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OCCUPATIONAL SAFETY AND HEALTH AS AN AREA OF SCIENTIFIC COGNITION – CURRENT STATUS AND DEVELOPMENT OPPORTUNITIES

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Purpose: The main aim of the research was to analyse the current state and development opportunities of occupational safety and health as an area of scientific cognition in the context of safety engineering.
Design/methodology/approach: The context of safety engineering as a new scientific discipline in the field of engineering and technical sciences creates opportunities for the development of occupational safety and health in the areas of science and education. Selected databases and IT systems operating in the higher education and science system (POL-on; RAD-on; People of Science; Polish Science) were used as sources of information for the research. The website of the Council for Scientific Excellence (RDN) and selected websites of entities (universities, scientific institutes) were used to verify the information.
Findings: Based on research and analyses in the field of occupational safety and health in the aspect of areas of knowledge, education and science, assumptions and an example of synthetic assessment of occupational safety and health in the higher education and science system were proposed. The following information lists were developed: list of universities conducting a field of study, list of entities authorized to award academic degrees in a discipline, list of entities conducting scientific activity in a discipline, list of persons conducting scientific activity in a discipline, list of persons declaring a scientific specialty.
Research limitations/implications: Research and analyses focus on the context of the higher education and science system and selected fields of study dedicated to the occupational safety and health service (occupational safety and health, safety engineering).
Practical implications: The results of research and analyses can be used by entities (universities, scientific institutes) and persons (science managers, academic teachers, students) operating in the higher education and science system, as well as persons professionally involved in occupational safety and health (e.g.: employees of OSH service, lecturers, teachers).
Social implications: The results of research and analyses in the field of occupational safety and health concern the protection of human life and health both in the work environment (occupational) and the public environment (non-occupational).
Originality/value: The publication constitutes a new approach to the areas of occupational safety and health and safety engineering in the context of scientific knowledge in the aspect of the areas of knowledge, education and science.
Keywords: occupational safety and health (OSH), OSH service, safety engineering, higher education and science system, education and science, synthetic assessment.
Category of the paper: research paper, general review.

1. Introduction

Occupational safety and health and the accepted context of knowledge in the field of safety engineering can be considered in different aspects, because they are simultaneously areas of theory (e.g. cognition and discovery) and areas of practice (e.g. action and behavior).

The process of acquiring knowledge includes, among others, division into scientific cognition (objective), that is knowledge based on research and scientific methods, and non-scientific cognition (colloquial, subjective), that is knowledge based on other sources, e.g. personal experience.

The process of scientific cognition is characterized by specific requirements, i.e. standards for conducting scientific research in the fields of science and scientific disciplines (detailed methodology). The general methodology emphasizes, among other things, that scientific cognition is a purposeful and conscious research activity (Apanowicz, 2003), its goal is to solve a research problem, and its key feature is interdisciplinarity (Sadowski, Szydlik, 2016).

The original approach to the scientific cognition process in the field of occupational safety and health problems and the adopted context of safety engineering is the division into three following areas of research and analysis: knowledge, education and science (Krause, 2024c).

Occupational safety and health (EN: OSH or OHS, PL: bhp or BHP) is a popular area of knowledge that applies not only to employees and the work environment (but also to other exposed persons and the non-occupational environment). This concept has reference, among others, to the state security system as the labor protection system (including legal and organizational systems) and the legal system as the labor law (including general, specific and internal law). Who does not know the concept and abbreviation of occupational safety and health or related concepts, e.g.: state of OSH, OSH service, OSH regulations and principles, training in the field of OSH or OHS training?

Occupational safety and health is an area of education in the education system, including the core curriculum for vocational education, the occupation of occupational safety and health and technician (Regulation of the Minister of National Education of 31 March 2017) and initial training and periodic training dedicated to employees at the workplace (Regulation of the Minister of Economy and Labor of 27 July 2004), as well as in the higher education and science system, including qualification requirements dedicated to employees of the occupational safety and health service (Regulation of the Council of Ministers of 2 September 1997): postgraduate study in occupational safety and health, higher study in the field or specialty in occupational safety and health.

Occupational safety and health is not an independent area of science as a scientific discipline, it is a research area and an informal scientific specialty or specialization. The context of safety engineering as a new scientific discipline creates opportunities for the development of occupational safety and health in the areas of knowledge, education and science, in particular in the area of science as a specialty accepted by the scientific community in the higher education and science system, e.g. in promotion procedures (doctor, habilitated doctor, professor).

Safety engineering has been both an area of knowledge and an area of education for at least a dozen or so years, the conventional dates of its contemporary development can be assumed to be the years 2007-2008, in which the following facts were identified: regulations on the education standards were issued (Regulation of the Minister of Science and Higher Education of 12 July 2007), including for the field of study in safety engineering; the field of study in safety engineering was launched (including at the Faculty of Mining and Geology of the Silesian University of Technology); the most frequently cited monograph on the basics of technical safety engineering was published (Pihowicz, 2008).

Safety engineering was not included in the classification of science in Poland when the regulations changed in 2011 (Regulation of the Minister of Science and Higher Education of 8 August 2011) and 2018 (Regulation of the Minister of Science and Higher Education of 20 September 2018). The need to change the classification of science in the aspect of the new discipline of safety engineering was addressed, among others, in the publication (Lustostański, 2016), and the analysis of safety engineering in the aspect of the areas of education and science was presented, among others, in the publication (Krause, 2021b, 2022a).

Safety engineering is a new scientific discipline in the field of engineering and technical sciences, which was introduced in the legal system from November 2022 in connection with the changed classification of science (Regulation of the Minister of Education and Science of 11 October 2022). It began to function in the organizational system from January 2024 based on the results of elections to the Council of Scientific Excellence for the term of office in 2024-2027 (Council for Scientific Excellence, RDN Elections).

The legal basis for the higher education and science system is the fundamental law (Act of 20 July 2018) and implementing acts, including the applicable regulations on the classification of science (Regulation of the Minister of Education and Science of 11 October 2022), and withdrawn, but recommended regulations on the education standards (Regulation of the Minister of Science and Higher Education of 12 July 2007), including the fields of study in occupational safety and health and safety engineering.

This publication is a continuation of previous own research in the field of safety engineering and occupational safety and health, including:

- Assumptions of safety engineering as an area of education, an area of science and a new scientific discipline, e.g.: safety engineering as an area of science and education (Krause, 2021a, 2021b), safety engineering as a scientific discipline and an area of education (Krause, 2022a).
- The higher education and science system in Poland in the aspect of the area of occupational safety and health, discipline of safety engineering and discipline of safety sciences, e.g.: occupational safety and health as an area of knowledge and education (Krause, 2024a), occupational safety and health as an area of safety engineering (Krause, 2024c), safety sciences and safety engineering as areas of science and education (Krause, 2024b).

2. Material and methods

The main aim of the research was to analyse occupational safety and health in the aspect of the new scientific discipline of safety engineering. Based on the literature review and own research, the results of which were included in cyclical reports on the implementation of statutory works (directed research) at the Silesian University of Technology – BK/295/RG-3/2023 (Krause, 2023) and BK-272/RG3/2024 (Krause, 2024d), the following scope of publication was adopted: occupational safety and health as an area of knowledge, occupational safety and health as an area of education, occupational safety and health as an area of science, synthetic assessment of occupational safety and health. The scope of research and analyses in the area of education, due to the adopted context of safety engineering, was limited to the higher education and science system (without the education system) and higher studies (without postgraduate studies).

The research used the document analysis method to collect information (described, among others, in publications (Apanowicz, 2003; Krause, 2018). Publicly available, selected databases and IT systems operating in the higher education and science system) were used as sources of information (POL-on System, Public data; RAD-on System, Data; People of Science Portal; Polish Science Database). The website of central government administration body (Council for Scientific Excellence) and selected websites of entities (universities, scientific institutes) were used to verify and supplement the information.

The following information lists have been developed: list of universities conducting a field of study (RAD-on System, Studies…), list of entities authorized to award academic degrees in a discipline (RAD-on System, Bodies…; Council for Scientific Excellence, Powers …), list of entities conducting scientific activity in a discipline (RAD-on System, Disciplines…), list of persons conducting scientific activity in a discipline (RAD-on System, Academic…), list of persons declaring a scientific specialty (People of Science Portal; Polish Science Database).

3. Results and discussion

3.1. Occupational safety and health as an area of knowledge

The concept of occupational safety and health has no formal definition adopted in labor law or a generally accepted definition in technical standards or specialist publications. The most frequently cited (although withdrawn) national standard on occupational safety and health management systems (PN-N-18001:2004) includes the following definition: OSH is the state of working conditions and organization and employee behaviors that provide the required level of health and life protection against hazards occurring in the work environment.

Current standards on occupational safety and health management systems – international (PN-EN ISO 45001:2024) and national (PN-N-18002:2011) do not include a definition of occupational safety and health. An example interpretation in the context of OSH management systems could be as follows: OSH is the actions of an organization in order to prevent work-related accidents and diseases and to ensure safe and hygienic workplaces, including process approach based on risk and the PDCA cycle (Krause, 2020).

The concept of safety engineering has no generally accepted definition in legal acts, technical standards and specialist publications. In the literature, the most frequently cited monograph is (Pihowicz, 2008), which contains the following definition: safety engineering arises from the need to solve problems related to the necessity of counteracting hazards caused by technical objects, natural phenomena and human activities in order to rationally maximize the protection of people, the natural environment and the goods of civilization.

Frequently cited monographs in the field of safety engineering include, among others, monographs published in 2008-2009 entitled "Technical safety engineering. Basic problems" (Pihowicz, 2008) and "Reliability and safety" (Szopa, 2009), as well as the latest monographs published in 2020 entitled "Engineering in internal security" (Wolanin, 2020) and "Basics of safety engineering" (Krause, 2020).

Occupational safety and health is a basic area of safety engineering, which is clearly emphasized by, among others, the monograph (Krause, 2020) in the aspect of the adopted conceptual framework and work structure (chapter numbers and titles): safety (2.7. Occupational safety and health), hazard (4.3. Hazards in the work environment), risk (5.4. Occupational risk assessment), accident (6.4. Analysis of accidents at work).

It is necessary to emphasize in the classification of safety engineering the basic criterion of the connection with professional activity, which distinguishes the division into occupational safety engineering and public safety engineering. Occupational safety engineering concerns professional activity, including performing work on the basis of employment relationship, civil law contract and conducting business activity, and the entities are, among others: employed – employee, working person, officer, soldier, entrepreneur – self-employed (Krause, 2020).

Occupational safety and health in the context of safety engineering can be considered, among others, as specific elements of the state's internal security system and the human-technology-environment system (EN: H-T-E, PL: C-T-O). An example interpretation in the context of safety engineering may be as follows: OSH is the creation of the basics for the construction of the labor protection system in the scope of protecting human life and health in the work environment, which includes employees, other working persons and other exposed persons (Krause, 2020).

Occupational safety and health is an area of knowledge that has a direct reference to the labor protection system, which includes, among others, the legal system (including the division into general, industry, specific and internal law) and the organizational system (including the division into state and social supervision and control entities of working conditions and control

and advisory entities acting for the employer). The examples of state supervision and control entities include State Labor Inspection and State Sanitary Inspection, social supervision and control entities include trade unions and social labor inspection, and employer's control and advisory entities include occupational medicine service, occupational safety and health service, and occupational safety and health commission. The adopted scope of the publication focuses on the context of higher studies dedicated to the occupational safety and health service.

Occupational safety and health can also be analyzed in the aspect of the type of information sources, including the following three areas of analysis:

- Legal information as legal information portals, including Online Legal Database (ISAP, Legal information portal) and applicable legal acts, e.g. dedicated to OSH area are section X of the Labor Code Act (Act of 26 June 1974) and basic implementing acts (Regulation of the Minister of Labor and Social Policy of 26 September 1997).
- Standardization information as standardization information portals, including Polish Committee for Standardization (PKN, Standardization information portal) and recommended technical standards, e.g. dedicated to OSH area are standards belonging to the ICS classification (International Classification for Standards) to group no. 13 entitled "Environment – Health Protection – Safety" (PKN, Standards search engine).
- Industry information as recommended achievements of science and technology, including those dedicated to OSH area, are monographs, periodicals and Internet portals, e.g.: State Labor Inspection (PIP, Labor law knowledge portal), Central Institute for Labour Protection – National Research Institute (CIOP-PIB, OSH knowledge Portal), European Agency for Safety and Health at Work (EU-OSHA, OSH knowledge Portal).

Frequently cited theoretical and methodological basics in the field of occupational safety and health (including those related hazards in the work environment and occupational risk assessment) are included, among others, in monographs published by the Central Institute for Labour Protection – National Research Institute, e.g. in the years 1997-1999 "Occupational safety and ergonomics. Volumes I-II" (Koradecka et al., 1997) and "Occupational risk assessment. Methodological basics. Volume 1" (Zawieska et al., 1999), and in the years 2008-2009 "Occupational safety and health" (Koradecka et al., 2008) and "Occupational risk. Methodological basics of assessment" (Zawieska et al., 2009).

Theoretical and methodological basics in the field of occupational safety and health were the subject of numerous original research and analyses, the results of which were published, among others, in the following monographs issued by the Silesian University of Technology in 2018-2023: "Basics of research in the field of occupational safety and health" (Krause, 2018), "Diploma thesis in the field of occupational safety and health" (Krause, 2019), "Research methodology in the field of OSH. Examples of quantitative risk assessment" (Krause, 2022b), "Research methodology in the field of OSH. Examples of quantitative accident forecast" (Krause, Gil, Pelon, 2023).

The current list of monographs in the field of occupational safety and health is presented in the publication (Krause, Salamon, 2024), and the current list of monographs in the field of safety engineering – in the publication (Krause, 2024c).

3.2. Occupational safety and health as an area of education

Occupational safety and health is an area of education in the education system and the higher education and science system. The adopted scope of the publication focuses on the context of the higher education and science system and selected fields of study dedicated to the occupational safety and health service (occupational safety and health, safety engineering).

Occupational safety and health and safety engineering as elements of the higher education and science system have reference, among others, to the following areas of analysis:

- The organizational structure of the units of the higher education and science system, including the names of entities (universities, institutes) and their basic and internal units, e.g.: faculty, institute, department, laboratory.
- Scientific activity (scientific research, development work) conducted in entities (universities, institutes) in the discipline of safety engineering or related disciplines in the specialty in occupational safety and health.
- Teaching activity conducted in the field of higher studies (universities) and postgraduate studies (universities, institutes) includes, among others, teaching that meets the qualification requirements for employees of OSH service.

Higher studies dedicated to OSH service is based, among others, on the education standard for the field of study in occupational safety and health or related fields (including safety engineering). Qualifying studies are conducted in the field of study or specialty of education in the field of occupational safety and health, and include the following types of studies: level of education (first-cycle, second-cycle), profile of study (general academic, practical), form of studies (full-time, part-time).

If higher studies are conducted field of study without specialty of education in the field of occupational safety and health, then, at the request of the graduate, the university makes an entry in the diploma supplement about obtaining qualifications in the field of OSH service on the basis of curriculum covering the content and outcomes of education in the field of occupational safety and health.

The list of universities conducting field of study in occupational safety and health or related fields in the aspect of the level of education and profile of study (only conducted studies) is presented in Tables 1 and 2.

Table 1.
List of universities conducting field of study in occupational safety and health or related fields in the aspect of the level of education and profile of study

Name of the university	Name of the field of study	Type of studies	
		level of education	profile of study
Academy of Applied Sciences of the Association for Adult Education in Szczecin	occupational safety and health	I	P
Bialystok School of Economics	occupational safety and health	I	P
Casimir Pulaski Radom University	occupational safety and health	I	P
	occupational safety and health	II	P
Cuiavian University in Włocławek	occupational safety and health	I	P
Częstochowa University of Technology	occupational safety and health	I	O
	occupational safety and health	II	O
Fire University	occupational safety and health	I	P
	occupational safety and health	II	P
Higher Engineering School of Safety and Labor Organization in Radom	occupational safety and health	I	P
Higher School of Pedagogics and Technology in Konin	occupational safety and health	I	P
Humanitas University in Sosnowiec	occupational safety and health	I	P
Kazimierz Wielki University	occupational safety and health	I	O
	occupational safety and health	I	P
Medical University of Gdańsk	environmental health and occupational safety and health	II	O
Medical University of Silesia in Katowice	occupational safety and health – protection of workers' health	I	O
Private College of Environmental Protection in Radom	occupational safety and health	I	P
Professor Edward Lipinski Academy of Applied Sciences	occupational safety and health	I	P
University of Life Sciences in Lublin	occupational safety and health	I	O
	occupational safety and health	II	O
University of Zielona Góra	occupational safety and health	I	O
	occupational safety and health	II	O
Wrocław University of Technology	occupational safety and health	II	O
WSB Merito University in Gdansk	occupational safety and health	I	P

Marks (PL): I – first-cycle study, II – second-cycle study, O – general academic profile, P – practical profile.

Source: own study based on data (RAD-on System, Studies…).

Selected results of the analysis of universities conducting field of study in occupational safety and health or related fields: The field of study is offered at 18 universities – 9 public universities (6 universities, 2 technical universities, 1 uniformed services university) and 9 private universities (5 higher schools, 4 universities and academies). The field of study is offered at 24 types of studies – 17 first-cycle studies and 7 second-cycle studies, no long-cycle master's studies in the list; 14 studies with practical profile and 10 studies with general academic profile. Field of study assigned to 9 scientific disciplines as leading disciplines – 11 types of studies in 4 disciplines of engineering and technical sciences (5 environmental engineering, mining and energy, 2 each of chemical engineering, materials engineering and mechanical engineering), 8 types of studies in 2 disciplines of social sciences (5 safety sciences, 3 management and quality sciences), other disciplines: 2 health sciences, 2 animal sciences and fisheries, 1 legal sciences.

Table 2.
List of universities conducting field of study in safety engineering or related fields in the aspect of the level of education and profile of studies

Name of the university	Name of the field of study	Type of studies	
		level of education	profile of study
AGH University of Krakow	safety engineering	II	O
Cracow University of Technology	safety engineering	I	O
Fire University	safety engineering	I	O
	safety engineering	II	O
	safety engineering	JM	O
General Tadeusz Kościuszko Military University of Land Forces	safety engineering	I	P
	safety engineering	II	P
	safety engineering	JM	P
Jan Dlugosz University in Czestochowa	safety engineering	I	P
	safety engineering	II	P
Kazimierz Wielki University	safety engineering	I	P
Kielce University of Technology	safety engineering	I	O
Lodz University of Technology	occupational safety engineering	I	O
Lublin University of Technology	safety engineering	I	P
Military University of Technology	safety engineering	I	O
	safety engineering	II	O
	safety engineering	JM	O
Opole University of Technology	safety engineering	I	O
Polish Air Force University	air safety engineering	JM	P
Poznań University of Technology	safety engineering	I	O
	safety engineering	II	O
	safety engineering and quality	I	O
	safety engineering and quality	II	O
Silesian University of Technology	safety engineering	I	O
	safety engineering	II	O
University of the National Education Commission	safety engineering	I	P
	safety engineering	II	P
West Pomeranian University of Technology in Szczecin	technical safety	I	O
Wrocław University of Environmental and Life Sciences	safety engineering	I	O
	safety engineering	II	O

Marks (PL): I – first-cycle study, II – second-cycle study, JM – long-cycle master's study, O – general academic profile, P – practical profile.

Source: own study based on data (RAD-on System, Studies…).

Selected results of the analysis of universities conducting field of study in safety engineering or related fields: Field of study is offered at 17 universities – only 17 public universities (9 technical universities, 4 universities, 4 uniformed service universities), no of private universities in the list. Field of study is offered at 30 types of studies – 16 first-cycle studies, 10 second-cycle studies, 4 long-cycle master's studies; 20 studies with general academic profile and 10 studies with practical profile. Field of study assigned to 7 scientific disciplines as leading disciplines – 22 types of studies in 5 disciplines of engineering and technical sciences (8 environmental engineering, mining and energy, 7 mechanical engineering, 4 civil engineering, geodesy and transport, 2 safety engineering, 1 chemical engineering), 8 types of studies in 2 disciplines of social sciences (4 each of safety sciences and management and quality sciences).

The list of universities conducting higher studies dedicated to OSH service in the field of study in occupational safety and health or related fields and safety engineering or related fields (only conducted studies) is presented in Tables 3 and 4.

Table 3.
List of universities conducting higher studies dedicated to the occupational safety and health service in the field of study in occupational safety and health or related fields

Name of the university	Name of the field of study (level of education)	Field of study	
		without specialty	with specialty
Academy of Applied Sciences of the Association for Adult Education in Szczecin	occupational safety and health (first-cycle)		YES
Bialystok School of Economics	occupational safety and health (first-cycle)	YES	
Casimir Pulaski Radom University	occupational safety and health (first-cycle)	YES	
	occupational safety and health (second-cycle)	YES	
Cuiavian University in Włocławek	occupational safety and health (first-cycle)		YES
Częstochowa University of Technology	occupational safety and health (first-cycle)		YES
	occupational safety and health (second-cycle)		YES
Fire University	occupational safety and health (first-cycle)	YES	
	occupational safety and health (second-cycle)	YES	
Higher Engineering School of Safety and Labor Organization in Radom	occupational safety and health (first-cycle)	YES	
Higher School of Pedagogics and Technology in Konin	occupational safety and health (first-cycle)		YES
Humanitas University in Sosnowiec	occupational safety and health (first-cycle)		YES
Kazimierz Wielki University	occupational safety and health (first-cycle, general academic profile)	YES	
	occupational safety and health (first-cycle, practical profile)	YES	
Medical University of Gdańsk	environmental health and occupational safety and health (second-cycle)	YES	
Medical University of Silesia in Katowice	occupational safety and health – protection of workers' health (first-cycle)	YES	
Private College of Environmental Protection in Radom	occupational safety and health (first-cycle)	YES	
Professor Edward Lipinski Academy of Applied Sciences	occupational safety and health (first-cycle)	YES	
University of Life Sciences in Lublin	occupational safety and health (first-cycle)	YES	
	occupational safety and health (second-cycle)	YES	

Cont. table 3.

University of Zielona Góra	occupational safety and health (first-cycle)	YES	
	occupational safety and health (second-cycle)	YES	
Wrocław University of Technology	occupational safety and health (second-cycle)		YES
WSB Merito University in Gdansk	occupational safety and health (first-cycle)		YES

Source: own study based on data (RAD-on System, Studies…) and selected websites of universities.

Table 4.
List of universities conducting higher studies dedicated to the occupational safety and health service in the field of study in safety engineering or related fields

Name of the university	Name of the field of study (level of education)	Field of study	
		without specialty	without specialty
AGH University of Krakow	safety engineering (second-cycle)		YES
Cracow University of Technology	safety engineering (first-cycle)	YES	
Jan Dlugosz University in Czestochowa	safety engineering (first-cycle)		YES
Kielce University of Technology	safety engineering (first-cycle)		YES
Lodz University of Technology	occupational safety engineering (first-cycle)	YES	
Lublin University of Technology	safety engineering (first-cycle)	YES	
Opole University of Technology	safety engineering (first-cycle)		YES
Poznań University of Technology	safety engineering (first-cycle)	YES	
	safety engineering (second-cycle)		YES
	safety engineering and quality (first-cycle)	YES	
	safety engineering and quality (second-cycle)		YES
Silesian University of Technology	safety engineering (first-cycle)		YES
	safety engineering (second-cycle)		YES
University of the National Education Commission	safety engineering (second-cycle)		YES
West Pomeranian University of Technology in Szczecin	technical safety (first-cycle)		YES
Wrocław University of Environmental and Life Sciences	safety engineering (first-cycle)	YES	
	safety engineering (second-cycle)		YES

Source: own study based on data (RAD-on System, Studies…) and selected websites of universities.

Selected results of the analysis of universities conducting higher studies dedicated to OSH service in the field of study in occupational safety and health or related fields: The field of study is offered at 18 universities and 24 types of studies. The field of study is offered at 16 types of studies without specialty and 8 types of studies with 20 specialties. The field of study without specialty of education is offered at 11 universities: 7 public universities (6 universities, 1 uniformed services university), 4 private universities (3 higher schools, 1 academy). The field of study with specialty of education is offered at 7 universities: 5 private universities (3 universities and academies, 2 higher schools), 2 public universities (only 2 technical universities).

Selected results of the analysis of universities conducting higher studies dedicated to OSH service in the field of study in safety engineering or related fields: The field of study is offered at 12 universities and 17 types of studies (out of 17 universities and 30 types of studies). The field of study is offered at 6 types of studies without specialty and 11 types of studies with 13 specialties. The field of study without specialty of education is offered at 3 public universities (only 3 technical universities). The field of study with specialty of education is offered at 7 public universities (5 technical universities, 2 universities). The field of study with and without specialty of education is offered at 2 public universities (1 university, 1 technical university).

Universities conducting higher studies dedicated to OSH service in the fields of study in occupational safety and health and safety engineering can be divided into the following groups of entities of the higher education and science system:

- 11 technical universities: polytechnics (Cracow University of Technology, Częstochowa University of Technology, Kielce University of Technology, Lodz University of Technology, Lublin University of Technology, Opole University of Technology, Poznań University of Technology, Silesian University of Technology, Wrocław University of Technology), other universities (AGH University of Krakow, West Pomeranian University of Technology in Szczecin).
- 10 public universities: uniformed services university (Fire University), medical universities (Medical University of Gdańsk, Medical University of Silesia in Katowice), other universities (Casimir Pulaski Radom University, Jan Dlugosz University in Czestochowa, Kazimierz Wielki University, University of Life Sciences in Lublin, University of the National Education Commission, University of Zielona Góra, Wrocław University of Environmental and Life Sciences).
- 9 private higher school: universities and academies (Academy of Applied Sciences of the Association for Adult Education in Szczecin, Humanitas University in Sosnowiec, Professor Edward Lipinski Academy of Applied Sciences, WSB Merito University in Gdansk), other higher school (Bialystok School of Economics, Cuiavian University in Włocławek, Higher Engineering School of Safety and Labor Organization in Radom, Higher School of Pedagogics and Technology in Konin, Private College of Environmental Protection in Radom).

The analysis covered only two fields of study dedicated to the occupational safety and health service: occupational safety and health, safety engineering.

3.3. Occupational safety and health as an area of science

Occupational safety and health is a research area, but it is not an independent area of science as a scientific discipline. According to the changed classification of science in Poland, safety engineering is a new scientific discipline in the field of engineering and technical sciences (Regulation of the Minister of Education and Science of 11 October 2022). The adopted scope

of the publication focuses on the analysis of occupational safety and health in the context of safety engineering or related disciplines.

In accordance with the Resolution of the Council for Scientific Excellence of 13 February 2023 on changes in the classification of scientific fields and disciplines (Council for Scientific Excellence, Announcement No. 3/2023) safety engineering was separated from the disciplines of engineering and technical sciences (architecture and urban planning, automation, electronics and electrical engineering, information and communication technology, biomedical engineering, chemical engineering, civil engineering and transport, materials engineering, mechanical engineering, environmental engineering, mining and energy), social sciences (economics and finance, safety sciences, management and quality sciences) and other fields of science (computer science, biological sciences, chemical sciences, physical sciences, earth and environmental sciences, food and nutrition technology).

The list of entities and number of people conducting scientific activity in the discipline of safety engineering in the aspect of academic title or degree (only persons with at least a doctoral degree and current employment as their primary place of work) is presented in Table 5.

Universities and scientific institutes conducting scientific activity in the discipline of safety engineering can be divided into the following groups of entities of the higher education and science system:

- 5 entities employing at least 12 people: scientific institutes (Military Institute of Armament Technology, Scientific and Academic Computer Network – National Research Institute), uniformed services universities (General Tadeusz Kościuszko Military University of Land Forces, Fire University), private university (WSB University).
- 6 entities employing from 2 to 11 people: uniformed services university (Military University of Technology), technical universities (Cracow University of Technology, Częstochowa University of Technology, Poznań University of Technology), public universities (Warsaw University of Life Sciences, Wrocław University of Environmental and Life Sciences).
- 7 entities employing 1 person: scientific institutes (Central Institute for Labour Protection – National Research Institute, Military Institute of Engineering Technology named after Professor Józef Kosacki), technical universities (Koszalin University of Technology, Silesian University of Technology, Warsaw University of Technology), public university (Gdynia Maritime University), private university (Polish-Japanese Academy of Information Technology).

Table 5.
List of entities and number of people conducting scientific activity in the discipline of safety engineering in the aspect of academic title or degree

The employing entity	Academic title or degree			Sum
	Prof.	DSc	PhD	
Central Institute for Labour Protection – National Research Institute[1]	0	0	1	1
Cracow University of Technology	1	0	1	2
Częstochowa University of Technology[1]	1	2	1	4
Fire University	2	12	20	34
Gdynia Maritime University	0	1	0	1
General Tadeusz Kościuszko Military University of Land Forces	1	2	9	12
Koszalin University of Technology	0	0	1	1
Military Institute of Armament Technology	2	1	18	21
Military Institute of Engineering Technology named after Professor Józef Kosacki[1]	0	0	1	1
Military University of Technology	0	0	2	2
Polish-Japanese Academy of Information Technology[1]	0	0	1	1
Poznań University of Technology	0	1	1	2
Scientific and Academic Computer Network – National Research Institute	2	2	12	16
Silesian University of Technology	0	1	0	1
Warsaw University of Life Sciences[1]	0	5	2	7
Warsaw University of Technology[1]	1	0	0	1
Wrocław University of Environmental and Life Sciences	0	4	1	5
WSB University	4	7	5	16
Sum	**14**	**38**	**76**	**128**

Marks: [1] university not included in the list of entities conducting scientific activity in the discipline of safety engineering (RAD-on System, Disciplines…).

Source: own study based on data (RAD-on System, Disciplines…; RAD-on System, Academic…).

Conducting scientific activity in the discipline of safety engineering was declared by 128 people with at least a doctoral degree and current employment as their primary place of work:

- people with the academic title of professor (14, 10.9% share), including: WSB University (4), Fire University (2), Military Institute of Armament Technology (2), Scientific and Academic Computer Network – National Research Institute (2).
- persons with the academic degree of habilitated doctor (38, 29.7% share), including: Fire University (12), WSB University (7), Warsaw University of Life Sciences (5), Wrocław University of Environmental and Life Sciences (4).
- people with a doctoral degree (76, 59.4% share), including: Fire University (20), Military Institute of Armament Technology (18), Scientific and Academic Computer Network – National Research Institute (12), General Tadeusz Kościuszko Military University of Land Forces (9), WSB University (5).

The largest number of people conducting scientific activity in the discipline of safety engineering was identified in the following entities (total number of people and number of independent scientists): Fire University (34 and 14), WSB University (16 and 11), Scientific and Academic Computer Network – National Research Institute (16 and 4), Military Institute of Armament Technology (21 and 3), General Tadeusz Kościuszko Military University of Land Forces (12 and 3), Warsaw University of Life Sciences (7 and 5), Wrocław University of

Environmental and Life Sciences (5 and 4), Częstochowa University of Technology (4 and 3).

Based on our own research (Krause, 2023; Krause, 2024d), the list of specialties was proposed for the analysis of occupational safety and health in the aspect of the area of science.

The proposal for the analysis of occupational safety and health in the aspect of areas of science includes the following scientific specialties:

- Occupational safety and health (OSH) as the leading specialty (occupational safety, occupational hygiene).
- Related specialties: occupational safety and health in mining (occupational safety in mining), occupational safety and health management systems (occupational safety and health management, occupational safety management), ergonomics in the aspect of working conditions (e.g.: ergonomics, biomechanics, occupational physiology, occupational psychology).

The list of entities and number of persons declaring scientific specialty in occupational safety and health or related specialties in the aspect of academic title or degree (only persons with at least a doctoral degree and current employment as their primary place of work) is presented in Table 6.

Universities and scientific institutes employing persons declaring scientific specialty in occupational safety and health or related specialties can be divided into the following groups of entities of the higher education and science system:

- 5 entities employing at least 5 people: scientific institutes (Central Institute for Labour Protection – National Research Institute, Central Mining Institute – National Research Institute), technical universities (Poznań University of Technology, Silesian University of Technology, Wrocław University of Technology).
- 13 entities employing 2 to 4 people: scientific institutes (KOMAG Institute of Mining Technology, Nofer Institute of Occupational Medicine), technical universities (Częstochowa University of Technology, Gdańsk University of Technology, Lodz University of Technology, Warsaw University of Technology), public universities (Casimir Pulaski Radom University, Jagiellonian University in Kraków, Poznań University of Life Sciences, University of Agriculture in Krakow, University of Bielsko-Biala, University of Zielona Góra), private university (University of Technology and Arts in Applied Sciences in Warsaw).
- 24 entities employing 1 person, including scientific institutes, public and private universities, np.: AGH University of Krakow, Bialystok University of Technology, General Karol Kaczkowski Military Institute of Hygiene and Epidemiology, General Tadeusz Kościuszko Military University of Land Forces, Higher Engineering School of Safety and Labor Organization in Radom, Humanitas University in Sosnowiec, Jan Dlugosz University in Czestochowa, Koszalin University of Technology, Lublin University of Technology, Medical University of Silesia, Poznań University of Economics and Business, Scientific and Research Centre for Fire Protection – National

Research Institute, University of Occupational Safety Management in Katowice, University of Security in Poznań, Warsaw University of Life Sciences, Wrocław University of Environmental and Life Science).

Table 6.
List of entities and number of persons declaring scientific specialty in occupational safety and health or related specialties in the aspect of academic title or degree

The employing entity	Academic title or degree			Sum
	Prof.	DSc	PhD	
Casimir Pulaski Radom University	1	1	0	2
Central Institute for Labour Protection – National Research Institute	0	5	4	9
Central Mining Institute – National Research Institute	1	3	2	6
Częstochowa University of Technology	0	1	3	4
Gdańsk University of Technology	1	0	1	2
Jagiellonian University in Kraków	0	2	0	2
KOMAG Institute of Mining Technology	0	0	2	2
Lodz University of Technology	0	1	3	4
Nofer Institute of Occupational Medicine	0	1	1	2
Poznań University of Life Sciences	0	2	0	2
Poznań University of Technology	0	4	4	8
Silesian University of Technology	1	4	11	16
University of Agriculture in Krakow	1	2	0	3
University of Bielsko-Biala	1	2	0	3
University of Technology and Arts in Applied Sciences in Warsaw	1	1	0	2
University of Zielona Góra	1	0	2	3
Warsaw University of Technology	1	1	0	2
Wrocław University of Technology	1	3	1	5
Entities employing 1 person	8	4	12	24
Sum	**18**	**37**	**46**	**101**

Source: own study based on data (People of Science Portal).

The scientific specialty in occupational safety and health or related specialties was declared by 101 persons with at least a doctoral degree and current employment as their primary place of work:

- persons with the academic title of professor (18, 17.8% share), including 18 entities of 1 person each.
- persons with the academic degree of habilitated doctor (37, 36.6% share), including at least 2 people: Central Institute for Labour Protection – National Research Institute (5), Poznań University of Technology (4), Silesian University of Technology (4), Central Mining Institute – National Research Institute (3), Wrocław University of Technology (3), Jagiellonian University in Kraków (2), Poznań University of Life Sciences (2), University of Bielsko-Biala (2), University of Agriculture in Krakow (2).
- people with a doctoral degree (46, 45.6% share), including at least 2 people: Silesian University of Technology (11), Central Institute for Labour Protection – National Research Institute (4), Poznań University of Technology (4), Częstochowa University of Technology (3), Lodz University of Technology (3), Central Mining Institute – National Research Institute (2), KOMAG Institute of Mining Technology (2), University of Zielona Góra (2).

The largest number of people declaring scientific specialty in occupational safety and health or related specialties was identified in the following entities (total number of people and number of independent scientists): Silesian University of Technology (16 and 5), Central Institute for Labour Protection – National Research Institute (9 and 5), Poznań University of Technology (8 and 4), Central Mining Institute – National Research Institute (6 and 4), Wrocław University of Technology (5 and 4), Częstochowa University of Technology (4 and 1), Lodz University of Technology (4 and 1).

Among the population of people declaring scientific specialty in occupational safety and health or related specialties, 10 people did not declare any discipline, and the remaining 91 people declared 17 disciplines (number of people), the dominant disciplines are management and quality sciences (34) and environmental engineering, mining and energy (33), other disciplines include: mechanical engineering (14), health sciences (6), forestry sciences (5), safety engineering (4), safety sciences (4), architecture and urban planning (3), psychology (3).

The population of people declaring scientific specialty in occupational safety and health or related specialties demonstrate an association with the obtained scientific degrees in the field of occupational safety and health (51, 50.5% share), including: doctor (27, 26.7% share), habilitated doctor (18, 17.8% share), and both doctor and habilitated doctor (6, 6.0% share).

The largest number of people declaring scientific specialty in occupational safety and health or related specialties was obtained academic degrees in the following entities (number of people): Silesian University of Technology (14), Central Mining Institute – National Research Institute (7), Lodz University of Technology (4), Poznań University of Technology (4), Wrocław University of Technology (4), Częstochowa University of Technology (3). 6 people hold both doctor and habilitated doctor: Grodzicka Aneta, Korban Zygmunt, Krause Marcin, Krzemień Alicja, Rypicz Łukasz, Skubacz Krystian.

3.4. Synthetic assessment of occupational safety and health

In the available literature, no research results were identified in the field of occupational safety and health analysis in the aspect of the discipline of safety engineering (apart from the author's publications presented in the introduction).

Based on own research (Krause, 2023, 2024d), the context of safety engineering or related disciplines and the criteria for the synthetic assessment of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines were proposed for the analysis of occupational safety and health in the aspect of areas of science and education.

The proposal for the analysis of occupational safety and health in the aspect of areas of science and education includes the following disciplines:

- Safety engineering as the leading discipline.
- Related disciplines including: 2 disciplines of the social sciences (safety sciences, management and quality sciences) and 3 disciplines of the engineering and technical sciences (environmental engineering, mining and energy, civil engineering, geodesy and transport, mechanical engineering).

The proposal for synthetic assessment of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines includes the following criteria:

- Basic criteria as detailed assessment of entities and persons, e.g.: teaching activity (higher studies, postgraduate studies), academic qualifications (disciplines), scientific activity (disciplines), scientific staff (disciplines).
- Additional criteria as supplementary assessment of entities and persons, e.g.: scientific staff (declared scientific specialty, obtained academic degrees), organization of scientific conferences, scientific publishing house (from the list of the Ministry of Science and Higher Education), scientific journals (from the list of the Ministry of Science and Higher Education), research programs (national, international).

The list of selected entities conducting scientific and teaching activity in the field of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines is presented in Tables 7 and 8.

Universities and scientific institutes conducting long-term scientific research or research and teaching activity in the field of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines can be divided into the following groups of entities of the higher education and science system:

- Scientific institutes conducting long-term scientific research in the field of occupational safety and health, including: Central Institute for Labour Protection – National Research Institute, Central Mining Institute – National Research Institute, Nofer Institute of Occupational Medicine.
- Academic universities authorized to award academic degrees in the discipline of safety engineering, including Fire University and WSB University.
- Technical universities conducting long-term scientific research and teaching activity in the field of occupational safety and health (only entities employing at least 4 people declaring scientific specialty in occupational safety and health), including: Częstochowa University of Technology, Lodz University of Technology, Poznań University of Technology, Silesian University of Technology, Wrocław University of Technology.
- Other entities conducting long-term scientific and teaching activity in the field of occupational safety and health, including: universities conducting higher studies in the field of study in occupational safety and health, safety engineering, other fields of study or postgraduate studies dedicated to the occupational safety and health service: other technical universities (np.: AGH University of Krakow, Cracow University of

Technology, Kielce University of Technology, Lublin University of Technology, Opole University of Technology, West Pomeranian University of Technology in Szczecin), public universities (np.: Casimir Pulaski Radom University, Jan Dlugosz University in Czestochowa, Kazimierz Wielki University, Medical University of Gdańsk, Medical University of Silesia in Katowice, University of Life Sciences in Lublin, University of the National Education Commission, University of Zielona Góra, Wrocław University of Environmental and Life Sciences), private universities (np.: Higher Engineering School of Safety and Labor Organization in Radom, Humanitas University in Sosnowiec, Private College of Environmental Protection in Radom, University of Occupational Safety Management in Katowice, WSB Merito University in Gdansk).

Table 7.
List of selected entities conducting scientific and teaching activity in the field of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines (teaching activity, scientific activity, academic qualifications)

Name of entity	Teaching activity (higher study, postgraduate study)	Scientific activity (discipline)	Academic qualifications (discipline)
Central Institute for Labour Protection – National Research Institute	higher study (not applicable), postgraduate study (BHP)	IŚGiE	IŚGiE
Central Mining Institute – National Research Institute	higher study (not applicable), postgraduate study (none)	NoZiJ, IŚGiE, IM	IŚGiE
Częstochowa University of Technology	higher study (BHP), postgraduate study (none)	NoB, NoZiJ, IŚGiE, ILGiT, IM	NoZiJ, IŚGiE, ILGiT, IM
Fire University	higher study (BHP), postgraduate study (BHP)	IB, NoB, NoZiJ, IŚGiE, IM	IB, NoB, IŚGiE
Lodz University of Technology	higher study (IB); postgraduate study (BHP)	NoZiJ, IŚGiE, ILGiT, IM, NoZd	NoZiJ, ILGiT, IM
Nofer Institute of Occupational Medicine	higher study (not applicable), postgraduate study (none)	NoZd	NoZd
Poznań University of Technology	higher study (IB), postgraduate study (BHP)	IB, NoB, NoZiJ, IŚGiE, ILGiT, IM	NoZiJ, IŚGiE, ILGiT, IM
Silesian University of Technology	higher study (IB), postgraduate study (BHP)	IB, NoB, NoZiJ, IŚGiE, ILGiT, IM	NoZiJ, IŚGiE, ILGiT, IM
Wrocław University of Technology	higher study (BHP), postgraduate study (BHP)	NoZiJ, IŚGiE, ILGiT, IM	NoZiJ, IŚGiE, ILGiT, IM
WSB University	higher study (other fields in the scope of specialty BHP), postgraduate study (BHP)	IB, NoB, NoZiJ, IŚGiE, ILGiT, NoZd	IB, NoB, NoZiJ, ILGiT

Marks (PL): BHP – occupational safety and health, IB – safety engineering, ILGiT – civil engineering, geodesy and transport, IM – mechanical engineering, IŚGiE – environmental engineering, mining and energy, NoB – safety sciences, NoZd – health sciences, NoZiJ – management and quality sciences.

Source: own study based on data (RAD-on System, Disciplines…; RAD-on System, Bodies…; Council for Scientific Excellence, Powers…).

Table 8.
List of selected entities conducting scientific and teaching activity in the field of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines (number of scientific staff – scientific discipline and scientific specialty)

Name of entity	Safety engineering and related disciplines (number of people)	Scientific specialty (number of people) / scientific discipline (number of people)
Central Institute for Labour Protection – National Research Institute	IB (1), NoZiJ (4), IŚGiE (136), IM (3)	BHP (9) / IB (1), NoZiJ (1), IŚGiE (9), NoZd (2)
Central Mining Institute – National Research Institute	NoZiJ (3), IŚGiE (235), IM (1)	BHP (6) / IŚGiE (6)
Częstochowa University of Technology	IB (4), NoB (10), NoZiJ (160), IŚGiE (67), ILGiT (51), IM (91)	BHP (4) / NoZiJ (4), IŚGiE (1)
Fire University	IB (37), NoB (37), NoZiJ (1), IŚGiE (54), ILGiT (1), IM (2)	BHP (0)
Lodz University of Technology	NoZiJ (83), IŚGiE (5), ILGiT (64), IM (126)	BHP (4) / NoZiJ (3), ITiT (1)
Nofer Institute of Occupational Medicine	NoZd (69)	BHP (2) / NoZd (2)
Poznań University of Technology	IB (2), NoB (7), NoZiJ (110), IŚGiE (103), ILGiT (183), IM (192)	BHP (8) / IB (1), NoB (2), NoZiJ (7), IŚGiE (1), IM (1), brak (1)
Silesian University of Technology	IB (3), NoB (4), NoZiJ (132), IŚGiE (251), ILGiT (199), IM (166)	BHP (16) / IB (1), NoB (1), NoZiJ (6), IŚGiE (8), IM (3), IMa (1), AiU (1)
Wrocław University of Technology	IB (2), NoZiJ (90), IŚGiE (275), ILGiT (153), IM (280)	BHP (5) / NoZiJ (3), IŚGiE (1), AiU (1)
WSB University	IB (17), NoB (23), NoZiJ (69), IŚGiE (3), ILGiT (17), IM (8)	BHP (0)

Marks (PL): AiU – architecture and urban planning, BHP – occupational safety and health, IB – safety engineering, ILGiT – civil engineering, geodesy and transport, IM – mechanical engineering, IMa – materials engineering, IŚGiE – environmental engineering, mining and energy, ITiT – information and communication technology, NoB – safety sciences, NoZd – health sciences, NoZiJ – management and quality sciences.

Source: own study based on data (RAD-on System, Disciplines…; RAD-on System, Academic…; People of Science Portal).

The presented example and the proposed criteria for synthetic assessment of occupational safety and health are pilot studies and will be the subject of subsequent publications.

4. Summary and conclusions

The scope of the publication covers, in turn: occupational safety and health as an area of knowledge, occupational safety and health as an area of education, occupational safety and health as an area of science, synthetic assessment of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines.

The proposal for synthetic assessment of occupational safety and health in the aspect of the discipline of safety engineering or related disciplines includes, among others, the following groups of criteria: basic criteria (detailed assessment of entities and persons), e.g.: teaching

activity (higher studies, postgraduate studies), academic qualifications (disciplines), scientific activity (disciplines), scientific staff (disciplines); additional criteria (supplementary assessment of entities and persons), e.g.: scientific staff (declared scientific specialty, obtained academic degrees), organization of scientific conferences, scientific publishing house and scientific journals (from the list of the Ministry of Science and Higher Education), research programs (national, international).

Occupational safety and health in the aspect of the discipline of safety engineering or related disciplines is created by, among others, the following groups of entities of the higher education and science system: scientific institutes conducting long-term scientific research in the field of occupational safety and health (e.g.: Central Institute for Labour Protection – National Research Institute, Central Mining Institute – National Research Institute, Nofer Institute of Occupational Medicine), academic universities authorized to award academic degrees in the discipline of safety engineering (e.g. Fire University and WSB University), technical universities conducting long-term scientific research and teaching activity in the field of occupational safety and health (e.g.: Częstochowa University of Technology, Lodz University of Technology, Poznań University of Technology, Silesian University of Technology, Wrocław University of Technology), other entities conducting long-term scientific and teaching activity in the field of occupational safety and health, including universities conducting higher and postgraduate studies dedicated to employees of the occupational safety and health service.

Based on the conducted research and analyses, as well as the author's many years of scientific and teaching experience in this field, the following conclusions were formulated:

- Occupational safety and health as an area of scientific cognition can be considered in the aspect of the area of knowledge (chapter 3.1), the area of education (chapter 3.2) and the area of science (chapter 3.3), as well as developing an example and proposal of criteria for the synthetic evaluation of entities of the higher education and science system (chapter 3.4).
- The context of safety engineering as a new scientific discipline in the field of engineering and technical sciences creates opportunities for the development of occupational safety and health in the areas of science and education in the higher education and science system.
- The opportunities for the development of occupational safety and health as a specialty accepted by the academic community include the recognition of this area of science and education as an official scientific specialty in promotion procedures (doctor, doctor habilitated, professor).
- The population of people declaring a scientific specialty in occupational safety and health or related specialties is associated with the scientific degrees obtained in this field (51 out of 101 declared people), including: PhD (28 people), DSc (17 people), and both PhD and DSc (6 people).

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