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Pedro M. Arezes · J. Santos Baptista · Mónica P. Barroso · Paula Carneiro · Patrício Cordeiro · Nélson Costa · Rui B. Melo · A. Sérgio Miguel · Gonçalo Perestrelo *Editors*

Occupational and Environmental Safety and Health II

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Preface

Occupational and Environmental Safety and Health II is a compilation of the most recent work of some selected authors from 13 countries within the domain of occupational safety and health (OSH). The included works are focused on selected topics, including occupational safety, risk assessment, safety management, ergonomics, management systems, environmental ergonomics, physical environments, construction safety and human factors, among others.

This book represents the state of the art, and it is mainly based on research carried out at universities and other research institutions, as well as some on-field interventions and case studies. Due to the broad scope, relevance and originality of the contributions, it is expected that this book contains useful and up-to-date information, and it presents fundamental scientific research that is being carried out in the subject, as well as it contributes to the outreach of practical tools and approaches currently used by OSH practitioners in a global context. All the included contributions were selected based on their potential to show the newest research and approaches, giving visibility to emerging issues and presenting new solutions in the field of occupational safety and health.

This book is based on selected contributions presented at the 16th edition of the International Symposium on Occupational Safety and Hygiene (SHO 2020), which was held on 6–7 April, in Porto, Portugal.

All the contributions included in this book were previously peer-reviewed by, at least, two of the 131 members from 17 different countries of the International Scientific Committee of the 2020 edition. The event is organised annually by the Portuguese Society of Occupational Safety and Hygiene (SPOSHO).

Editors would like to take this opportunity to thank their academic partners, namely the School of Engineering of the University of Minho, the Faculty of Engineering of the University of Porto, the Faculty of Human Kinetics of the University of Lisbon, the Polytechnic University of Catalonia and the Technical University of Delft. The editors also would like to thank the scientific sponsorship of several academic and professional institutions, the official support of the Portuguese Authority for Working Conditions (ACT), as well as the valuable

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Occupational Health and Safety-Sustainable Development and the Changes in Organizations

Cristina Reis, Carlos Oliveira, Paula Braga, J. F. Silva and L. T. Silva

Abstract The paper aims to demonstrate the interconnection between occupational hygiene and health, which is based on three main pillars: economy, environment and society, just as sustainable development is based on three major topics: people, planet and profit. Thus there must be strong OHS policies that encompass sufficient environmental programs to ensure workers are safe and thus ensure sustainability. Sustainable development is an increasingly imminent concern in all countries and organizations today. The United Nations (UN) has played a key role in this context. In 1992 at Rio-92, through Agenda 21, elaborated with the collaboration of 172 countries, they decided to create goals for sustainable development, giving priority to the environment. The document was based on environmental conservation, social

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justice and economic growth. In the meantime, at the beginning of the century, the eight outlined goals that became known as the «8 millennium goals» for the period 2000–2015 were set. At the UN Summit, in New York (USA), a new action agenda, until 2030, was established. This agenda is the result of the joint work of governments and citizens, around the world, to create a new global model for ending poverty, promoting prosperity and well-being, protecting the environment and fighting against climate change. The year of 2015 will be in history as the year of defining the 17 Sustainable Development Goals, known as the 2030 agenda.

Keywords Sustainability · Environment · Prevention · Safety · Occupational health

1 Introduction

1.1 Sustainable Development

Sustainability has played a predominant role in our society over the last few years. During the 2000s, space and urban policy in the United Kingdom became increasingly concerned with the creation of sustainable communities. The urban renaissance's focus on security through design has been replaced by new, more holistic discourses that emphasize "community security" and the ways in which the planning process can be reformulated to achieve this [1].

Sustainability is, in fact, a "process" that seeks to strike a balance between the environment and use of natural resources. Humanity over time has so degraded the planet's natural resources that it is now necessary to carefully seek and plan their consumption to ensure their existence for future generations [1].

According to the UN, sustainable development is a development model that enables the needs of the present to be met without compromising the ability of future generations to meet their own needs [2].

Factors that affect sustainable development and deserve individual and collective reflection are:

- Energy efficiency;
- Sustainable mobility;
- Climate and climate change;
- Sustainable consumption;
- The efficient use of resources;
- Waste recovery or preservation of biodiversity.

The way in which the concept of sustainable development is viewed has evolved in recent decades, due to the new scientific knowledge, but also due to the awareness of society in general, reflected on several international decisions already taken, namely within the UN Organization.

1.2 Occupational Health and Safety

Occupational hygiene is understood as a set of norms and procedures that aim at protecting the physical and mental integrity of the worker, preserving from health risks inherent to the tasks and the physical environment where the work is performed [3].

In turn, Occupational health is the science that encompasses occupational hygiene, safety and medicine by monitoring workers at their work, establishing methods, organizing the work environment and designing programs that promote workers' health [4].

Companies are responsible for providing a safe working environment for their workers. Occupational hygiene and health seeks to reduce work-related hazards by identifying and minimizing factors that may eventually affect employees' environments [5]. Safety at work sensitizes employees and seeks to eliminate unsafe conditions by preventing work accidents [5].

2 Evolution of Organizations on Sustainable Development

2.1 Evolution in Organizations

This development paradigm was embodied in Rio-92, through Agend-21, prepared with the collaboration of 172 countries, which decided to create goals for sustainable development, giving priority to the environment. The document was based on environmental conservation, social justice and economic growth.

These three pillars are still considered essential for the application of this development concept. At the beginning of this century, eight objectives were set internationally, which became known as the «8 millennium goals» for the period of 2000–2015 [6].

In 2015, at the UN Summit in New York (USA), a new action agenda was embodied by 2030. This agenda is the result of the joint effort of governments and citizens around the world to create a new global model for ending poverty, promoting prosperity and well-being, protecting the environment and combating climate change. Thus 2015 will be in history as the year of the 17 Sustainable Development Goals definition [6].

2.2 2030 Agenda

The 2030 agenda set out a new action schedule, by 2030, which was build on the progress and lessons learned from the «8 Millennium Development Goals» between 2000 and 2015. The 17 Sustainable Development Goals are:

- Eradicate poverty;
- Eradicate hunger;
- Quality health;
- Quality education;
- Gender equality;
- Drinking water and sanitation;
- Renewable and affordable energy;
- Decent work and economic growth;
- Industry, innovation and infrastructures;
- Reduce inequalities;
- Sustainable cities and communities;
- Sustainable production and consumption;
- Climate action;
- Protect marine life;
- Protect terrestrial life;
- Peace, justice and effective institutions;
- Partnership for the implementation of the objectives.

The UN launches these goals based on real facts. The need to eradicate poverty is associated with the hunger in the world. For instance, it may be found that in an urban slum in Hanoi, Vietnam (Fig. 1), over 13% of Vietnam's population and a quarter of the world's population—nearly 2 billion people—live on $1.25, or less, a day, according to the World Food Bank.

The Sustainable Development Goals set global priorities and aspirations for 2030 and require global action by governments, businesses and civil society to eradicate poverty and create a life with dignity and opportunity, for all, within the planet limits [8]. The Sustainable Development Goals (SDGs) and the 2030 Agenda, adopted by almost all countries in the world (having been signed by 193 countries) in the UN context, sets the priorities and aspirations for global sustainable development for 2030 and seek to mobilize global efforts around a set of common goals and objectives. There are 17 SDGs in areas that affect the quality of life of all the world's citizens and those yet to come [7].

Fig. 1 Urban slum in Hanoi, Vietnam. *Photo* UN/Kibae Park [7]

The SDGs require global action by governments, businesses and civil society to eradicate poverty and create a life with dignity and opportunity for all within the confines of the planet. For companies, particularly, the SDGs provides an opportunity to create and implement solutions and technologies that address the greatest global challenges, helping to link business strategies and global priorities.

More broadly and comprehensively, an overview of the objectives of sustainable development is presented [7]:

- End poverty in all its forms and everywhere;
- End hunger, achieve food security and improved nutrition, and promote sustainable agriculture;
- Ensure a healthy life and promote well-being for all, at all ages;
- Ensure quality inclusive and equitable education and promote lifelong learning opportunities for all;
- Achieve gender equality and empower all women and girls;
- Ensure the availability and sustainable management of water and sanitation for all;
- Ensure access to reliable, sustainable, modern and affordable energy for all;
- Promote sustainable, inclusive and sustainable economic growth, full and productive employment and decent work for all;
- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation;
- Reduce inequality within and between countries;
- Make cities and human settlements inclusive, safe, resilient and sustainable;
- Ensure sustainable production and consumption patterns;
- Take urgent action to combat climate change and its impacts;
- Conserve and sustainably use oceans, seas and marine resources for sustainable development;
- Protect, restore and promote sustainable use of terrestrial ecosystems, manage forests sustainably, combat desertification, halt and reverse land degradation and halt biodiversity loss;
- Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, responsible and inclusive institutions at all levels;
- Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Only 1/5 of the planet's population consumes 70% of the energy, 85% of the wood and 75% of the metals, holding four fifths of world income [9].

The SDGs results from the joint work of governments and citizens around the world to create a new global model for ending poverty, promoting prosperity and well-being for all, protecting the environment and combating climate change [9].

2.3 International Labour Organization

The International Labour Organization (ILO), on the occasion of World Day for Safety and Health at Work, publishes its new report "Safety and Health at the Centre of the Future of Work: Building on 100 Years of Experience", which examines the organization's 100 years of work dedicated to improving occupational health and safety (OSH), and highlights emerging issues in this area in the world of work [10].

1st—Technology—such as digitalization, robotics and nanotechnology—can also affect psychosocial health and introduce new materials with health risks that have not yet been taken into account. Properly applied, it can also contribute to reduce exposure to occupational hazards, facilitating job training and inspection [10].

2nd—Demographic changes are relevant because there are high levels of occupational injuries in the young working population. On the other hand it is also necessary to ensure working methods and equipments that ensure the safety and health of younger workers. Increasing numbers of women at work are more likely to work in atypical forms of employment and are at a greater risk for musculoskeletal injury [10].

3rd—Sustainable development and climate change that open the door to risks such as air contamination, stress from excess heat, emerging diseases, changes in rainfall patterns, which may lead to job losses. But also, new jobs will be created thanks to the green economy [10].

4th—Changes in work organization can give rise to flexibility that allows more people to enter the working world, but also may lead to psychosocial problems (e.g. insecurity, reduced privacy and rest time, or inadequate OSH and social protection) and excessive working hours [10].

Based on these challenges, the ILO report proposes six areas on which policy makers and other relevant partners should be concentrated [10].

- Anticipate new and emerging OSH risks;
- Adopt a multidisciplinary approach;
- Establish a greater relationship with public health;
- Better understanding of OSH related issues;
- Strengthen international labour standards and country legislation;
- Enhance collaboration between governments, employers and employees representatives.

3 Good Examples and Methodology

The methodology followed in this research work was based on a bibliographical research on the subject and the changes in the organizations involved in this matter. In a second phase it was tried to present examples of a program of good practices, for sustainable development, that has been implemented.

3.1 Eco-Schools Program

At a national level, in this area of sustainable development, several actions have been promoted at primary, secondary and higher education level, with the action program being designated Eco-schools. This program aims to alert children and adolescents to environmental issues, to promote good practices. The early awareness of these issues begins to reverse years of environmental unconsciousness [11].

3.2 Eco-Campus Program

At a national level, as regards higher education, the sustainable Eco-Campus has been promoted. Its purpose is to reduce the energy load of universities by promoting the use of clean energy sources, placing solar panels, replacing traditional lamps with LED lamps. Other measures include promoting the reduction of plastic use, food waste, physical exercise for a healthier life, the use of sustainable transportation, such as the use of electric bicycles, running bike paths, among others [11].

4 Interface Between Occupational Health and Sustainable Development

After giving a brief presentation of the concepts, and an analysis of the organizations regarding sustainable development and occupational health, it is possible to outline the objective and motivation that led to the elaboration of this work. It aims to show how occupational health is interconnected with the sustainable development paradigm. According to major international references such as the World Health Organization: Healthy Environments for Healthy People and the International Labor Organization which says, “decent work: the key to sustainable development”, occupational health is considered to be the important driver for achievement of three main objectives of sustainable development [12]. Fulfilling, in this way, the 3 objectives of the 2030 agenda:

- Goal 3: Quality Health;
- Goal 8: Decent Work and Economic Growth;
- Goal 12: Sustainable Consumption and Production.

Also, another approach is that occupational health is at the center of sustainable development in the following ways [13]:

(a) The prevention of accidents, injuries and illness at work, and the protection of workers from physical and psychological overload require a parsimonious use of resources, minimizing unnecessary loss of human and material resources.

(b) The goal of healthy and safe work environments requires the use of safer, lower energy, low emission and low waste (green) and in many countries occupational health legislation requires the use of the best available production technology.
(c) The occupational health approach has been shown to facilitate undisturbed production that increases product quality, productivity and process management, thereby helping to avoid unnecessary energy and material losses, and to avoid unwanted impacts on the environment.
(d) Many environmental risks and burdens are derived from occupational environments, industry, farming or transportation practices and services. Occupational health specialists, and other safety officers, are well informed of the processes and agents that can be hazardous to the environment. Often this information is available to them at a very early stage of the problem, thus allowing prevention that is no longer possible when the hazardous substances are released into the environment. The impact of occupational health on protecting the environment from problems arising from production systems is likely to be effective and economical. In many industrialized countries, measures exist to approximate links between occupational health and environmental health approaches.
(e) Occupational health services aim to ensure the health, safe, capacity and well-being of the working population. A healthy, productive and well-motivated workforce is the main agent for socioeconomic development. In addition, high quality and productivity work can ensure healthy production of materials, goods and services, and the consideration and practical implementation of sustainable development principles.
(f) Most of the environmental health risks that were later found to affect the health of the general population were first detected in the workplace and/or working population. Thus, the occupational environment provides an early warning system for certain environmental health risks, as well as provides effective models for preventive action.
(g) For more than half of the adults, the work environment is the most demanding environment in terms of physical, chemical, ergonomic or psychological stress and physical workload. The requirement of the Rio Declaration, on healthy and productive living, is particularly relevant to the work environment and calls for occupational health.
(h) The state of the general environment and ecosystem has an impact on workers' health, indirectly or directly on various occupations, like agriculture, mining, fishing and manufacturing. Therefore, there is a two-way relationship between occupational health and safety, on the one hand, and environmentally sound sustainable development, on the other.

Equally important to the personal well-being, and socio-economic development of communities and countries, is an employment policy that guarantees access to work for all and enables individuals to support themselves and their families

through their own work. Potential employment is also a key factor in the safe, stable and sustainable social development of countries, while high unemployment rates and other associated problems put this development at risk [13].

5 Conclusion

From this research work it may be concluded that occupational health and safety policies are critical for sustainable development. According to Kwesi Amponsah-Tawiah, occupational health and safety should bring benefits from improved environmental and social performance, more employment, worker satisfaction and commitment, greater innovation and creativity [14].

There is a positive correlation between protecting workers against work-related injuries, illness, physical and psychological overload and prudent use of resources, minimizing unnecessary loss of human and material resources. Occupational health and safety emphasizes best practices in the use of production technologies that ensure low energy consumption, low emission and low waste technology, key elements in maintaining the environment [15].

As a major reflection on sustainable development, it should be noted that only 1/5 of the planet's population consumes 70% of energy, 85% of wood and 75% of metals, accounting for four fifths of the world income [16].

The SDGs results from the joint work of governments and citizens, around the world, to create a new global model for ending poverty, promoting prosperity and well-being for all, protecting the environment and combating climate change [9].

There is still a lack of environmental sensitivity, especially in underdeveloped countries, where investing in such actions is considered as an added cost. On the other hand, the application of good practices will depend not only on the organizations that run them, but also on the leaders who are governing the countries. If they are not focused on investing in this matter, to have the return of these policies adopted in the future this will not be possible. Often governments have only a short-term economic view and do not worry about the consequences this will have in the future.

According to Apolpia et al. [17] the term, urban regeneration, is synonymous of rehabilitation or urban renewal. Whatever the mode of expression this is based on, on a set of action principles, aiming at the sustainable development of cities. The problem of urban growth can be tackled effectively through the rehabilitation of historic centers. The rehabilitation of historic centers allows new life to be given to the cities that are already dead, but in turn it is an added value for traffic control, as it will avoid the movement of vehicles from the surroundings to the urban center. Urban rehabilitation of historic centres largely contributes to the application of sustainable developments, as it encourages the use of public transportation, physical exercise and CO_2 emissions, as no car is needed to go to work.

The use of a mobile environmental monitoring station to evaluate the urban environment, for instance, would also be a technological aid, by developing a platform where the population could be informed about the quality of the urban environment (air and noise) on the city they live [18].

From this analysis it may be concluded that there is a strong relationship between sustainable development and occupational health. For a healthy work environment, safety is essential, and for that, the sustainability of the environment must be taken into account.

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