certificates worldwide (comparing 2019 and 2020) [16].

Standard	Total Increase/Decrease in the Number of Valid Certificates (2019–2020)	Percentage Increase/Decrease in the Number of Valid Certificates (2019–2020) %
ISO 9001	33,321	3.77
ISO 14001	35,893	11.48
ISO/IEC 27001	8137	22.38
<b>ISO 45001</b>	<b>151,827</b>	<b>392.78</b>
ISO 22000	239	0.71
ISO 13485:2003&2016	2611	11.33
ISO 50001	1504	8.25
ISO 20000-1	1799	29.75
ISO 28000	−1354	−72.25
ISO 22301	512	30.24
ISO 37001	1193	136.81
ISO 39001	108	12.50
<b>Total</b>	<b>1,357,241</b>	<b>1,593,031</b>

The survey shows that, between 2019 and 2020, the number of ISO 9001 (Quality Management Systems) increased by 4%, ISO 14001 certificates (Environmental Management Systems) increased by 11.5%. The highest increase was recorded in the ISO 45001 standard (Occupational Health and Safety Management Systems), up to 393%. This standard was not published until 2018, and the transitional period from BS EN OHS&S 18001 to ISO 45001 ended on 11 September 2021. The aim of the survey was to point out the growing trend and development of standards, especially in the field of safety management systems.

### 5. Characteristics of the ISO 45001:2018 Standard from the Point of View of the PDCA Cycle

The occupational health and safety management system brings several benefits to the organization. It is proof that the organization is interested in its employees, which is a positive signal for customers as well as for current and potential employees [8,17]. For the organization, this means increasing productivity and work efficiency, improving corporate culture, increasing employee loyalty and satisfaction, improving working conditions and minimizing occupational accidents and diseases. At the same time, the organization proves that its products or services are implemented under defined working conditions in terms of health and safety.

In the current concept of safety, a holistic approach to addressing occupational safety and health means understanding occupational safety and health as a whole. This principle is strongly emphasized in all conceptual materials of international organizations. This approach also includes the comprehensive development of well-being at work, increasing the culture of work, strengthening economic incentives, and the social responsibility of employers.

The applied health and safety management system is based on the Plan-Do-Check-Act concept (PDCA) [18,19]. The PDCA concept is an iterative process used by organization to achieve continual improvement [20–23]. It can be applied to a management system, and to each of its individual elements, as follows [2,24]:

- (a) Plan: determine and assess OH&S risks, OH&S opportunities, and other risks and other opportunities; establish OH&S objectives and processes necessary to deliver results in accordance with the organization's OH&S policy.
- (b) Do: implement the processes as planned.
- (c) Check: monitor and measure activities and processes with regard to the OH&S policy and OH&S objectives, and report the results.
- (d) Act: take actions to continually improve the OH&S performance to achieve the intended outcomes.

Figure 2 shows the incorporation of the PDCA concept into the new structure of the ISO 45001: 2018 standard.

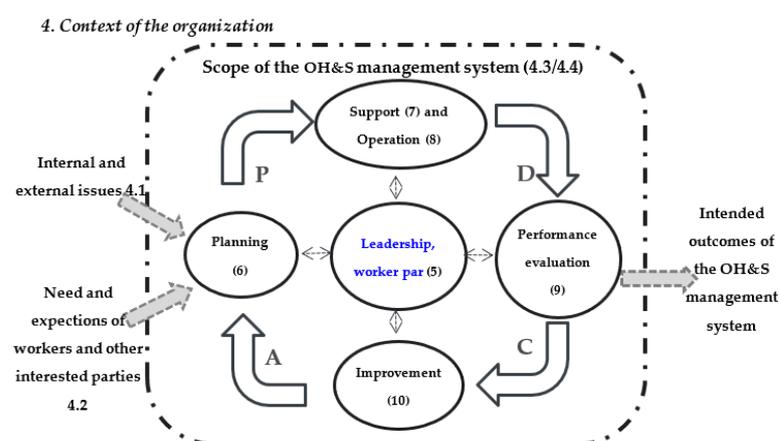


Figure 2. Health and safety management system vs. PDCA [2].

In Figure 3 it can be seen that, from the point of view of the new standard ISO 45001:2018, the structure of the occupational health and safety management system is at a high level.

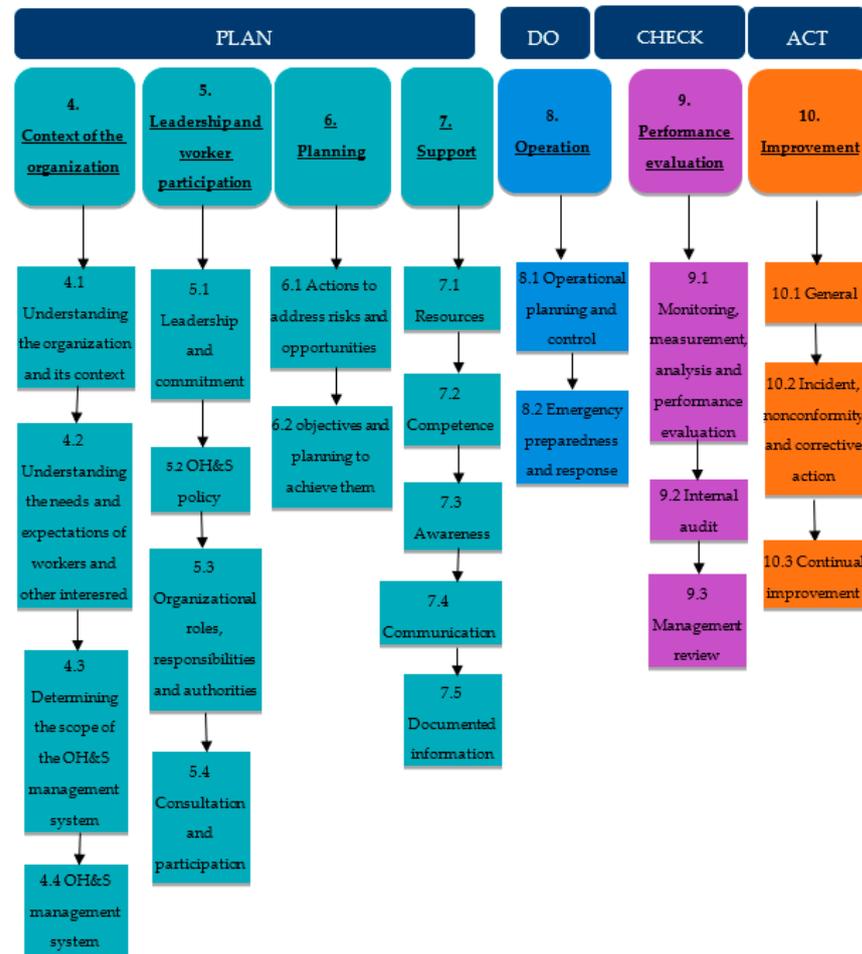


Figure 3. The structure of the OH&S according to ISO 45001 from the point of view of PDCA [25].

## 6. Importance and Advantages of the Occupational Health and Safety Management System According to the ISO 45001:2018 Standard

The purpose of an OH&S management system is to provide a framework for managing OH&S risks and opportunities [26]. The aim and intended outcomes of the OH&S management system are to prevent work-related injury and ill health of workers and to provide safe and healthy workplaces. Consequently, it is critically important for the organization to eliminate hazards and minimize OH&S risks by taking effective preventive and protective measures. When these measures are applied by the organization through its OH&S management system, they affect its OH&S performance. An OH&S management system can be more effective and efficient when taking early action to address opportunities for improvement and protective measurement. Implementing an OH&S management system conforming to this document enables an organization to manage its OH&S risks and improve its OH&S performance. An OH&S management system can assist an organization to fulfill its legal requirements and other requirements.

The main advantages of the new OH&S management system according to ISO 45001:2018 can include:

- Elimination of health and safety risks;
- Development of best practices in the field of occupational safety and health;
- Reduction in fatalities, accidents at work, and diseases in the workplace;

- Demonstration of leadership and commitment with regard to the OH&S management system;
- Creation and implementation of health and safety policy and goals;
- Monitoring and measurement supports supervisory management by providing key performance indicators (KPIs) in measuring the level of performance of the health and safety management system.

The aim of the OH&S management system certification, according to ISO 45001:2018, is to verify compliance with the requirements of the international standard ISO 45001, to introduce a systemic and process approach in the field of OH&S, and to introduce a system of continuous improvement in the field of OH&S.

The occupational health and safety management standard certification aims to ensure that the organization cares for and pays attention to the occupational health and safety management system in carrying out the overall activities of the certified organization [27].

As for employers, they can say after successful certification that:

- They objectively assessed the current state of the health and safety management system;
- They have expanded their business opportunities and increased their credibility;
- They have introduced continuous improvement;
- They have eliminated chaos and shortcomings in the field of health and safety.

As far as customers are concerned, after the introduction and certification of the health and safety management system, preconditions will be created for improvement in the areas, see Table 4.

**Table 4.** Areas benefiting from the implementation and certification of the health and safety management system according to ISO 45001:2018 from the customer's point of view [28].

Managerial benefits	Clearly defined management system
	Increasing process safety
	Fulfillment of legislative requirements in the field of occupational safety and health
	Raising health and safety awareness
	Continuous improvement
Work environment	Workplace ergonomics solutions
	Device functionality
	Health safety and hygiene of the working environment
Economic benefits	Cost reduction
	Increasing the efficiency and effectiveness of processes
	Long-term prosperity of the company
Risks and threats	Regular analyzes and evaluations
	Threat and risk management
	Reducing the number of accidents at work

ISO 45001 sets out to provide a robust and effective set of processes for improving work safety in global supply chains and is also the world's first International Standard for occupational health and safety. For example, among the first organizations in the UK to successfully obtain certification for the ISO 45001:2018 standard are organizations CBRE, Colas Rail, EMCOR UK, Eurovia UK, Interserve, Morgan Sindall, OKI UK, OPG, Overbury, and Ringway Jacobs [29].

As for Slovakia, it is difficult to summarize how many organizations have implemented and certified STN EN ISO 45001:2019. The standard STN EN ISO 45001:2019 came into force in March 2019. The number of organizations that have the STN ISO 45001:2019 standard in place is in the hundreds. However, all large companies that have a significant role in

the Slovak industry have the standard STN EN ISO 45001:2019 established and certified in accordance with applicable legislative requirements.

### 7. Occupational Health and Safety STN EN ISO 45001:2019 in the Context of Occupational Accidents in the Conditions of the Slovak Republic

Occupational health and safety is a key concern and responsibility of the state. The role of the state is to support the protection of employees at work; social justice; strengthen the functioning of the labor market; eliminate losses from accidents at work, occupational diseases, and industrial accidents; promote suitable working conditions; increase labor efficiency and productivity; and encourage market competitiveness with an impact on business prosperity and overall development of the country.

Occupational accidents and diseases have a detrimental effect on workers and equipment and on the quantity and quality of production [30].

ISO is designed to help organizations of all sizes and industries. It is this new international standard (ISO 45001) that is expected to reduce the number of accidents and illnesses in the workplace worldwide. As far as the Slovak Republic is concerned, these claims can be partially confirmed by the number of occupational accidents that occurred before the creation of the standard STN EN ISO 45001:2019 and which occurred only after the creation of the standard. Of course, the COVID-19 pandemic also had a potential impact on these statistics. Serious and fatal accidents have really occurred in workplaces (such as heavy industry, engineering, and automotive environments) where there is continuous production. Employees had to come to the workplace in person, and they had to be there in the number required by this type of work, so the COVID-19 pandemic had little effect on the total number of fatalities and serious accidents at work.

Table 5 shows the share of the main groups of resources in the total number of fatal accidents at work in organizations in the years 2010–2021. Table 6 shows the share of the main groups of resources in the total number of serious accidents at work in organizations in the years 2010–2021.

**Table 5.** Share of main groups of resources in the total number of fatal accidents at work in organizations in the years 2010–2021 [31].

Code	Source Group (Decree. MLSAF SR No. 500/2006 St.)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I.	Means of transport	28	17	20	20	18	23	23	17	15	14	16	11
II.	Hoists and conveyors, lifting and transport aids	0	2	3	2	0	3	2	5	1	1	1	3
III.	Machines—driving, auxiliary, machining and working	1	4	4	2	5	2	2	0	2	3	4	4
IV.	Working or road transport spaces as sources of falls	10	11	10	14	6	14	5	12	8	2	5	8
V.	Material, loads, objects	3	3	7	5	6	8	5	6	8	5	1	5
VI.	Tools, instruments, hand—operated machines and apparatus	0	0	0	0	0	0	0	0	0	0	0	0
VII.	Average pollutants, hot substances and objects, fire, and explosives	0	0	2	5	2	0	0	1	1	1	0	0
VIII.	Boilers, vessels, and pipelines under pressure	0	0	0	0	0	0	0	0	0	0	0	0
IX.	Electricity	1	0	4	1	1	2	5	1	3	1	0	0
X.	People, animals, and the elements	3	1	1	4	1	1	2	0	1	3	3	1
XI.	Other resources	3	0	2	0	1	2	1	0	0	1	2	1
	<b>Sum</b>	<b>49</b>	<b>38</b>	<b>53</b>	<b>53</b>	<b>40</b>	<b>55</b>	<b>45</b>	<b>42</b>	<b>39</b>	<b>31</b>	<b>32</b>	<b>33</b>

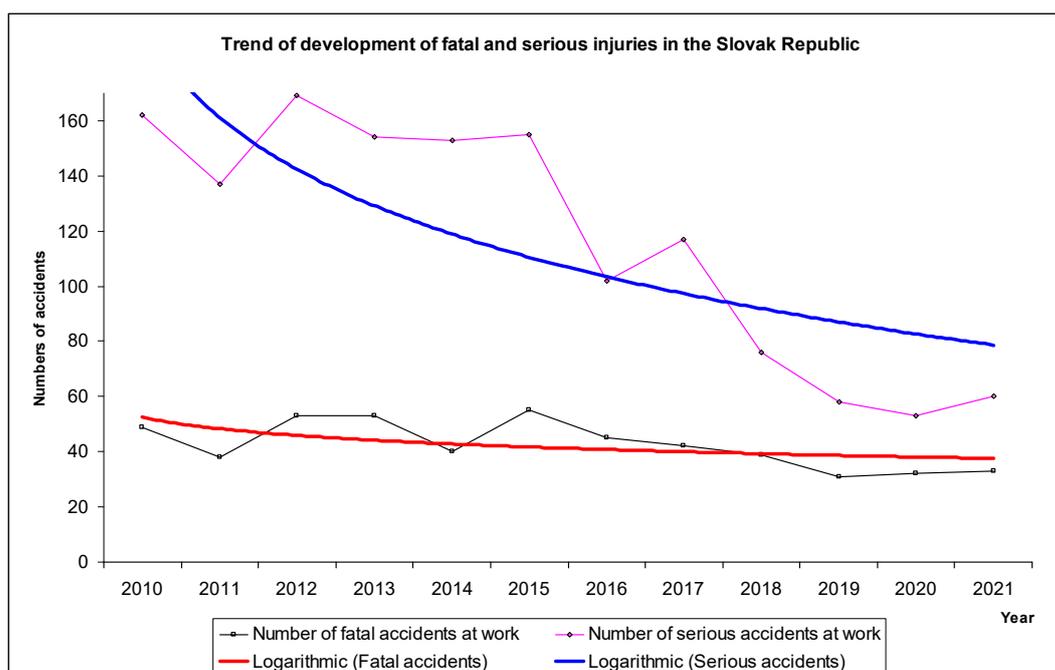
STN EN ISO  
45001:2019

**Table 6.** Share of main groups of resources in the total number of serious accidents at work in organizations in the years 2010–2021 [31].

Code	Source Group (Decree. MLSAF SR No. 500/2006 St.)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
I.	Means of transport	28	23	38	25	37	35	23	28	19	12	9	10
II.	Hoists and conveyors, lifting and transport aids	9	13	8	4	9	7	6	5	3	7	2	3
III.	Machines—driving, auxiliary, machining and working	44	37	37	34	26	33	25	24	19	16	14	13
IV.	Working or road transport spaces as sources of falls	51	35	48	46	41	37	23	36	10	15	13	18
V.	Material, loads, objects	18	17	16	23	20	23	12	9	15	5	7	6
VI.	Tools, instruments, hand—operated machines and apparatus	1	4	1	4	4	6	1	5	1	0	2	4
VII.	Average pollutants, hot substances and objects, fire, and explosives	2	3	6	3	5	4	5	8	0	2	1	0
VIII.	Boilers, vessels, and pipelines under pressure	1	0	0	0	1	0	0	0	0	0	0	0
IX.	Electricity	3	2	3	3	2	0	2	1	1	0	1	2
X.	People, animals, and the elements	3	3	7	8	6	4	3	0	6	0	3	3
XI.	Other resources	2	0	5	4	2	6	2	1	2	1	1	1
	<b>Sum</b>	<b>162</b>	<b>137</b>	<b>169</b>	<b>154</b>	<b>153</b>	<b>155</b>	<b>102</b>	<b>117</b>	<b>76</b>	<b>58</b>	<b>53</b>	<b>60</b>

STN EN ISO  
45001:2019

Regarding the development of fatal and serious accidents at work, the tendency to reduce the number of these accidents is visible in Figure 4.

**Figure 4.** Trend of development of fatal and serious injuries in the Slovak Republic.

As the standard STN EN ISO 45001:2019 came into force in Slovakia in March 2019, the trend in the number of fatal accidents and serious accidents is declining.

## 8. Conclusions

ISO 45001:2018 contains more requirements compared to the previous edition. At the same time, however, it provides more freedom in fulfilling them. The wording of the standard can be considered a step forward—it is clear, and it reflects the current situation in the business environment. Its structure is compatible with other management systems, in particular the ISO 9001:2015 quality management system and the ISO 14001:2015 environmental management system. All three management standards have the same chapter structure, which allows one to create an integrated management system of quality, environment, and health and safety.

The OH&SMS implementation helps the company in the process of structuring and organizing the OH&S management area, as well as in a better development of all the activities that are part of this area [32]. ISO 45001 improves the effectiveness of work accident control by implementing a comprehensive OH&S management system [33,34].

The success of the OH&S management systems depends on leadership, commitment, and participation from all levels and functions of the organization; the allocation of the necessary health and safety resources, policies, and objectives; compliance with legal and other requirements; effective safety risk management; rigorous monitoring; evaluation of the performance of the health and safety management system; and the integration of this system into the business processes of the organization.

**Author Contributions:** Management and validation, writing and final review, M.Š. and P.B.; application of statistical, mathematical techniques, M.Š. and L.G.; research and verification, P.B.; development of methodology, L.G.; and data collection J.K. All authors have read and agreed to the published version of the manuscript.

**Funding:** This contribution is the result of the implementation of the following project: VEGA 1/0633/20 “Research of the variability of properties and functions of products made of composite materials produced by additive manufacturing”.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Swepston, L. Human Rights to Health and Safety at work: The International Labor Organization. 2018. Available online: <https://oneill.law.georgetown.edu/human-rights-to-health-and-safety-at-work-the-international-labor-organization/> (accessed on 30 April 2022).
2. ISO 45001; Occupational Health and Safety Management Systems. International Organization for Standardization: Geneva, Switzerland, 2018.
3. Nováková, R.; Paulíková, A.; Čekanová, K. Risk Management as a Part of a Quality Management System in Woodworking Companies. In Proceedings of the Scientific Papers More Wood, Better Management, Increasing Effectiveness: Starting Points and Perspective, Prague, Czech Republic, 24–26 May 2017; Czech University of Life Sciences Prague: Prague, Czechia, 2017; pp. 170–178.
4. Cehlar, M.; Teplická, K.; Seňová, A. Risk Management as Instrument for Financing Project in Mining Industry. *SGEM Albena* **2011**, *1*, 913–920.
5. Pačaiová, H.; Sinay, J.; Glatz, J. *Bezpečnosť a Riziká Technických Systémov*; Strojnícka Fakulta TU Košice: Košice, Slovakia, 2009; ISBN 978-80-553-0180-8.
6. Dado, M.; Hnilica, R.; Kotus, M.; Kotek, L. Use of Virtual Reality in Machinery Safety Education. In Proceedings of the 10th International Conference of Education, Research and Innovation, Seville, Spain, 16–18 November 2017; IATED, IATED Academy Publishing: Seville, Spain, 2017; pp. 2737–2740.
7. Gobernado, L.M.; Gil, V.D. ISO 45001: Opportunity for healthcare organizations in improving occupational health. *Revista de Calidad Asistencial* **2017**, *32*, 120–121. [CrossRef]

8. Sinay, J.; Pačaiiová, H.; Majer, I. *Manažérstvo bezpečnosti Práce*; TU, SjF: Košice, Slovakia, 2006; ISBN 80-8073-754-1.
9. Nagyova, A.; Balazikova, M.; Markulik, S.; Sinay, J.; Pacaiiova, H. Implementation Proposal of OH&S Management System According to the Standard ISO/DIS 45001. In *Advances in Safety Management and Human Factors*; Arezes, P., Ed.; Advances in Intelligent Systems and Computing; Springer International Publishing: Cham, Switzerland, 2018; Volume 604, pp. 472–485. ISBN 978-3-319-60524-1.
10. Vykydal, D.; Halfarová, P.; Nenadál, J.; Plura, J.; Hekelová, E. Risk analysis related to quality management principles. In Proceedings of the Scientific Proceedings Faculty of Mechanical Engineering STU in Bratislava, Bratislava, Slovak Republic, 5–6 December 2012; Slovak University of Technology Bratislava: Bratislava, Slovakia, 2012; pp. 87–92.
11. Kotus, M.; Burda, M.; Pauliček, T.; Kiedrowicz, M. Risk Assessment of Decreasing the Failure of Thermal Liquid Collector. *Manag. Syst. Prod. Eng.* **2014**, *1*, 10–12. [CrossRef]
12. Hasle, P.; Zwetsloot, G. Editorial: Occupational Health and Safety Management System: Issues and challenges. *Saf. Sci.* **2011**, *49*, 961–963. [CrossRef]
13. Karanikas, N.; Weber, D.; Bruschi, K.; Brown, S. Identification of systems thinking aspects in ISO 45001:2018 on occupational health & safety management. *Saf. Sci.* **2022**, *148*, 105671. [CrossRef]
14. Campailla, C.; Martini, A.; Minini, F.; Sartor, M. *ISO 45001; Quality Management: Tools, Methods, and Standards*; Sartor, M., Orzes, G., Eds.; Emerald Publishing Limited: Bradford, UK, 2019; pp. 217–243. ISBN 978-1-78769-804-8.
15. Ramos, D.; Almeida, L. Overview of Standards Related to the Occupational Risk and Safety of Nanotechnologies. *Standards* **2022**, *2*, 83–89. [CrossRef]
16. 2020 ISO Survey of Management System Standards Reveals 17% Increase in Certifications. 2022. Available online: <https://www.quality.org/article/2020-iso-survey-management-system-standards-reveals-17-increase-certifications> (accessed on 27 April 2022).
17. Heras-Saizarbitoria, I.; Ibarloza, A.; de Junguitu, A.D. Conflicts Arising in the Generation Process of the ISO 45001 Standard. In *ISO 9001, ISO 14001, and New Management Standards*; Heras-Saizarbitoria, I., Ed.; Measuring Operations Performance; Springer International Publishing: Cham, Switzerland, 2018; pp. 177–191. ISBN 978-3-319-65674-8.
18. Darabont, D.C.; Bejinariu, C.; Baciuc, C.; Bernevig-Sava, M.A. Modern approaches in integrated management systems of quality, environmental and occupational health and safety. *Qual. Access Success* **2019**, *20*, 105–108.
19. Beisseyev, S.A.; Naukenova, A.S.; Tulekbayva, A.K.; Otunshiyeva, A.E.; Kenzhekhanova, M.B.; Toktabek, A.A. ISO 45001 as a tool to improve the occupational health and safety management system at Kazakhstan enterprises, on the example of the fat and oil industry. *Eur. Asian J. Biosci.* **2020**, *14*, 809–816.
20. Kotus, M.; Bujna, M.; Čičo, P. *Základy bezpečnosti Práce*; Slovenská Poľnohospodárska Univerzita: Nitra, Slovakia, 2012; ISBN 978-80-552-0780-3.
21. Bochkovskiy, A. Improvement of Risk Management Principles in Occupational Health and Safety. *Natsional'nyi Hirnychiy Universitet. Naukovyi Visnyk* **2020**, *4*, 94–104. [CrossRef]
22. Zhao, W.; Jiang, Z. Research on Occupational Health and Safety of Medical Staff Based on ISO 45001. *Am. J. Biochem. Biotechnol.* **2020**, *16*, 288–298. [CrossRef]
23. Zgodavová, K.; Slimák, I. Advanced Improvement of Quality. In Proceedings of the 19th International DAAAM Symposium: Intelligent Manufacturing & Automation: Focus on Next Generation of Intelligent Systems and Solutions, Vienna, Austria, 22–25 October 2008; Katalinc, B., Ed.; DAAAM International: Vienna, Austria, 2008; pp. 1551–1552.
24. Markulík, Š.; Kamenický, L. How to Transform the Requirements into the Management System. In Proceedings of the 15th International Multidisciplinary Scientific GeoConference SGEM, Sofia, Bulgaria, 18–24 June 2015; pp. 689–693.
25. Šolc, M.; Kliment, J.; Šmelko, M. Vývoj a podstata nového systému manažerstva BOZP v organizácií podľa ISO 45001. *Bezpečnosť práce v praxi.* **2018**, *8*, 2–6.
26. Pačaiiová, H.; Nagyová, A.; Oravec, M. Risk-Based Thinking Methodology and Its Influence on Occupational Health and Safety Process. In *Advances in Physical Ergonomics and Human Factors*; Goonetilleke, R., Karwowski, W., Eds.; Advances in Intelligent Systems and Computing; Springer International Publishing: Cham, Switzerland, 2019; Volume 967, pp. 1–10. ISBN 978-3-030-20141-8.
27. Jannah, M.; Fahlevi, M.; Paulina, J.; Nugroho, B.S.; Purwanto, A.; Subarkah, M.A.; Kurniati, E.; Wibowo, T.S.; Kalbuana10, K.N.; Cahyono11, Y. Effect of ISO 9001, ISO 45001 and ISO 14000 toward Financial Performance of Indonesian Manufacturing. *Syst. Rev. Pharm.* **2020**, *11*, 894–902. [CrossRef]
28. Certifikácia Systému Manažerstva BOZP Podľa Normy ISO 45001 (Bývala OHSAS 19001). CeMS, s.r.o. 2022. Available online: <https://www.cems.sk/produkt/18-certifikacia-systemu-manazerstva-bozp-podla-normy-iso-45001-byvala-ohsas-18001> (accessed on 2 May 2022).
29. Hailstone, J. First 10 Companies to Achieve ISO 45001 Announced. Safety&Health Practitioner. 2018. Available online: <https://www.shponline.co.uk/legislation-and-guidance/first-10-companies-achieve-iso-45001-announced/> (accessed on 4 May 2022).
30. Al-Musawi, A.S.; Nagham, A. To What Extent the System of the Occupational Safety and Health Administration ISO 45001:2018 Prevents Injury. *ResearchGate* **2020**. [CrossRef]
31. Štatistika úrazov. BESOFT. 2022. Available online: <https://ebts.besoft.sk/odborne-informacie/statistika-urazov> (accessed on 17 April 2022).
32. Campanelli, L.C.; Ribeiro, L.D.; Campanelli, L.C. Involvement of Brazilian Companies with Occupational Health and Safety Aspects and the New ISO 45001:2018. *Production* **2021**, *31*, e20210005. [CrossRef]

33. Malinda, A.; Soediantono, D. Benefits of Implementing ISO 45001 Occupational Health and Safety Management Systems and Implementation Suggestion in the Defense Industry: A Literature Review. *J. Ind. Eng. Manag. Res.* **2022**, *3*, 35–47. [[CrossRef](#)]
34. Filimonov, V.A. Development and Implementation of Occupational Health and Safety Management System Based on the ISO 45001:2018 International Standard. *OSI* **2020**, 58–67. [[CrossRef](#)]