

OCCUPATIONAL SAFETY, HEALTH, AND ERGONOMICS THEORY AND PRACTICE SERIES

New Opportunities and Challenges in Occupational Safety and Health Management



EDITED BY
Daniel Podgórski



CRC Press
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New Opportunities and Challenges in Occupational Safety and Health Management

Occupational Safety, Health, and Ergonomics: Theory and Practice

Series Editor: Danuta Koradecka

(Central Institute for Labour Protection – National Research Institute)

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CRC Press

Taylor & Francis Group

Boca Raton London New York

CRC Press is an imprint of the
Taylor & Francis Group, an **informa** business

First edition published 2020
by CRC Press
6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742

and by CRC Press
2 Park Square, Milton Park, Abingdon, Oxon, OX14 4RN

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Library of Congress Cataloging-in-Publication Data

Names: Podgórski, Daniel, editor.
Title: New opportunities and challenges in occupational safety and health management / edited by Daniel Podgórski.
Description: Seventh edition. | Boca Raton, FL : CRC Press, 2020. | Series: Occupational safety, health, and ergonomics : theory and practice | Includes bibliographical references and index.
Identifiers: LCCN 2020005684 (print) | LCCN 2020005685 (ebook) | ISBN 9780367469320 (hardback) | ISBN 9780367505325 (paperback) | ISBN 9781003050247 (ebook)
Subjects: LCSH: Industrial safety--Management. | Industrial hygiene--Management.
Classification: LCC T55 .N4626 2020 (print) | LCC T55 (ebook) | DDC 658.3/82--dc23
LC record available at <https://lcn.loc.gov/2020005684>
LC ebook record available at <https://lcn.loc.gov/2020005685>

ISBN: 978-0-367-46932-0 (hbk)
ISBN: 978-1-003-05024-7 (ebk)

Typeset in Times
by Deanta Global Publishing Services, Chennai, India

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Editor

Daniel Podgórski graduated from the Faculty of Electronics of the Warsaw University of Technology in 1983, and received his PhD at the Institute of Industrial Automation of the Faculty of Mechatronics of the same university in 1992. Since 1984 he has worked for the Central Institute of Labour Protection (currently CIOP-PIB), initially as a researcher in the Department of Ergonomics and the Department of Safety Engineering, and then, as the deputy director for management systems and certification. The scope of research studies carried out by Dr Daniel Podgórski mainly included the analysis of factors influencing the implementation of OSH management systems in enterprises, and the application of selected key performance indicators (KPIs) for the measurement of operational performance of OSH management processes. His competences in the field of systematic OSH management are also being used in his function as chairman of the technical committee TC 276 for OSH Management Systems, which operates within the structures of the Polish Committee for Standardization (PKN). In recent years, the scope of scientific interests of Dr Daniel Podgórski has been extended to include the development and implementation of novel digital technologies for improving safety and health at work, which comprises in particular the use of smart personal protective equipment (smart PPE), workplace wearables and other Internet of Things technologies to facilitate OSH risk management at Industry 4.0 workplaces.



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Contributors

Zofia Pawłowska graduated from the Faculty of Mechatronics of the Warsaw University of Technology in 1975, and in 1982 she received her PhD at this Faculty. Since 1996 she has worked at the Central Institute of Occupational Protection (currently CIOP-PIB) as a researcher in the Department of Occupational Safety and Health Management. The scope of research carried out by Dr Zofia Pawłowska mainly covers methods aimed at the improvement of OSH management systems' performance in terms of ensuring better prevention of accidents and diseases at work. In recent years, her research studies has also included exploration of links between OSH management and workforce age management, and the introduction of social responsibility principles into OSH management systems. As a member of the technical committee TC 276 for OSH Management Systems, and the chair of the technical committee TC 305 for Corporate Social Responsibility (CSR), both operating within the structures of the Polish Committee for Standardization (PKN), she actively participates in standardization activities in these fields. She also provides advice and conducts numerous training courses for employers and managers, with a focus on issues related to her research and area of competence.

Małgorzata Peciłło graduated from the Faculty of Marketing and Management of the Warsaw School of Economics (SGH) in 1997, and obtained her PhD in 2007 at the Institute of Organization and Management in Industry (ORGMASZ, Warsaw). Since 1999 she has been employed as a researcher at the Department of Occupational Safety and Health Management of the Central Institute for Labour Protection – National Research Institute (CIOP-PIB). In her work, she focuses mainly on the development of new occupational health and safety management methods and their application in practice, involving in particular process approach to OSH management, the use of Balanced Scorecard, the development of programs for modification of workers' hazardous behaviours, and the exploitation of resilience engineering concepts. Dr Małgorzata Peciłło is the author of many educational materials and gives lectures at post-graduate studies and seminars in the field of OSH, organised for employers, safety managers, and workers alike. For many years, she has also conducted consulting activities covering the implementation of effective risk assessment procedures and accident prevention programmes in industrial enterprises.

Anna Skład graduated from the Warsaw School of Economics (SGH) in 1996, where she studied international economic and political relations. She continued her education at SGH participating in the postgraduate studies for quality managers (2007–2008), and doctoral studies in business management (2009–2013). Between 2001 and 2006, she worked in the IT section at Orbis S.A. (tourist services), and in the years 2006–2008 she was implementing the integrated management system in the Marshal's Office of the Mazovian Region. In 2008 she started working for Orange telecommunication company in the area of designing and improving business process architecture. Since 2014, she has been employed in the Department

of Occupational Safety and Health Management at the Central Institute for Labour Protection – National Research Institute, where in 2017 she defended her doctoral thesis on the implementation of fuzzy cognitive maps for the improvement of OSH management systems. Her scientific interests focus, among others, on the measurement of OSH management system effectiveness, the implementation of process approach in management systems, age management practices, and the introduction of the concept of vision zero with regard to accidents at work.

Series Editor



Professor Danuta Koradecka, PhD, D.Med.Sc. and Director of the Central Institute for Labour Protection – National Research Institute (CIOP-PIB), is a specialist in occupational health. Her research interests include the human health effects of hand-transmitted vibration; ergonomics research on the human body's response to the combined effects of vibration, noise, low temperature and static load; assessment of static and dynamic physical load; development of hygienic standards as well as development and implementation of ergonomic solutions to improve working conditions in accordance with International Labour Organisation (ILO) convention and European Union (EU) directives. She is the author of over 200 scientific publications and several books on occupational safety and health.

The “Occupational Safety, Health, and Ergonomics: Theory and Practice” series of monographs is focused on the challenges of the 21st century in this area of knowledge. These challenges address diverse risks in the working environment of chemical (including carcinogens, mutagens, endocrine agents), biological (bacteria, viruses), physical (noise, electromagnetic radiation) and psychophysical (stress) nature. Humans have been in contact with all these risks for thousands of years. Initially, their intensity was lower, but over time it has gradually increased, and now too often exceeds the limits of man's ability to adapt. Moreover, risks to human safety and health, so far assigned to the working environment, are now also increasingly emerging in the living environment. With the globalisation of production and merging of labour markets, the practical use of the knowledge on occupational safety, health, and ergonomics should be comparable between countries. The presented series will contribute to this process.

The Central Institute for Labour Protection – National Research Institute, conducting research in the discipline of environmental engineering, in the area of working environment and implementing its results, has summarised the achievements – including its own – in this field from 2011 to 2019. Such work would not be possible without cooperation with scientists from other Polish and foreign institutions as authors or reviewers of this series. I would like to express my gratitude to all of them for their work.

It would not be feasible to publish this series without the professionalism of the specialists from the Publishing Division, the Centre for Scientific Information and Documentation, and the International Cooperation Division of our Institute. The challenge was also the editorial compilation of the series and ensuring the efficiency of this publishing process, for which I would like to thank the entire editorial team of CRC Press – Taylor & Francis.

This monograph, published in 2020, has been based on the results of a research task carried out within the scope of the second to fourth stage of the Polish National Programme “Improvement of safety and working conditions” partly supported – within the scope of research and development – by the Ministry of Science and Higher Education/National Centre for Research and Development, and within the scope of state services – by the Ministry of Family, Labour and Social Policy. The Central Institute for Labour Protection – National Research Institute is the Programme’s main coordinator and contractor.

1 Introduction

*Daniel Podgórski, Zofia Pawłowska,
Małgorzata Pęciłło and Anna Skład*

Knowledge and practice in the field of occupational safety and health (OSH), including systematic approaches to OSH management, have been developing for several decades. This topic has been the subject of many studies, scientific articles, dissertations, monographs, etc., as well as the basis for the development and dissemination of many practical guidelines and specific standards, both at national and international level. At the same time, it should be noted that the global economy and its business environment, and thus the world of work, has recently been strongly influenced by demographic and social changes and globalisation, as well as the rapid development and introduction of novel, sophisticated and previously unknown technologies and new business models, especially in the context of the so-called fourth industrial revolution (otherwise known as Industry 4.0). These changes pose a number of challenges in terms of maintaining and improving the effectiveness of OSH management, as in new working environments traditional approaches may no longer be effective.

The word “challenge” has different meanings depending on the context in which it is used, but in business and management this term is usually used in the sense of a problem that stimulates a person or group to take specific action (Merriam-Webster 2019a). Thus, challenges should not be seen as obstacles but rather as stimuli to search for new solutions in order to make improvements or a progress in a particular area. This in turn leads us to use the term “opportunity”, which can be defined in this context as “a good chance for advancement or progress” (Merriam-Webster 2019b).

Furthermore, when considering the role of opportunities in management activities, including improving the effectiveness of OSH management, attention should be paid to the new requirements that were promoted internationally beginning in 2018 through the adoption and publication of the new standard ISO 45001 (ISO 2018). It is appropriate to cite the contents of Clause 6.1.2.3:

The organization shall establish, implement and maintain a process(es) to assess:

- a) OH&S* opportunities to enhance OH&S performance, while taking into account planned changes to the organization, its policies, its processes or its activities and:
 - 1) opportunities to adapt work, work organization and work environment to workers;
 - 2) opportunities to eliminate hazards and reduce OH&S risks;
- b) other opportunities for improving the OH&S management system.

* The term “occupational health and safety” (OH&S), which was adopted in the standard ISO 45001:2018, has the same meaning as the terms “occupational safety and health” (OSH) and “safety and health at work”. These latter terms are used interchangeably throughout this book.

The afore-mentioned circumstances imply very clearly that today's managers should exploit the most recent opportunities in the field of OSH management when taking ambitious measures to prevent work-related accidents and diseases, particularly when striving to improve the efficiency and competitiveness of their businesses as well as adapting to increasing trends in sustainable development. In particular, it is worthwhile to explore and exploit these opportunities – the results of latest research – to ensure that they are compatible with the latest trends in business management and combine them with the introduction of novel digital technologies harnessed to realise the vision of smart manufacturing and the digitally connected world of work.

Moreover, managers in increasingly complex business environments have to face trade-offs as a natural consequence of existing multi-role management systems. Thus, safety managers as well as CEOs need to gather knowledge regarding solutions and tools that may easily and effectively assist them in OSH-related decision-making processes.

Therefore, this book focuses on five thematic areas which have been identified by the co-authors as relevant for consideration of these challenges and related opportunities. These areas include:

- 1) introduction of the process approach to OSH management
- 2) improving OSH management systems using the fuzzy cognitive maps method
- 3) introduction of the strategic thinking approaches in relation to OSH management
- 4) integration of OSH management within the framework of the CSR concept
- 5) enhancing OSH management processes through the use of smart digital technologies.

All of this is introduced here briefly, and then will be addressed individually in greater depth in subsequent chapters.

First, the inherent objective of business activity is to generate economic profit and increase the value of an enterprise. Although in the 21st century no one questions the need to prevent occupational accidents and diseases, unfortunately ensuring safety and health at work is still seen by many business leaders as an additional burden that hinders the achievement of business goals. The opportunity to meet this challenge lies in the deeper integration of OSH activities into day-to-day operational activities. This is feasible when the traditional hierarchical organisational structure of an enterprise management is complemented by the establishment and implementation of a well-thought-out and structured business process architecture that embraces OSH processes and ensures their smooth integration with operational ones. This approach is particularly relevant in the context of the implementation of ISO 45001 standard, according to which an adoption of a process-oriented management is the basic prerequisite for OSH management system compliance with this standard. Therefore, Chapter 2 introduces readers to the basic principles of the process approach in the area of OSH management. The typology of processes, in which OSH processes and their basic components are addressed and examined in order to understand their performance and inter-relations, as well as determine the skills that are necessary

for effective management of OSH processes, is presented. Attention is paid to the measurement of processes effectiveness, with a particular focus on the principles of creating and selecting a set of indicators and their implementation to support decision making in an organisation. The Activity-Based Costing (ABC) method and the possibilities resulting from its application in the economic analysis of process costs are also presented in Chapter 2.

Since the standards setting out the formal requirements for OSH management systems were established, the concepts of these systems have been the subject of lively discussion, with both supporters and opponents arguing whether the implementation and improvement of such systems contribute to the real improvement of workers' safety and health. Without taking a particular side, Chapter 3 attempts to showcase a new advanced method for improving OSH management systems in order to credibly ensure that they are more effective in preventing work-related accidents and diseases. The chapter describes the method of fuzzy cognitive maps (FCM) and the means of applying this method to improve OSH management in enterprises. The FCM concept is based on an assumption that although people possess valuable knowledge resources, these resources are not used in practice due to the lack of user-friendly methods for extraction and further processing. There are many scientific studies proving the use of this method in management sciences and confirming its effectiveness in solving practical problems. Chapter 3 describes in detail the subsequent stages of creating a model of an OSH management system in an enterprise via the use of FCM, explains the expert role of workers, and then proposes ready-made linguistic scales for the assessment of objects and influences adopted in an FCM-based management system model. The chapter also covers how to transform a model developed by experts into a mathematical record, apply this record in simulations, and use the achieved results in the decision-making process.

The search for new solutions to improve OSH management performance has led to the conceptualisation and increasingly widespread use of process approaches. However, the introduction of these approaches without linking the processes and indicators developed to the enterprise's global strategy is useless when trying to understand the enterprise management system as a whole. It is therefore necessary to implement a holistic approach which would make it possible to link the processes carried out with the enterprise's strategy as well as with respective resources applied together with its intellectual capital. Hence, in Chapter 4, linking the performance of OSH management processes with strategic management assessment is discussed in detail. The application of the strategic management performance metric called Balanced Scorecard (BSC) to OSH management as an assessment and diagnosis tool is described. This chapter also explains how the BSC may facilitate the implementation of the process approach as well as the implementation of traditional preventive programs, such as behavioural-based safety (BBS). Finally, Chapter 4 presents the issue of senior management perception of the importance of safety and health when making trade-offs. This in part is based on the resilience engineering theory, a new approach to OSH management developed to find a counterweight to overall managerial practices that typically focus on achieving effectiveness and process optimisation.

Another answer to these challenges involves a new approach to extend the traditional area of OSH management so that it not only focuses on the prevention of occupational accidents and diseases but also includes measures to improve workers' health and well-being as well as prolong their working lives. This approach requires that Corporate Social Responsibility (CSR) aspects be taken into account in the management of OSH, including the incorporation in this context of appropriate measures to reduce psychosocial risks in the working environment and to take account of the diversity of workers, particularly the ageing of the workforce. By managing OSH in a socially responsible way, organisations may contribute to the achievement of the United Nations Sustainable Development Goals, particularly with regard to the eighth goal, which relates to the promotion of inclusive and sustainable economic growth, employment and decent work for all (UN 2015). With regard to these aspects, Chapter 5 addresses OSH management challenges from a social responsibility perspective. OSH-related issues of CSR are identified in accordance with the ISO 26000 standard "Guidance on Social Responsibility" (ISO 2010), and opportunities to integrate these issues into OSH management system components are discussed, taking into account the system structure adopted in the ISO 45001 standard. Chapter 5 pays particular attention to systematic measures to maintain workers' work ability and to integrating the age management into socially responsible OSH management, particularly in light of emerging demographic changes in society. Finally, the chapter discusses the method of evaluating the outcomes of socially responsible OSH management and presents a set of performance indicators that can be used for this purpose.

The basic rationale behind the content of the final thematic area is the recently observed radical progress in the development of manufacturing technologies, in particular the increasing involvement of digital technologies in manufacturing and business processes. This movement, often referred to as the digital transformation of the economy, is based on the application of new concepts such as the industrial Internet of Things (IIoT), cyber-physical systems (CPS), collaborative robots, cloud and edge computing, advanced methods of data analytics and so forth, whose introduction to the workplace inevitably changes work processes and poses new challenges to OSH. In contrast, enabling technologies, which play a significant role in the Industry 4.0 developments, can be successfully deployed to create new solutions and systems to effectively support OSH management systems in enterprises. Chapter 6 presents and discusses the potential for applying digital technologies to manage safety and health at work. In particular, this chapter provides a typology and review of smart personal protective equipment and other wearables for OSH-related applications, with an emphasis on their usefulness in the context of IT-empowered OSH risk management. These issues are complemented by a vision of the future potential of using machine-learning algorithms and big data analytics methods for OSH management. The chapter also includes a discussion on privacy protection and cyber-security aspects, both of which are an important problem and to some extent a hindrance to the dissemination and application of otherwise useful digital technologies in the workplace.

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