Universitatea
Transilvania
din Brașov

INTERDISCIPLINARY DOCTORAL SCHOOL

Department: Faculty of Material Science and Engineering

Eng. Petru-Iulian MUREȘAN

DOCTORAL THESIS

SUMMARY

# RESEARCH ON USING A SOFTWARE PLATFORM IN THE PROCESS OF TRAINING AND DIGITAL OSH TRAINING RECORDING WITHIN INDUSTRIAL COMPANIES

Scientific Advisor

Prof.PhD. Eng. Ioan MILOȘAN

BRAȘOV, 2024

TABLE OF CONTENT

# DOCTORAL THESIS SUMMARY

The social and economic dynamics of the recent years have led to the worldwide identification and development of new ways to ensure that everyday activities, whether economic, working, educational or social interaction, are carried out safely and with the same efficiency. Over recent years major global changes have taken place and the current social context has made us rethink our lifestyle, how we work, learn, socialize, in other words, reorganize our lives by reducing physical interaction.

Why occupational safety and health and online training of workers digitization has become necessary? Still using pen and paper? Why is this inefficient working style still being used in a booming era of digitization? The efficient use of smart solutions and modern technologies provide the answer to all these questions, which make it possible to transform or adapt various economic and social processes in line with new social and organizational standards.
Given that Romania has implemented in 2001 a legislative framework that allows the use of electronic signature, there is a specific national legislation - Law no. 455/2001 [GD1] and Law no. 214/2024 [GD11] on digital signature and a European law - European Regulation eIDAS no. 910/2014 [GD2] which applies directly in all Member States of the European Union, Romania included, and which regulates the electronic signature of legal documents, paradoxically, the vast majority of companies continue to rely on paper and pen in their internal processes and workflows, disregarding the advantages of using electronic documents: no paper consumption and printer consumables, no costs with the physical transmission of the original documents to be signed with a handwritten signature, time saving in relation to such operations management, the costs being considerably reduced compared to all that means the handwritten signing of documents in a company or institution.

**Chapter 1** of the doctoral thesis is *The current state of use of software platforms in the process of training and recording Occupational Safety and Health training* approaches the OSH concept from several perspectives starting from the meaning of this concept and up to the principles and rules governing implementation of the legal provisions on occupational safety and health, both in Romania, in some EU countries and beyond. This chapter covers a comparative study examining the current state of training both nationally and in terms of country specific legislation. The chapter ends with conclusions and presents a new innovative direction towards streamlining the entire OSH activity.

**Chapter 2** named *Goals of the doctoral thesis,* presents the primary and the secondary objectives and directions of this paper based on the established line of research on the analysis of the OSH field.

**Chapter 3** *Supplementing OSH legislation in Romania regarding the use of electronic documents, online training of employees, its digital recording and electronic signing of the individual training records,* is focused on the notions of completing the legislation in Romania in the field of OSH starting from the classical way of training and going through all the stages of change and adaptation such as the proposal on completing the legislation, continuing with its completion and the analysis that considered carrying out a comparative study between the two ways of working, classic vs. digital. The chapter concludes with conclusions in favor of the digital way of working and provides the solution for efficient work, by using the functions developed by the SSM.ro Platform.

**Chapter 4** named *The information system (software platform) intended for the management of the OSH activity,* starts with the presentation of the information system underlying the digitization of the OSH activity. The description of the platform was made from several perspectives, both that of the employee and that of the employer, highlighting the working mode of each user and the infrastructure underlying this software.

**Chapter 5** named *Research on implementing online OSH training and assessment. Case Study: Autoliv Romania Company,* presents the research carried out within Autoliv Romania based on a well-established structure. The objectives of the study (general and specific objective), assumptions, sample, instruments, description of variables and how to interpret the data were established. Finally, it was concluded with a summary of the information previously explained in detail.

**Chapter 6** *Statistical data review on online osh training satisfaction. Case Study: Autoliv Romania Company,* is focused on the analysis and interpretation of the data collected based on the study conducted in Chapter 5. This chapter used the SPSS program for statistical analysis. The following aspects were studied: Preliminary data analysis, Exploratory Factorial Analysis (AFE), Hypothesis Testing: application of the Wilcoxon Test for dependent variables; application of the H Kruskal-Wallis and U Mann-Whitney Tests for independent variables. Proposals to improve the online training submitted by the participants were also collected and analyzed, and in the end the analysis and interpretation of the results obtained were carried out.

**Chapter 7** *Final Conclusions. Personal Contributions. Dissemination of results. Future research directions,* general conclusions are presented and personal contributions are highlighted. At the same time, in terms of personal contributions and dissemination of results, actions taken in recent years have been presented in order to amend the legislation and adapt the classic way of working to the digital way of working in the field of OSH.

The doctoral thesis contains 61 tables and 89 figures.

**Motto: The past was written on papers, the present is digitally written by all of us together**

## INTRODUCTION

The social and economic dynamics in recent years has led, worldwide, to the identification and development of new ways to ensure the safe and efficient performance of daily activities, whether we are talking about economic activities, working conditions, education or social interaction. In recent years, major changes have taken place worldwide, and the current social context has forced us to rethink the way we live, work, learn, socialize, in other words, to reorganize our lives by reducing physical interaction.

These have an essential contribution to streamlining economic and social activity: the use of work at home, teleworking and, in particular, digital tools, the use of electronic signatures being an ideal solution for carrying out remote activity, in relations with business partners, customers of companies, employees of state institutions or employers with their own employees.

Thus, the concept of digitalization of occupational safety and health activity took shape: "just a click away", moving from theory to practice.

Why is it necessary to digitize occupational safety and health processes and workers' online training? Paper and pen are still used? Why is this inefficient work style still being used in an ever-expanding era of digitalization? Why would we still allow occupational safety and health procedures to be carried out in this way, as long as we have at hand a high-performance work variant that involves speed, efficiency, cost reduction, gaining physical space by using the electronic signature to validate any type of document, from any device, be it PC, tablet or smartphone? Why not consider the ecological impact that would entail replacing the current way of drawing up documents – the one on paper with the one that allows the drawing up, legal validation, transmission and archiving of electronic documents? The answer to all these questions is found in the efficiency brought by the use of intelligent solutions and current technologies, which allow the transformation or adaptation of various economic and social processes according to the new social and organizational standards.
Taking into account the fact that in Romania there is since 2001 a legislative framework that allows the use of electronic signature, there is a specific national legislation - Law no. 455/2001 on electronic signature [GD1] and a European one - the European Regulation [GD2] that directly applies in all Member States of the European Union, including Romania, and that regulates the electronic signing of documents of legal value, paradoxically, the vast majority of companies continue to rely on paper and pen in internal processes and workflows, disregarding the advantages of using electronic documents: no paper consumption and printer consumables, no costs with the physical transmission of original documents to be signed with handwritten signature, time saving in managing such operations, with considerabily lower costs compared to everything that means the handwritten signing of documents in a company or institution.

The complete digitization of human resources processes and procedures in companies and institutions, especially in terms of occupational safety and health of workers, may seem at first glance an abstract concept. But when there are technical instruments, the legal framework and especially the concrete example that confirms the possibility of moving from theory to practice – the SSM.ro platform - only one thing prevents us from taking this step - the lack of information. Precisely to overcome this last "impediment", we chose to conduct this study on the opportunity and how to practically achieve digitalization in the field of occupational safety and health in all areas of activity.

Within the doctoral thesis, references and names from national and international legislation were used. In order to maintain the authenticity and accuracy of the information, the names and contents of these legislations were presented in their original form. This approach ensures the integrity of the analysis and allows readers to correctly interpret the legal context under review.

# 1. CURRENT STATE OF SOFTWARE PLATFORMS USAGE IN OSH TRAINING AND RECORDING

## 1.1. Occupational Safety and Health (OSH) Concept

The concept of occupational safety and health (OSH) is basically a set of measures and procedures designed to protect workers from OSH risks at work. The purpose of OSH is to prevent occupational accidents and occupational diseases in connection with the health and safety of workers [GD3], [GD4].

## 1.2. International and national legislative framework

Article 153 of the Treaty on the Functioning of the European Union gives the European Union the authority to adopt directives in the field of occupational safety and health.

The European Framework Directive on Safety and Health at Work [GD4] has been an important tool for improving occupational safety and health. This guarantees minimum safety and health requirements across Europe, while Member States have the possibility to maintain measures or set stricter measures.

## 1.3. The current state of OSH training at international level – ways to carry out and implement the training

Worker training has proven to be one of the essential tools to improve occupational safety and health.

Framework Directive in the field of occupational safety and health no. 89/391/EEC [GD3] was transposed into the legislation of the EU countries, which led to the amendment of the national legislation of the member countries.

## 1.4. Current state of OSH training at national level

ROMANIA transposed Council Directive 89 /391/EEC in 2006 [GD4], in particular through the adoption of the Occupational Safety and Health Law no. 319/ 2006 and the Government Decision no. 1425/ 2006 [GD5] for the approval of the methodological norms for the application of the provisions of the Occupational Safety and Health Law no. 319 of 2006 [GD4]. In Romania, training in the field of occupational safety and health is based on all the internal provisions resulting from the technical and organizational measures taken to eliminate or minimize the risks specific to the professional activity, identified and assessed.

According to specific legal provisions, at national level, Romanian employers have the obligation to make sure that all workers involved in the work process have sappropriate working conditions and adequate training, within the time limits prescribed by law. The documentation drawn up by each employer constitutes an internal rule that is binding for the issuing unit, becoming its own occupational health and safety instructions.

## 1.5 Comparison of OSH training at national and international level

We noticed similarities and differences in making and implementing OSH training internationally and nationally, as shown in Table 1.1.

Table 1.1 Comparison table of OSH training at national and international level

| Country analyzed (date of transposition of Directive 89/391/EEC) | Training<br>1. online<br>2. classical<br>3. periodicity | Types of training (general, on-site, periodic) | Recording method (records/ other documents) | Organization (internal/external department) |
|---|---|---|---|---|
| **BULGARIA**<br><br>01/01/2007 | 1. IT platforms, external services only;<br><br>2. Upon employment; when changing jobs; when introducing new equipment; periodically, to maintain and complete OSH knowledge.<br><br>3. Periodicity every 3 months/ annually/ according to the provisions of special normative acts | - Initial training;<br><br>- on-site training;<br><br>- periodic training;<br><br>- daily training;<br><br>- extraordinary training (events: occupational accident,<br><br>serious violations of the rules; change of technological process; at the direction of the control body; work resumption after an absence of more than 45 days);<br><br>- training of employer representatives with OSH tasks: initial and annual.<br><br>All types of training also apply to fire protection. | Recording is done in training books by the manager/other person designated. | Internal and external department. |
| **CYPRUS** | 1. The online e-GNOSIS system (provided by the Cyprus Productivity Center) containing free OSH training and monitoring programs<br><br>2. When recruiting/hiring; upon transfer or change of duties; when introducing/changing work equipment; to the introduction of new | - on-site training;<br><br>- training of employer representatives with OSH tasks. | Training recording is not provided for by specific legal provisions, but the employer is obliged to provide training, | The employer or the employer's representative. |

| | | | | |
|---|---|---|---|---|
| | technologies; when introducing new instructions/methods;<br>3. Periodicity: according to needs, regular time intervals. | | so it must keep records. | |
| **FRANCE**<br>31/12/1992 | 1. No express legal regulations regarding online training.<br>2. Mandatory in the language spoken by the employee. Upon hire; temporary/seasonal workers; employees of subcontractors/ secondees; when changing jobs; to changing technology/working conditions; in the case of casual employees for maintenance and service; work accidents. Workers called to carry out emergency work are not trained (prior authorization required).<br>3. Periodicity: whenever necessary; each individual employer decides. There are only<br>recommendations of the national technical committees. | - General training, fire safety included;<br>- specific additional (special) training;<br>- Training to resume work after the worker has been absent for more than 21 days. | Supporting documents, for control, the content, dates and duration of the trainings. | Special internal and external department. |
| **GERMANY**<br>31/12/1992 | 1. Training including online electronics (most online trainings are done through the iManSys software).<br>2. General training or at each workplace/ device; individually or for the whole team.<br>3. Periodicity: whenever necessary; each employer decides, according to the needs of the company and according to the progress of risks, except: provided by special provisions every six months or annually. | - General training or workplace specific;<br>- Training for the use of personal protective equipment. | Recording in the record book or digital file, signed by the employee and<br>countersigned by the employer; the language used in the training was adapted to the target group, with the employees signing that they understood. | Internal and External OSH department, which can use IT training platforms. |
| **ITALY**<br>31/12/1992 | 1. Through the National Computerized Prevention System, Electronic and Technical Support.<br>2. When recruiting; when changing workplace/procedures/technologies. | - General training;<br>- Specific training (depending on the company). | Supporting documents, for control, the content, dates and duration of the trainings. | Internal OSH service |
| **POLAND**<br>31/12/2005 | 1. No express legal regulations regarding online training.<br>2. Upon hire; when changing jobs; | - initial general training;<br>- initial on-site | Recording in the initial training book, and signed | Internal and external OSH department. |

| | | | | |
|---|---|---|---|---|
| | apprentices/pupils/ internship students<br>.<br>3. Periodicity: depending on the position held, every 6 months; 12 months; 3 years; 5 years; 6 years. | training;<br>- periodic training; | by the employee. | |
| **ROMANIA**<br>01/01/2007 | 1. OSH training process includes methods and techniques, such as: presentation, demonstration, case study, watching movies, slides, projections, computer-assisted training.<br>2. Depending on the type of training, it addresses<br>the following categories of workers: newly hired workers; seconded or delegated workers from other companies; workers made available by a temporary employment agency; workers who change their job within the company.<br>Refreshing and updating the knowledge of workers in the field of OSH.<br>3. Periodicity according to the position held: 6 months/ 12 months | - General introductory training;<br>- on-site training;<br>- periodic training;<br>- additional training. | It is recorded in training records. | Internal and external OSH department. |
| **SLOVENIA**<br>31/12/2005 | 1. No express legal regulations regarding online training.<br>2. Training of workers and other persons present in the work process. When recruiting; when changing jobs; to the change of technology/ means of work/ work processes;<br>**3.** Periodicity at least once every 2 years. | - on-site training;<br>- periodic training; | There is no obligation<br>to record the training, but in practice each employer chooses the form/method of recording. | Safety officer. |
| **HUNGARY**<br>31/12/2005 | 1. Computerized platforms; digital training is accepted if the electronic signature is authentic (clearly identifies the name of the trained employee). Example: *Miin-kavudelem file*.<br>2. Upon hire; when changing the job or job description; when converting work equipment/new work equipment; the introduction of new technologies; in special cases, | - on-site training;<br>- periodic training; | Recording the training in writing, in the *Training Journal document,* including signed with a digital signature. | Workplace manager/ a person qualified in OSH. |

| | | | | |
|---|---|---|---|---|
| | provided by law.<br>3. Periodicity: at intervals provided by law or periodically, according to the employer's decision. | | | |
| **REPUBLIC OF MOLDOVA**<br>Non-EU state | 1. No legal regulations regarding online training.<br>2. Upon hire secondment; when changing jobs; when introducing a new work equipment/ modifying the existing one; when introducing any new technology/work procedure; when the worker was absent for more than 30 days; in case of a work accident; when performing special works.<br>3. Periodic training periodicity: 6 months | - upon hire<br>- General introductory training;<br>- on-site training;<br>- periodic training; | Recording in the Training Ledger and in the Personal /Collective Training record. | Internal and external OSH department. |
| **UK**<br>EU member state until 31.01.2020 | 1. No express legal regulations regarding online training.<br>2. The employer decides how on internal OSH training organization<br>3. The decision belongs to the employer. | - Training according to the employer's decision. | According to the employer's decision. | According to the employer's decision. |
| **CANADA** | 1. No express legal regulations regarding online training.<br>2. Upon hire/reassignment or transfer to a new job; when introducing new equipment/processes/procedures/; updating annual or periodic training to ensure skills and knowledge in case of inadequate performance.<br>3. The periodicity of training differs, depending on the type of training. | - OSH and ES training<br>- orientation training;<br>- annual training;<br>- periodic training | Training is based on written procedures and practical exercises. | System of internal responsibility (employee-employer partnership). |
| **RUSSIAN FEDERATION** | 1. No legal regulations regarding online training.<br>2. Upon hire/transfer/secondment/temporary work; for practicing students; legislative changes or news; new standards;<br>new instructions or equipment; In the event of serious violation of the rules/ accident; absence from work for more than 30 days; at the request of the authorities.<br>Periodicity: at least once every 6 months | - introductory training;<br>- primary training (on-site);<br>- repeated (periodic) training;<br>- unscheduled training;<br>- targeted/ punctual/ thematic training | In standard ledgers or the work permit, stating the date of the training and the signature of the employee and the trainer | OSH Engineer and external OSH service |

## 1.6. Conclusions

1. Training diversity:

The study showed that most of the countries analyzed use both traditional (face-to-face) and online (digital platforms) methods for training employees.

For example, Germany, Italy, Hungary, Italy, Bulgaria, Cyprus have adopted online OSH training platforms.

In countries such as France, Poland, Slovenia, Republic of Moldova, Canada, United Kingdom, Russian Federation there are no explicit regulations for online training.

2. Training periodicity:

The periodicity of workers' training varies from country to country and depends on the specifics of the job and regional legislation. Some countries have regulated the periodicity and types of training through legislation and regulations (e.g. Bulgaria, Poland, Romania, Bulgaria), while other countries consider that it is the employer's responsibility to determine the periodicity of training through regulations, internal acts, etc. (e.g. France, Germany, United Kingdom, Spain).

3. Training type:

The study revealed that in most of the analyzed countries, the provisions regarding worker training are approximately similar and include initial training (upon hire), on-site training, as well as periodic training. Additional training for workers is also present as a separate chapter in worker preparation, especially in the case of new specific work tasks, technological changes, or following work accidents.

4. Recording:

Due to the fact that employers in all the countries analyzed have the obligation to demonstrate that their employees have received sufficient and adequate on-site training, it was found that in all legislation there is a way of recording the training. These documents attest that such recording have various forms and names, for example: standard ledgers, training records, or digital documents. Germany, for instance provides recording in ledgers or in the digital file, in the Russian Federation in the standard ledgers or the work permit, while in the Republic of Moldova the recording is made in the Training Ledger and personal /collective training records and in Hungary training is recorded in the Training Journal that can be signed with a digital signature.

For example, in the legislation of Cyprus and Slovenia there are no legal obligations on how training is recorded, considering that employers according to the legislation have the responsibility to present and document the training in case of accident or inspection, they choose various own methods to be able to provide the training to the authorities.

5. Occupational Health and Safety organization

Occupational safety and health activity organization at company level in different countries is roughly common, i.e. companies rely on internal occupational safety and health services (internal OSH officers) and/or external services specialized in the field of OSH.

By way of illustration, in Bulgaria and Romania, OSH training can be carried out by an internal or external service, while Italy and Poland make extensive use of internal services. Germany and Hungary also use IT platforms provided by external services to facilitate training.

# 2. GOALS OF THE DOCTORAL THESIS

Any company requires good planning so that the activity can be carried out efficiently, in optimal conditions. In today's economic and social context, distance learning is a viable solution, given that the economic environment is constantly changing, legislative regulations are constantly changing the way in which economic activity is carried out at both national and global level, and the social, economic and financial mechanisms that are vital for society as a whole and for each individual must be kept in a functional balance.

In this context, in line with the title of the thesis and the data presented in chapter 1, 3 general objectives have been set:

**O1. Research on the development of an OSH-specific software platform that allows an integrated approach to digital training and recording**

Goal focused activities:

- Design, software architecture and platform development;

- Interconnecting the software platform with trusted electronic signature providers;

- Interconnecting the software platform with the electronic archive providers;

- developing alternatives for digital identification and user access within the software platform;

- testing and validation from the point of view of cybersecurity in controlled environments;

**O2. Practical validation of the software platform in a company representative for the Romanian industry**

Goal focused activities:

- OSH digitization through online training

- digital recording of online training and electronic signing of training records within a representative industrial company;

**O3. Analysis of the level of satisfaction of the software platform users in the online training in the field of OSH**

Goal focused activities:

- Identifying a set of variables that differentiate the satisfaction associated with the online training and the use of the electronic signature to record OSH training on the training records, with a potential influence on the quality of the training;

- Identifying the benefits/ advantages felt by the trainees who attended the online training;

- Preliminary data review in order to verify the internal consistency of the questionnaire, the characteristics of the respondents, the verification of the normality distribution of the data and the calculation of the Relative Importance Index (IIR);

- Exploratory Factor Analysis (EFA) in order to verify the relevant correlations between the dependent variables and the investigated independent variables;

- Assumption testing by comparing the efficiency perceived by the trainees for classical training and online training (applying the Wilcoxon Test for dependent variables);

- identification of the difficulties experienced by the trainees following the online training and the analysis of the independent variables by applying the Kruskal-Wallis H and U Mann-Whitney Tests with pair comparisons;

- Collecting proposals for improving online training;

- analysis and interpretation of the results.

In order to achieve the general objectives, the following research stages were carried out:

- Desk research on the current state of the use of software platforms in the process of training and recording the training of workers in the field of SSM
- Experimental research on the realization of a software platform for SSM activity management.
- Experimental research on the use of a software platform in the process of training and recording of digital training in the field of SSM in an industrial company.
- Interdisciplinary approach from different fields: computer science, management, sociological research, statistical processing.

# 3. SUPPLEMENTING THE ROMANIAN LEGISLATION ON THE USE OF ELECTRONIC DOCUMENTS, ONLINE TRAINING OF EMPLOYEES, DIGITAL RECORDING AND ELECTRONIC SIGNATURE OF THE INDIVIDUAL TRAINING RECORD

## 3.1 The classical OSH employee training provides for individual training records drawn up in letter format and handwritten signing.

According to the legislation in force, namely GD no. 1425/2006 art.75 [GD5]., "Occupational safety and health training aims at acquiring OSH knowledge and skills. According to Article 76, "OSH training of workers at enterprise and/or unit leve lis done during the working hours". "Such OSH staff training uses means, methods and techniques of training, such as: exposure, demonstration, case study, videos, slides, screenings, computer-aided training" (art. 78). "(1) The result of the occupational safety and health training must be recorded in the individual training record [8]., following the template presented in Annex no. 11, indicating the material delivered, the duration and date of the training. (2) Each individual training record is filled in with blue ink, right after training check. (3) After the training has been carried out, the individual training record is signed by the trainee and by the trainers." (art. 81) [GD5].

## 3.2. Proposal on supplementing the Romanian OSH legislation on the use of electronic documents, online training of employees, digital recording and electronic signature of the individual training record.

Teleworking expansion [GD10] since 2020 has made even more visible the need to digitize the activities involved in carrying out labor relations in Romania. At the same time, the lack of legal provisions that allow the use of electronic signature in the legal validation of the documents related to the employment relationship required the drafting of a law leading to the completion with such provisions of Law 53/2003 – Labour Code [GD09], the Occupational Safety and Health Law nr.319/2006 [GD04] and the Implementing Rules of the Occupational Safety and Health Law nr.319/2006 [GD04], approved by Government Decision nr.1425/2006 [GD05].

## 3.3. Supplementing the Romanian OSH legislation on the use of electronic documents, online training of employees, its digital recording and electronic signature of the individual training record.

The steps taken [Annex 1] have led to digitization of the activities related to the employment relationship became possible with the Emergency Ordinance no. 36 of May 5, 2021 [GD08] on the use of advanced electronic signature or qualified electronic signature, accompanied by the qualified electronic time stamp and the qualified electronic seal of the employer in the field of employment relations and for the amendment and completion of some normative acts. This Emergency Ordinance supplemented the Labour Code and the Occupational Safety and Health Law and was the basis for completing the implementing rules of the Occupational Safety and Health Law.

In addition to the general regulation of the possibility of using electronic documents in the conclusion, execution, amendment, suspension and termination of the individual employment contract, the legislative approach explicitly supplemented the provisions of Article 81 of GD 1425/2006 [GD6] which imposed, in the form prior to completion, the obligation to record the training of workers in the individual training records with "pen with paste or pen". This imperative provision conditioned the preparation and the records made in the individual training record of the worker on the use of the pen with paste or pen, without the possibility of drawing up in electronic format and the use of the electronic signature to confer legal value to the document.

The amendment of art.81 of GD 1425/2006 [GD6] led to the explicit mention of the possibility of using electronic documents and electronic signature in the process of training workers.

## 3.4. Comparative study on digital vs. classical OSH training. Optimization of the OSH training process through digitalization.

Table 3.1. - digital OSH training is compared with classical training.

Tabel 3.1 Comparison table on classical and digital OSH training

| DIGITAL OSH training | CLASSICAL OSH training |
|---|---|
| The SSM.ro platform - operates 24 /24 hours - flexibility of the time of the training, which can be done virtually any time of the day. | Limited time training (during the operating hours and exclusively with the physical presence of the persons involved (of the worker/workplace manager/OSH inspector at the general introductory training), as the case may be. |
| The work efficiency of the OSH inspector working digitally increases. A higher volume of trainings can be realized in a shorter period of time. The number of clients that can be processed by an OSH inspector is much higher. OSH external service costs are optimized. | Filling in the training records "with pen and paste" requires much more time and human resources. The external services to employ a greater number of OSHS inspectors to manage the same number of clients (higher wage costs). |
| OSH documentation uploaded on the platform SSM.ro with online trainings, digital OSH training is practical for clients with secondary offices globally. | Training of workers working at workplaces open in the country or abroad is particularly tedious and costly, due to the legal obligation to fill in the training records "with pen and pencil" and to sign the training with a handwritten signature. |
| Elimination of "downtime" caused by the travel of the OSH inspector to the work points of the economic agents. The activity of the OSH inspector is carried out mainly online. | Significant time consumption for travel in the country or locally, at the business units of the economic agents. |
| Paper consumption is almost entirely eliminated. Almost 0 costs for paper and printing equipment with related consumables and maintenance. | Significant costs for the purchase of paper and equipment and supplies for printing and for their maintenance. |
| Protect the environment by limiting paper consumption. | Paper consumption in significant quantities for documentation and training records. |
| | Protecting the environment should be a constant concern of all economic agents. |
| The number of people who can simultaneously receive the | The number of workers who can participate in training at |

| DIGITAL OSH training | CLASSICAL OSH training |
|---|---|
| topic and instructions for the training is unlimited. | the same time is limited to 20 people. |
| Learning the training (going through the topic) and solving the test questionnaire, which confirms the assimilation of the training being done individually by each worker, they have the opportunity to deepen the instructions received and to solve the questionnaire in a time period adapted to the ability of each trained person to understand and retain the information. | The processing of the instructions is done for groups of up to 20 people, these people having different capacities to process and retain the information. |
| The training is recorded remotely, the time required to sign a document using advanced or qualified electronic signature is very low, the costs are affordable and the document has the value of an original, i.e. the same legal value conferred by the handwritten signature. | The training shall be recorded exclusively in the training records, with handwritten signature. |
| Online training requires extremely high mobility. Workers are trained remotely, wherever they are, by simply connecting from any device: smartphone, tablet, laptop, PC, without having to go to the training room. | Workers must travel to the training room, consuming time and fuel/ money for transport. |

Analyzing the data presented in Table 3.1, it is noted that the online training of workers is characterized by flexibility, mobility, protection of the environment, saving of resources (material, financial, human) and time, determining the cost efficiency of the occupational safety and health activity both at the level of companies and of the external occupational safety and health services.

The new provisions of art. 81 para. (1), (2) and (3) of the Government Decision no.1425 of 2006 [GD5] allow, starting with the date of entry into force of the Government Decision no.259 of 2022 [GD6], both the performance and recording of the training in the field of occupational safety and health in electronic format, as well as the legal validation of these documents by using the electronic signature.

Although at the time of formulating the first proposals on the need to supplement the legislation in the field of occupational safety and health, by including the possibility of using electronic documents, this approach was not considered to be one that presents a priority in terms of drafting and adopting specific legislation, the emergence of the context generated by the coronavirus pandemic made the digitization of occupational safety and health management to be considered a necessity both in terms of the execution of health-safe employment relationships and in terms of streamlining the training of workers when using digital platforms to carry out this activity.

Last but not least, the steps taken to supplement the applicable legislation in the field of occupational safety and health with provisions allowing the digitization of the activity related to the performance and recording of the training of workers made it possible for the activities performed under teleworking contracts to benefit from the possibility of conducting and recording distance training, which led to the elimination of the obligation of those working under teleworking to go to the employer's headquarters to sign the individual training records drawn up in letter format.

## 3.5 Conclusions

At this point we see that it has become possible to electronically sign documents that until recently could only be signed handwritten. In this regard, an essential aspect should not be overlooked, namely data security, in particular in terms of access and storage.

Thus, employers will have the opportunity to use the SSM.ro platform as a means of implementing the legal rules contained in the legislation in force by digitizing the occupational safety and health activity, and the "rail file" can be successfully replaced by the "digital file".

# 4. INFORMATION SYSTEM (SOFTWARE PLATFORM) FOR OSH ACTIVITY MANAGEMENT

## 4.1. The need to implement the software platform on the use of electronic documents, online training of employees, its digital recording and electronic signing of the individual training record.

The dynamics of the total number of contracts with teleworking clause and home work contracts in the analyzed period 2019-2020 were analyzed

## 4.2 Description of the software platform (referred to in the paper as the SSM.ro platform)

The digitization of the activity of the management process - management of occupational safety and health documents can be achieved very efficiently through the electronic management of documents through the SSM.ro platform.

The architecture of the SSM.ro platform (Figure 4.1) intended for occupational safety and health management can be viewed from 3 perspectives, namely:

- technical
- functional
- operational

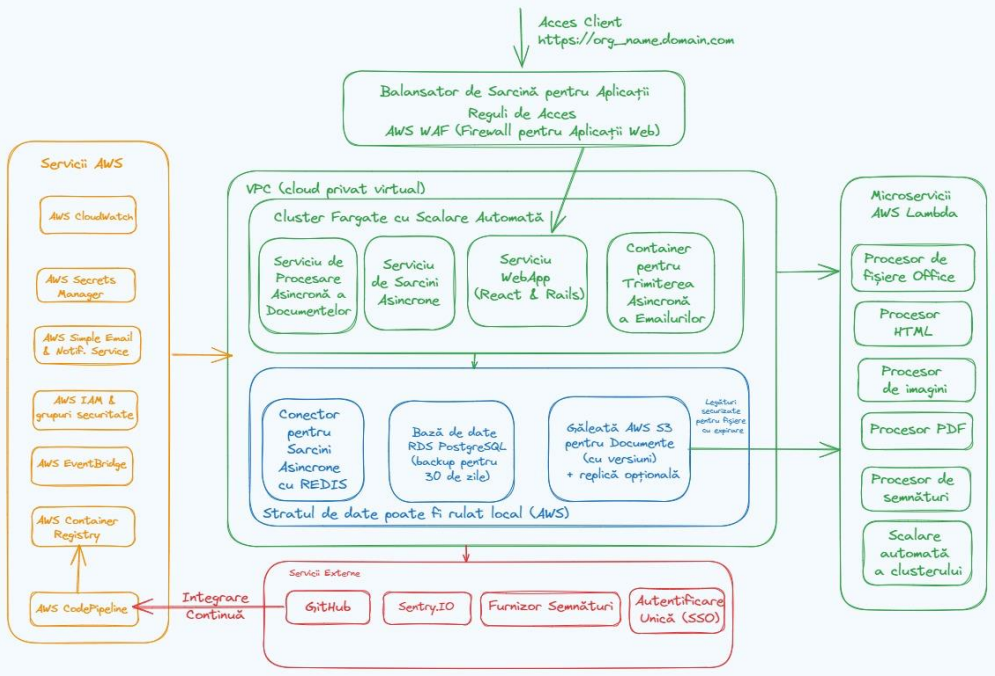


Fig 4.1 Computer architecture diagram of SSM.ro platform

The architecture of the SSM.ro platform was designed and developed based on the need for a common workspace and interaction for all persons involved in managing employment relationship.

The key user, according to Fig 4.2, is the legal representative of the employer, who creates the profile of the organization within the platform and who allows access to the persons with responsibilities in fulfilling and managing the obligations resulting from the conclusion of the employment contract. It sets roles and access levels for each user.


Fig. 4.2. Flowchart on the interaction of users and support services with the SSM.ro platform

The interaction between the above-mentioned persons is ensured by automated document flows that are issued by them in various phases of the performance of the employment contract. The final beneficiary of this process is the employee, to whose account all the documents he/she must assume and validate legally by applying the electronic signature will reach.

The structure of the SSM.ro platform allows the integration of three major categories of users with attributions in the occupational safety and health activity, namely:

- the Employer together with its representatives,
- the worker (employee)
- authorities with legal competences in the field of occupational safety and health.

Within the SSM.ro platform, for each category of users, functions necessary for the fulfillment of their tasks according to the legal obligations are provided.

Integrating users into the platform involves the following steps:

1. Creating the Employer Account
2. Creating the Worker Account

Electronic identification and access to the SSM.ro platform by using the RFID card is an alternative way to owning and using an email address. This involves the use of two complementary devices: the access card (RFID), used by the worker to access the organization's premises and to draw up the electronic time sheet, and a RFID cards reading device (Figure 4.6).

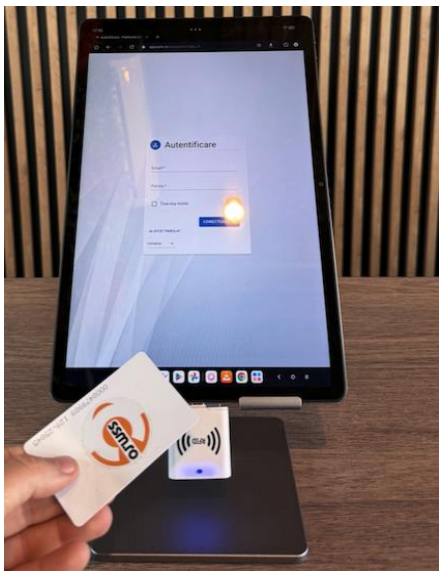


Fig 4.6 RFID card and reader connected to the tablet

The electronic identification and access of the worker to the SSM.ro platform can also be done by using the local account.

Opening the account allows filling in the full profile of the user (Figure 4.7), which includes information specific to his/her role in the organization.

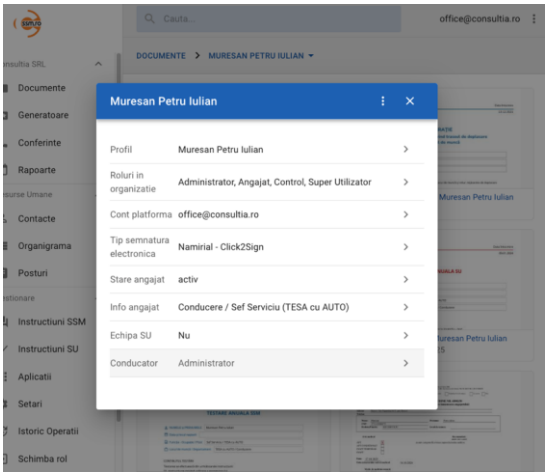


Fig.4.7. User profile

The primary functions developed within the SSM.ro platform

Company organization chart/ Posts / Add users / Upload documents / Generate specific documents/ Reports and Notifications

EMPLOYEE TRAINING VIA SSM.ro PLATFORM

In respect of the training function made available to users by the SSM.ro platform, we have taken into account the need for automated flows that allow the issuance and transmission of documents necessary for the theoretical training of workers (Figure 4.17).

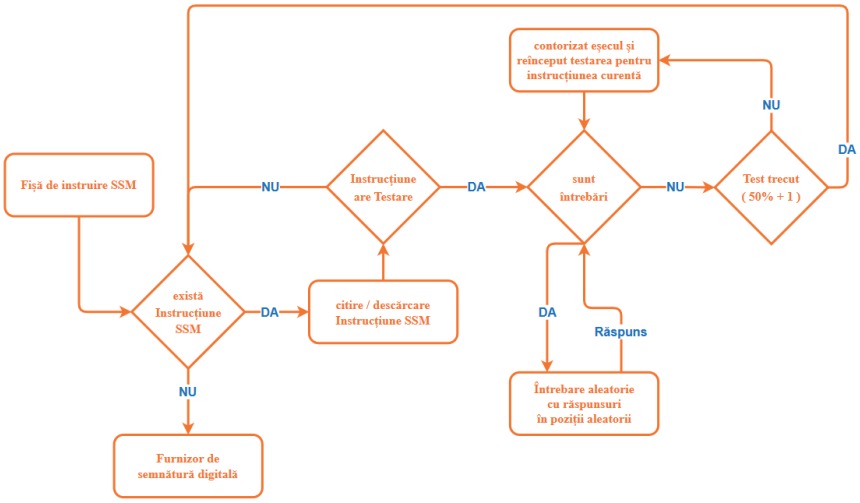


Fig. 4.17 Remote training and assessment in SSM.ro platform

In this regard, the officer in charge with issuing the documentation and ensuring the performance of the various types of training will proceed to initiate a training session that will automatically generate a notification (or several, depending on the option chosen) to the trainee.

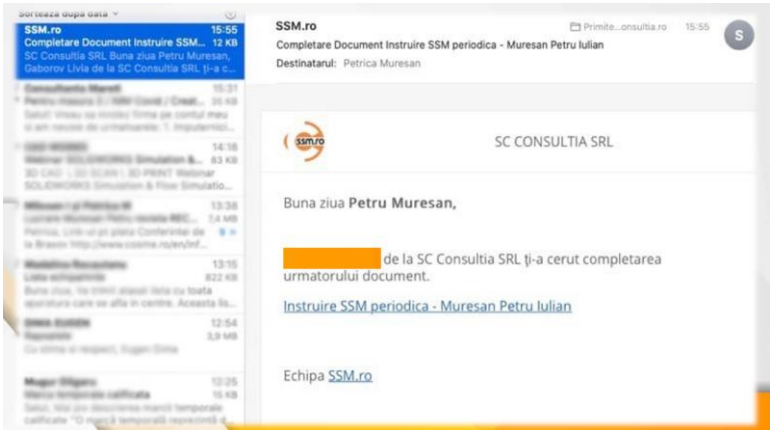


Fig. 4.19 Training notification via email

Notification of the worker about accessing the personal account in order to go through the training material is made by a message sent to the email address (Figure 4.19.) or to the user account in the platform (Figure 4.20.)

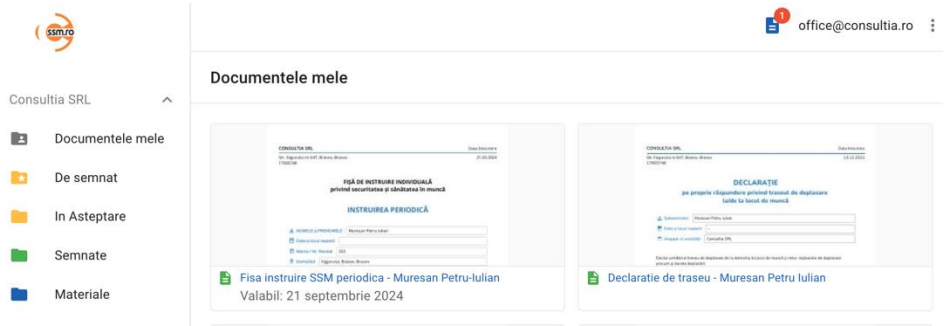

Fig. 4.20 Training notification into the user account

Following accessing the training material (Figure 4.21) and viewing it (Figure 4.22), the worker has the obligation to go through and assimilate the information received; at the end of this stage of the trainee will provide answers to the assimilated knowledge assessment tests.

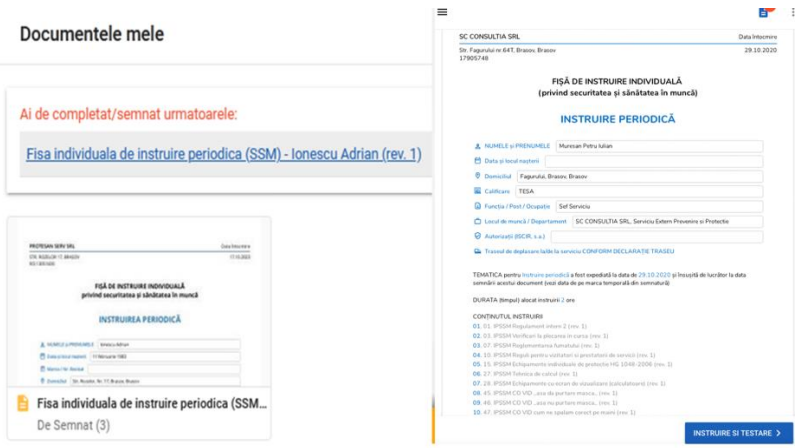


Fig. 4.21. Accesss to the OSH training record and material

Considering the need to achieve the main purpose of the training, which is achieved by testing the level of assimilation of the worker's knowledge, the employer has the possibility to activate the user's testing function after each training material (instruction) undergone.

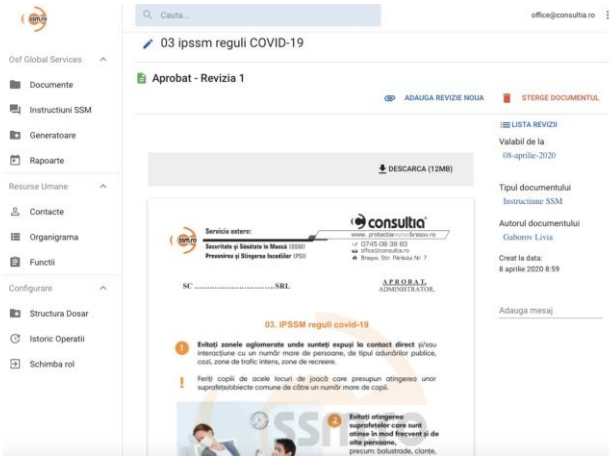


Fig. 4.22. Viewing the OSH training material

If the worker fails to obtain a predetermined score (50% +1 correct answers) in each knowledge assessment test, he/she will not be able to access the following training material, in which case he/she must resume the reading of that material and, at the end of it, the platform will generate a new knowledge assessment test with a different content (Figure 4.23).

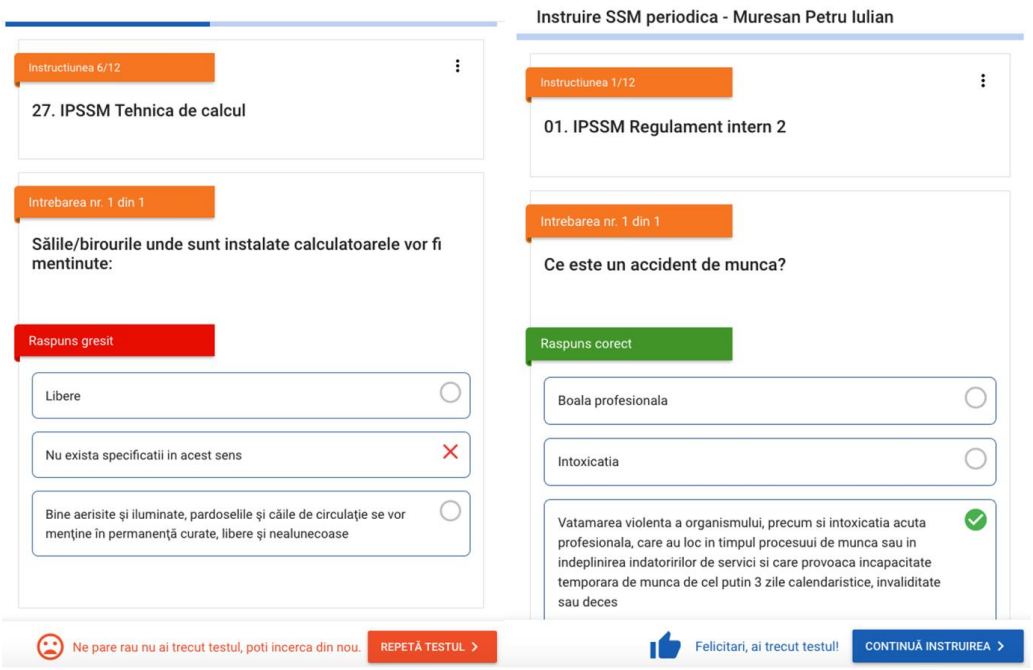


Fig. 4.23 Failed and passed score test

This process is resumed until all training materials are exhausted (Figure 4.24); after the last training material test, the platform generates the worker's individual training record (Figure 4.25) on which the signatures of all persons involved in the training process will be applied, starting with the worker.

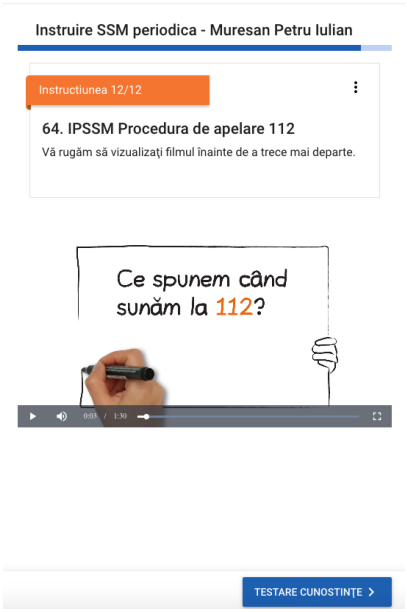


Figura 4.24 OSH training video

With respect on how obtaining the electronic signature by the worker, he/she must not have his/her own electronic signature, prior to acquiring the status of user on the SSM.ro platform. Integration of authorized electronic signature providers allows the employer, at the time of creating the worker's user profile, to include in its content the type and provider of electronic signature to be used for legal validation of the documents resulting from the employment relationship. The electronic signature provided through SSM.ro platform is activated when the account is opened.

Provision of the electronic signature to the trainee, which he/she is to apply on the individual training record (or on any other document to be signed), is included in the user profile he/she has within the platform, the only action necessary to apply the signature is to type the "sign" button available on any document subject to signature ( Figure 4.25).

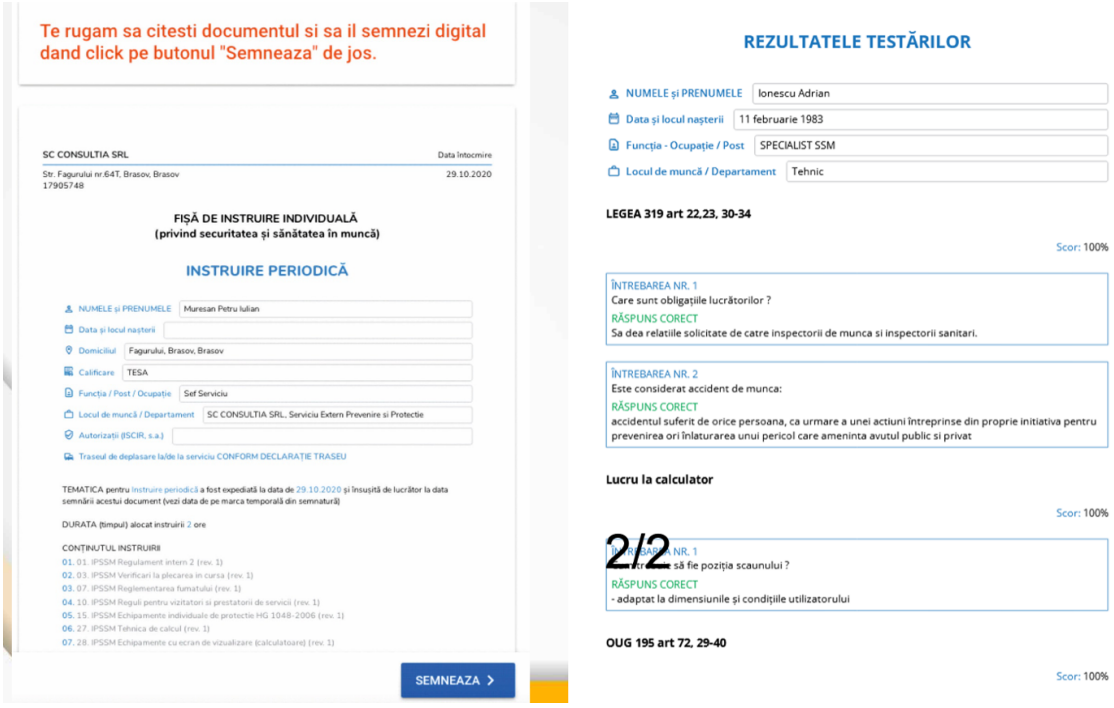


Fig. 4.25 OSH training record

To apply all the signatures of people involved in the training process, the signatories and the sequence of applying signatures on the training record (or on any other document to be signed) is be pre-defined when creating the document (Figure 4.26). Automating the flow of document transmission from the first signatory to the next allows the document to be transmitted automatically when signed by each person, in the pre-defined order.

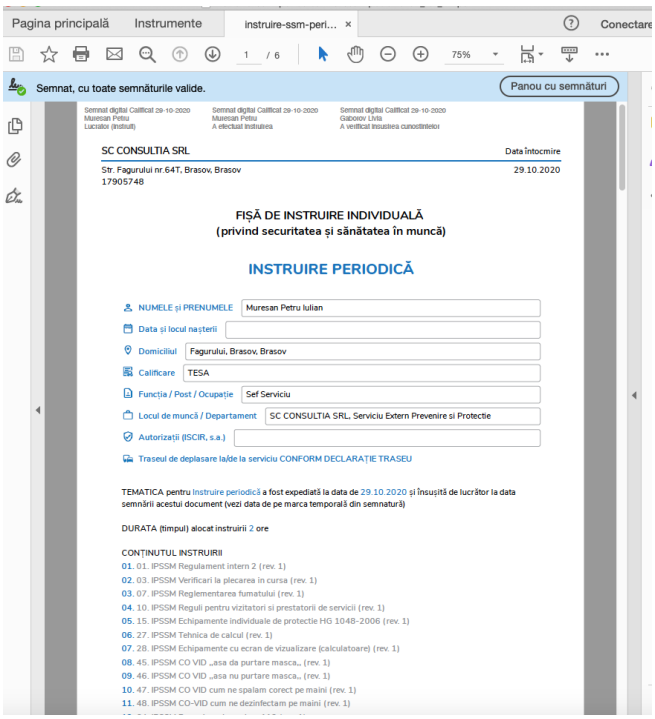


Fig. 4.26 Signed OSH training record

The videoconferencing mode allows direct interaction of the workplace manager/designated worker with the trainees, if this mode of training is chosen (Figure 4.27).

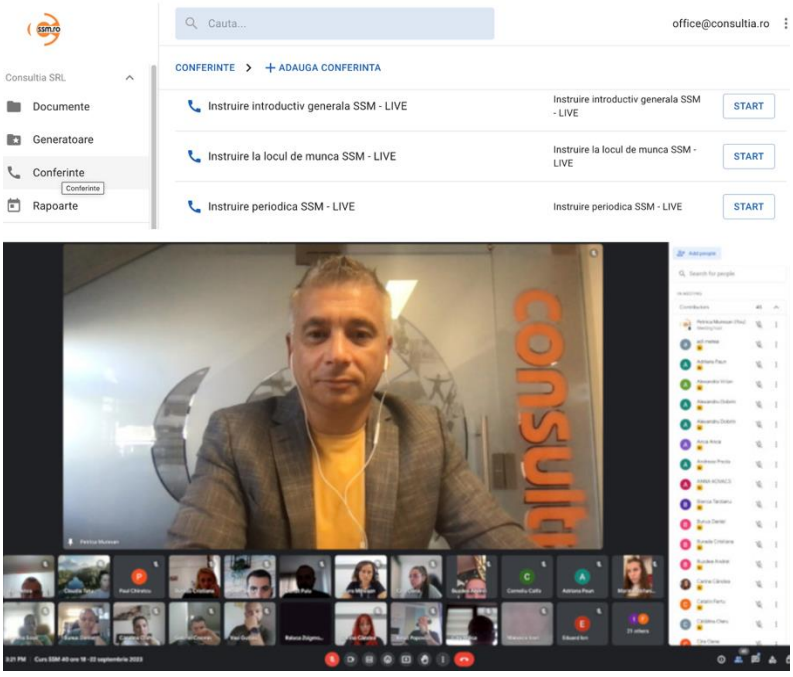


Fig. 4.27 Live videoconference OSH traning

## 4.3. Computerized system plus

The SSM.ro platform relies on software meeting the below criteria:

a) User friendly.

b) allows issuance, transmission and signature of any e-document, in line with the legal requirements on e-signature use.

c) all occupational safety and health/employment relations documents can be made available to labor inspectors, documents inspection initiated by the labor inspectors will be done online; the companies using the application can allow the authorized access of the labor inspectors on the platform, in the section dedicated to the control of the documents, where all the official documents of the company are stored.

The SSM.ro platform provides users, especially in the remote training process, the possibility to apply the digital signature on documents preoared and submitted to workers, in electronic format.

## 4.4 Conclusions

The SSM.ro platform is an innovative digital solution for the management of Occupational Safety and Health (OSH) and Fire Prevention and Control (PSI) activities and documents. It is intended for employers, employees, OSH authorized companies and OSH designated workers in the field of OSH/PSI/HR.

In conclusion, the SSM.ro is a value adding platform:

◘ Digitization of services: Enables the transition from paper to digital documentation, facilitating rapid and efficient access to information.

◘ Electronic signature: Simplifies the process of obtaining the electronic signature for employees, at a click distance.

◘ Online training: Provides the possibility of online OSH training, accessible from various devices, including smartphones and laptops.

◘ Data security: Ensures the protection of stored data, in accordance with personal data protection regulations.

From all these viewpoints, digitalization is the future in the management of OSH, PSI and HR activities, bringing significant value to organizations through technology, innovation and automation.

# 5. RESEARCH ON IMPLEMENTING ONLINE OSH TRAINING AND ASSESSMENT. CASE STUDY: AUTOLIV ROMANIA

This chapter provides an empirical experimental research within *Autoliv România.*
*Autoliv România* is a company founded in 1997 in Brasov, with a strong vision on reducing the risks of car drivers, focusing on safety and saving lives through marketed products. Autoliv Romania, based in Brasov, is a major player in the industrialization of automotive safety activities, specializing in the production of airbags, seat belts and steering wheels [W3, W4, W5, W6, W7].
This was a mixed research on two lines:

- The experimental component aims to compare the level of satisfaction after online OSH training between the analyzed groups.
- The exploratory component is intended to identify the plus and minuses perceived by the users of SSM.ro platform, for improvement purposes and to identify ways to improve the online OSH training.

## 5.1 Research goal

The overall goal (O3) of the research is *Review of the software platform users in OSH online training*
The activities carried out to achieve this general objective (O3) are presented in Chapters 5 and 6, as follows:

- Identifying a set of variables that differentiate the satisfaction associated with the online training and using the electronic signature to record the EHS training on the training sheets, with a potential influence on the quality of the training;
- Identifying the benefits/ advantages felt by the trainees following the online training;
- Preliminary data review aimed at checking the internal consistency of the questionnaire, respondents features, dissemination of data and Relative Importance Index calculation (IIR);
- Exploratory Factor Analysis (EFA) aimed at checking relevant correlations between the dependent variables and the independent variables researched,
- Assumption testing by comparing the efficiency perceived by learners under classical training and online training (applying the Wilcoxon Test for dependent variables);
- Identifying the difficulties felt by the trainees following the online training and the analysis of the independent variables by applying the Kruskal-Wallis H and U Mann-Whitney Tests with pair comparisons;
- Collecting proposals for improving online training;
- Analysis and interpretation of results.

## 5.2 Research assumptions

In the case of this experimental research, according to the data of the theoretical model "Safety Climate and Performance" presented by [GRI00] which assumed that a safe performance includes compliance (related to the job task) and participation, starting from the premise that through the implementation of online training and the use of electronic signature in the field of OSH represents a progress in the field of digitalization, organization, improvement of performance and safety of employees and also taking into account our own experience as well as the previously conducted research [MUR19, MUR20, MUR21a, MUR21b, MUR22], we proposed the enunciation and testing of *6 research assumptions:*

*H1.* Online training on the SSM.ro platform generates more intense satisfaction for employees compared to classical (face-to-face) training.
*H2.* Employee satisfaction associated with online training on the SSM.ro platform varies depending on the role in the organization.
*H3.* Employee satisfaction associated with online training on the SSM.ro platform differs depending on seniority at work.
*H4.* Employee satisfaction associated with online training on the SSM.ro platform varies depending on the level of education.
*H5.* Employee satisfaction associated with online training on SSM.ro platform varies by age.
*H6.* Employee satisfaction associated with online training on SSM.ro platform differs by gender.

## 5.3 Parties involved

Online training and recording of the digital training according to the occupational safety and health requirements was carried out in the sections: VOR (Vehicle Occupant Restraint) and RSD (Research and Development) within the industrial company Autoliv Romania.
The research population consisted of 225 employees, of which 200 people actually participated.
The 200 participants were trained through the SSM.ro platform between September 28, 2023 and February 13, 2024. Of these, 100 as Operators/Technicians attended the classic (face-to-face) OSH training, which was carried out previously between June 11, 2023 and January 22, 2024.

## 5.4 Research instrument

For data collection we used the survey method, while the tool used in this empirical research was the questionnaire [VIG21, HUT99, WAN19].
Given that employee satisfaction associated with OSH training was assessed after each of the two training programs, classical and online, two questionnaires were developed to capture each the specifics of the two training modalities.

### 5.4.1 Preparing questionnaires

The objectives of the questionnaires were:

1) Assessment of employee satisfaction with OSH training (traditional and online).
2) Assessment of internet use and personal effectiveness in using the internet.
3) Identification of the advantages and difficulties experienced by employees in online training.
4) Collection of proposals for improving the platform.

Assessment of employee satisfaction associated with OSH training was carried out using a questionnaire developed for this research.
The items were developed in accordance with the data presented in the literature [GRI00, VIG21, HUT99, WAN19, FLI15, MAR19], and on the basis of the PhD student's more than 20 years of experience in the field of OSH.
Figure 5.1 shows the schematic of the questionnaire development process.

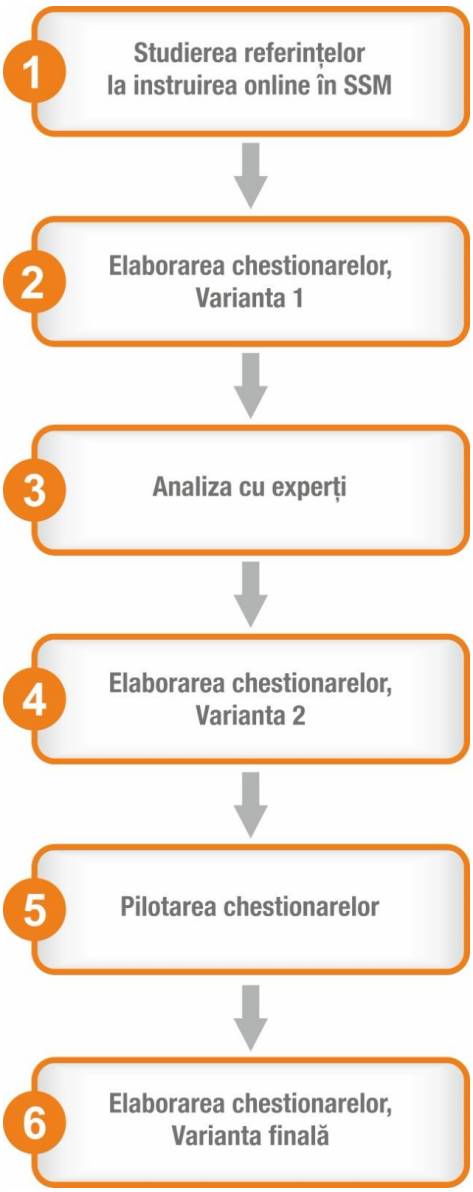


**Fig. 5.1** Schematic of the questionnaire development process

Followed the assessment of the questionnaire items in version 1, in which 10 experts, 5 academics (four engineers and one psychologist) and 5 industry experts attended. They reviewed the relevance of the items, proposed changes related to the clarity of the formulations to increase the ease of understanding of the questionnaire by the respondents, proposed the removal of some items and their replacement with others considered more appropriate.

After consensual agreement on the changes proposed by the experts, in version 2, the two questionnaires have 7 items for classical training and 15 items for online training. The structure of each questionnaire is detailed below, with reference to its dimensions, the answers are given on a five-step Likert scale (1 = total disagreement... 5 = total agreement) according to the specialized studies in the field [MAZ22, STE21, ĐOR21].

The questionnaire for assessing satisfaction after classical training is presented in Table 5.2.

Table 5.2. Questionnaire for assessing the satisfaction with the classical OSH training

| Item code | Item (Question) |
|---|---|
| C.01 | How often do you use the internet?<br>1-not at all; 2-very rarely (once a month); 3-rarely (once a week); 4-often (2/3 times a week); 5-very often (daily). |
| C.02 | Do you use the internet easily?<br>1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree. |
| C.10 | How satisfied are you with understanding the material in the online training?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| C.11 | How satisfied are you with the accountability in complying with SSM requirements provided by the online training?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| C.12 | How satisfied are you with the clarification of misunderstandings of SSM legislation provided by the online training?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| C.13 | How satisfied are you with the online training in order to test the knowledge acquired in the online training?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| C.14 | How satisfied are you with online training in general?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |

Analyzing Table 5.2, the presence of the following items is noted:

◘ Two items on how often is internet used and personal effectiveness in internet use (C.01, C.02)
◘ Five items to assess the satisfaction of occupational safety and health training. The answers are given on a five-step Likert scale (1 = very dissatisfied ... 5 = very satisfied), items C.10, C.11, C.12, C.13, C.14 of the Questionnaire for the evaluation of satisfaction after online training).
The questionnaire for the assessment of satisfaction after the online training is presented in Table 5.3.

Table 5.3. Questionnaire for assessing satisfaction with online OSH training

| Item code | Item (Question) |
|---|---|
| I.01 | Do you use the internet often?<br>1- not at all; 2-very rarely (once a month); 3-rare (once a week); 4-des (2/3 times a week); 5-very often (daily). |
| I.02 | Do you use the internet easily?<br>1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree. |
| I.03 | Recording/ training/ testing steps in the SSM.ro platform are easy to follow.<br>1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree. |
| I.04 | If the SSM.ro platform is used, do you consider that it increases your awareness and empowerment regarding OSH rules?<br>1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree. |
| I.05 | Do you think that using an electronic signature to record OSH training is more useful than a paper signature?<br>1-strongly disagree; 2-disagree; 3-neutral; 4-agree; 5-strongly agree. |
| I.06 | Compared to traditional (face-to-face/classroom) training, how do you rate online OSH training?<br>1-much less effective; 2-less effective; 3-neutral; 4-effective; 5-much more effective |
| I.07 | Is face-to-face interaction necessary for learning to take place?<br>1-strongly disagree; 2-strongly disagree; 3-neutral; 4-agree; 5-strongly agree. |
| I.08 | Does video conferencing training provide an equivalent experience to face-to-face training?<br>1-strongly disagree; 2-strongly disagree; 3-neutral; 4-agree; 5-strongly agree. |
| I.09 | How satisfied are you with the online training material? |

| Item code | Item (Question) |
|---|---|
| | 1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| **I.10** | How satisfied are you with understanding the material in the online training?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| **I.11** | How satisfied are you with the accountability in complying with OSHM requirements provided by the online training?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| **I.12** | How satisfied are you with the clarification of misunderstandings of OSH legislation provided by the online training?<br>1- very dissatisfied; 2-not satisfied; 3- neutral; 4-satisfied; 5-very satisfied. |
| **I.13** | How satisfied are you with the online training in order to test the knowledge acquired in the online training?<br>1- foarte nesatisfăcut; 2-nesatisfăcut; 3- neutru; 4-satisfăcut; 5-foarte satisfăcut. |
| **I.14** | Cât de satisfăcut sunteți cu privire la instruirea online în general?<br>1- foarte nesatisfăcut; 2-nesatisfăcut; 3- neutru; 4-satisfăcut; 5-foarte satisfăcut. |
| **I.15** | Care sunt sugestiile dumneavoastră pentru a face instruirea online o experiență mai satisfăcătoare? (se pot da mai multe răspunsuri)? |

Table 5.3 highlights presence of the following items:

- Two items about frequency of internet use and personal effectiveness in using the internet (I.01, I.02);
- Three items designed to identify the advantages perceived by the participants regarding online learning using the SSM.RO platform. Answers are given on a five-step Likert scale (1 = strongly disagree ... 5 = strongly agree), (I.03, I.04, I.05);
- Eight items to assess the satisfaction with occupational safety and health training. Responses are given on a five-step Likert scale (1 = very dissatisfied ... 5 = very satisfied), (I.06, I.07, I.08, I.09, I.10, I.11, I.12, I.13, I.14);
- A multiple-choice item to collect proposals for improving online training (I.15).

## 5.5 Reviewed variable description

- ✓ In terms of their relationship, the variables are divided into 2 categories:
- ✓ Dependent variables consisting of the 15 items;
- ✓ 5 independent variables are used, namely: role in the company; length of service; educational level (studies); age and gender of the participants;

## 5.6 Conclusions

The information presented in this chapter can be summarized as follows.

- ✓ In order to achieve the general objective of the empirical research, i.e. the analysis of the appropriateness of using the online platform SSM.ro at the industrial company Autoliv Brașov, the methodology necessary to carry out the research was developed, after operationalizing the general objective into 5 specific objectives. These objectives are aimed at the comparative evaluation of employee satisfaction generated by online training on the SSM.ro platform compared to face-to-face training; the analysis of the differences in the satisfaction generated by online training on the SSM.ro platform associated with socio-demographic factors of employees (position in the organization, seniority in the workplace, educational level, age and gender); the identification of the advantages and disadvantages

experienced by employees in online training, as a source of proposals to the management of the industrial company on improving the SSM online training system in order to increase employee satisfaction. In accordance with the specific objectives, 6 research hypotheses were formulated.

- ✓ Parties involved were 200 employees of Autoliv Romania, in the role of workplace supervisor, TESA (office) staff and operator/technician. Of these, 100 Operators/Technicians attended classical (face-to-face) OSH training.
- ✓ Two questionnaires were developed for data collection, one for each type of OSH training, following the steps prescribed in the literature. After the development of an item pool, 10 experts from industry, industrial and psychological academia examined the questionnaires; the first version of the two questionnaires was prepared. These variants were successively piloted on 10 employees who helped to refine the wording in order to facilitate understanding and avoid ambiguities. The result of the piloting phase was the final form of each of the two questionnaires (15 items for online training and 7 items for face-to-face training). Essentially, the questionnaires contained items related to the frequency of internet use and personal effectiveness in using the internet, evaluation of the satisfaction of the training for safety and health at work, advantages and disadvantages (challenges) perceived by the participants regarding online learning using the SSM.ro platform, proposals for improvement of online training. This last item allowed multiple-choice answers, all other items were answered on a five-step Likert scale.

# 6. STATISTICAL DATA REVIEW ON ONLINE OSH TRAINING SATISFACTION. CASE STUDY: AUTOLIV ROMANIA

## 6.1 Preliminary data review

In accordance with the literature [OME22, NIE22, STE21, ZAH22, BAL16, MAR19, PAL20, FIE13] *Preliminary data review* was conducted using the *Statistical Package for the Social Sciences* (SPSS 23.0) software application, following the steps shown in Figure 6.1.

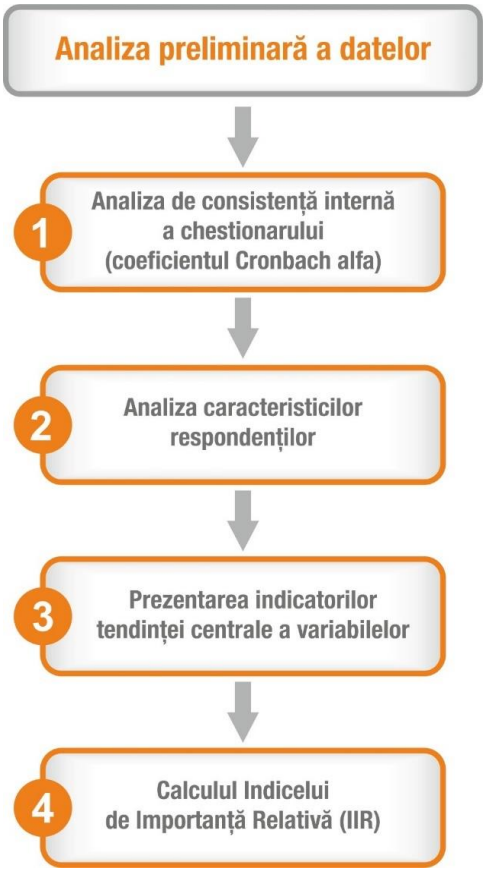


**Fig. 6.1** Preliminary data review

### 6.1.4 Checking normality of data distribution

In order to check the normality of the data distributions, the Shapiro-Wilk test was applied for all the research variables for both types of training.

For this test, the null hypothesis (Ho) specifies that the distribution of the data belongs to a normally distributed normal distribution. If the significance threshold value '$p \leq 0.05$', the null hypothesis (Ho) is rejected and in this case the alternative hypothesis ($H_1$) is accepted because statistical significance was obtained. If the significance threshold value '$p > 0.05$', in this case, the null hypothesis (Ho) is accepted because statistical significance was not obtained [BOL14, LUN10, DAV06].

The results of the Shapiro-Wilk test (a test considered as more powerful in determining normality by statisticians [FAR06, KES06, N0R11], indicate that ***none of the variables is normally distributed*** [GHA12, OZT06], all variables having p-value < 0.001.

## 6.2 Exploratory Factor Analysis (EFA)

The method of data analysis used in this study is Exploratory Factor Analysis (EFA), it aims to prioritize the importance of the key influencing indicators (in our case the 14 items), simplifying complex sets of variables. By applying this statistical computing technique it is realized:

- detect structure in the relationships between variables by categorizing them;

- reducing the number of variables to a smaller number with a more general descriptive power over the situation under investigation;

- Validating the construction of a multi-item scale.

*Exploratory Factor Analysis (EFA)* [GAO22, RAH21, EVE01, SMI62, BAR54, KAI55, LUC18, BLU10, DUT17, GRI00, DEM15], consists in solving the following computational steps (fig. 6.7): Correlation matrix analysis; Application of Kaiser-Meyer-Olkin (KMO) & Barlett tests; Primary Component Analysis (PCA).

## 6.3. Assumption testing

Given that the research data are not normally distributed, according to the literature [69], it is necessary to use non-parametric Assumption testing.

*The Wilcoxon test* is a non-parametric alternative to the dependent samples t-test, designed to test for differences between the distributions of two dependent samples drawn from the same population [STI12]. With this test, it is tested whether the mean values of two groups specific to the dependent variables differ significantly from each other.

*The Kruskal-Wallis H-test* (sometimes also called "one-way ANOVA on ranks") is a nonparametric test based on ranks that can be used to determine whether there are statistically significant differences between two or more groups of an independent variable (consisting of different subjects) on a continuous or ordinal dependent variable. The parametric equivalent of the Kruskal-Wallis *H* test is the one-way analysis of variance (ANOVA) [OME22, CHA97,SPU03, DEM15, COV20].

After applying the Kruskal-Wallis *H-test* for Pairwise Comparisons and identifying any differences between the independent variables, SPSS uses the *Dunn* post-hoc *test* with error adjustment performed by the *Bonferroni* test (also known as the *Dunn-Bonferroni* post-hoc test*)* [W17].

*The Mann-Whitney U-test* is a non-parametric test based on ranks, which can be used to determine whether there are statistically significant differences between two groups of an independent variable

(made up of different subjects) on an ordinal or quantitative normally undistributed ordinal or quantitative dependent variable [OME22, CHA97,SPU03, DEM15, COV20].

## 6.4 Conclusions

- By applying the factor analysis method *Primary Component* Analysis *(PCA)* in this empirical experimental research, the items that significantly influence the study are determined and analyzed, resulting in 2 specific factors (2 strategic directions);
- By applying the method of factor analysis *Primary Component* Analysis *(PCA)* (after eliminating Item I.07), the 2 strategic directions analyzed in the questionnaire were identified with the following particularities:

1) The first factor (F1) accounted for 44.415% of the variance (with rotating sums of squared loadings) and contains items I.13, I.11, I.12, I.14, I.09, I.05, I.06, and I.08;

2) The second factor (F2) accounted for 25.105% of the variance (with rotation sums of squared loadings) and contains items I.02, I.01, I.03 and I.04.

- Factor 1 (strategy 1) accounted for 44.415% of the variance, the same value being for PVE as for CPVE (with rotation sums of squared loadings) with the following specific values: eigenvalue = 5.774; Cronbach's alpha = 0.930, containing the following items: I.13, I.11, I.12, I.14, I.09, I.05, I.06, and I.08;
- Factor 2 (strategy 2) accounted for 25.105% of the variance for PVE and 69.519% for CPVE, with the following specific values: eigenvalue = 3.264; Cronbach's alpha = 0.864, containing the following items: I.02, I.01, I.03 and I.04.

- By applying the Wilcoxon *matched pairs* test *(signed rank test)* for two paired samples, the dependent variables analyzed: the items specific to online training compared to face-to-face training, the general observation is that all 5 items analyzed comparatively: C10/I.10; C11/I.11; C12/I.12; C13/I.13, C14/I.14, have higher values of negative differences (compared to positive differences) which shows a higher satisfaction of the respondents with online training compared to face-to-face training;
- By repeatedly applying the Kruskal-Wallis Pairwise Comparisons (Pairwise Comparisons) *H-test* for the independent variables: Position in the firm, Length of service; Educational level (Education) and Age for the independent variables specific to the online training items I.01÷I.14, we aimed to identify statistically significant differences between the groups that make up the independent variables mentioned above. Within this analysis, a post-hoc analysis was also carried out, a comparison based on the application of *Dunn-Bonferroni* tests to see which pairs of groups have opinions that differ significantly from each other, noting the case in which between all the groups compared there were differences of opinion on the item analyzed. In the rest of the cases analyzed, the SPSS application drew the specific graphs with blue (indicating *major differences of opinion* between respondent groups) , green

(indicating no *major differences of opinion* between respondent groups) or no lines (indicating *no difference of opinion between* respondent groups).

- When applying the Mann-Whitney *U-test* it was observed that among all the items analyzed, only for item I.12 (How satisfied are you with the clarification of misunderstandings of the legislation in the field of SSM provided by the online training?) there is a significant difference between the perception of female respondents compared to male respondents.

***Measures proposed following the review of statistical data :***

Due to the inherent difficulties of access to the company where the research was conducted, difficulties arising from internal regulations and GDPR legislation, it was not possible to compare the results of the evaluation results obtained by the two training methods. Such a comparison would have allowed the two training methods to be compared in terms of their effectiveness. Therefore, it is recommended to the organization to conduct such a study in the future.

The results obtained from the Primary Component Analysis (PCA) factor analysis and the applied statistical tests support the conclusion that at least the following measures should be undertaken in order to optimize the online training strategy in the company:

Strategic Measures Based on Identified Factors

**Factor 1 (Strategy 1):** 'Availability for online training' can also be leveraged for other types of training alongside SSM training as follows.

*1. Identification and Integration of Online Training Preferences:*

- Position in the firm:

The online training programs required by the organization should be tailored according to the positions held by the employees. Thus, for those in managerial positions, especially managers/job managers, specific training modules should be developed specifically for them, i.e. with the necessary leadership and management ~~skills~~, while for executive staff, the training part should include technical and operational training.

- Length of service:

Differentiated professional training courses will be initiated according to experience, by level.

Workers with less seniority (experience) will follow introductory and basic digital skills training courses, while senior workers will benefit from advanced and refresher courses.

- Educational level (Education):

The content of vocational training programs will be appropriate and adapted to different education levels. For example, employees with secondary education will benefit from additional training

modules compared to employees with tertiary education so that the digital competences obtained at the end for all categories will be sufficient for the use of digital solutions.

- Age:

The format of the training courses will have adapted, accessible and attractive content for all age groups. Interactive learning methods and new technologies will be used for young people, while more traditional (step-by-step) teaching approaches will be used for older workers.

*2. Continuous evaluation and update according to the need of the training programs in the field of SSM:*

- Regular feedback will be collected from workers in order to be able to intervene and continuously improve course content and delivery. Regular classic and online surveys will be conducted on target groups to better understand employee preferences and needs.
- Comparative studies will be continued on employees' perceptions of the classic and online training respectively in order to be able to establish elements that work well as well as elements that do not work well and need improvement.

*3. Implementation of Interactive Technologies and Methods:*

In order for the usefulness and the need to learn digital skills to be realized by the employees, it would be desirable that in addition to using the OSH platform, other platforms necessary for their day-to-day activities are used within the company. To this end, attractive forms of training - workshops, virtual simulations, online webinars - will be used. Interactive learning methods - group activities, case studies - will also be used to increase engagement and learning outcomes.

Factor 2 (Strategy 2): 'Difficulties of online training'

1. Identifying and Addressing Difficulties :

- Position withon the company:

Following an analysis of the difficulties encountered for different positions in the company, customized support will be offered. For example, managers may be offered additional assistance in the use of learning management platforms (LMS), while general technical support would be needed for executive staff.

- Educational level (Education):

Training materials adapted to the educational level of the employees will be used.

Lower-educated employees will benefit from video tutorials and step-by-step guides, while higher-educated employees will benefit from detailed manuals and advanced training sessions.

- Age:

Technical support and training materials will be tailored to be accessible and user-friendly for all age groups. Solutions with intuitive interfaces will be used for older employees, and personalized support will be used where deemed useful.

*2. Improving Technology Infrastructure:*

It is mandatory that all employees have access to electronic devices and adequate internet connections to participate in online training. A team will be formed to provide quick and efficient technical support to resolve any technical issues that may arise.

*3. Supporting and Promoting Continuing Training:*

In order to make the transition to digitization of business quickly and efficiently, it is important for the organization to create an organizational culture that promotes continuous learning and supports employees in the training process. To ensure that employees are motivated to learn digital skills and do not resist the new, consideration should be given to motivating employees by offering rewards and recognition for successful completion of certain courses and including training on the SSM.ro platform

General Measures

Monitoring and Impact Assessment:

- The whole process of using the technology in the training and testing process (SSM.ro platform) will be constantly monitored and user feedback will be constantly solicited in order to adjust strategies and ensure their effectiveness.
- In order to ensure the transparency of the whole digitization implementation process as well as its impact on workers and thus the efficiency of the process, the results will be communicated at least twice a year at the meetings of the Occupational Safety and Health Committee.
- Through these measures, the company can significantly improve the online training and education process, thus reaching the diverse needs and preferences of workers, optimizing efficiency and their overall satisfaction with online SSM training.
- Example: refresher courses on digitization for staff found to have problems with digitization
- Workshops on information transfer from experienced to inexperienced colleagues

# 7. FINAL CONCLUSIONS. PERSONAL CONTRIBUTIONS. DISSEMINATION OF RESULTS. FUTURE RESEARCH DIRECTIONS

## 7.1. Final conclusions

- The dynamics currently facing the labor market, both nationally and internationally, inevitably lead to the conclusion that the primary challenge for employees and employers is the ability to adapt to the pace at which technology is evolving and the challenges that technological progress brings.
- The widespread use and distribution of new digital work and communication tools is creating more flexible ways of working, which is also challenging the occupational safety and health system.
- The results of the experimental research showed that implementation of online training on occupational safety and health, so we believe that the use of a software for online training of employees has a high degree of usefulness and addressability from the perspective of all subjective criteria analyzed of the surveyed employees: age, educational level, the environment in which the activity is carried out, the way of acquiring knowledge, Internet use, and perception of: the functioning, efficiency, the degree of accessibility of the application, the degree of perception that online training is carried out in a more friendly and relaxing environment. Also, considering the opinions of the respondents involved in the study on the use of the online environment for conducting occupational safety and health training, it was found that the majority of the study participants rated the online training of employees as having a low degree of difficulty.
- Very importantly, more than 91% of the respondents to the survey expressed their willingness to conduct their next training online, the SSM.ro platform being appreciated as intuitive and easy to use.
- An additional argument, which emphasizes the need to use solutions that enable the conduct of occupational safety and health training in the online environment, is given by the official data provided by the Romanian Labor Inspectorate on the dynamics of individual employment contracts of employees entered in the General Register of Employees, revealing that the number of remote work agreements and teleworking agreements is exponential. Thus, during the period 2019-2020, the total number of teleworking agreements concluded in 2020 increased by 26.06 times compared to 2019, and the total number of remote-work contracts in 2020 increased by more than 7.42 times compared to 2019. These statistical data, as well as the need imposed by the pandemic context to identify solutions enabling the remote management of occupational safety and health activities, have led to the conclusion that it is imperative to harmonize specific legislation with the new socio-economic realities, particularly with regard to the training of home-based and teleworkers.
- In this respect, we consider of utmost importance the emergence of Law 208/2021 on the use of advanced electronic signature or qualified electronic signature, accompanied by

qualified electronic time stamp and qualified electronic seal of the employer in the field of labor relations, which supplemented Law 53/2003 - Labor Code, the Law on safety and health at work no. 319/2006, as well as the Methodological Norms for the application of the provisions of the Law on Safety and Health at Work No. 319/2006 approved by Government Decision No. 1425/2006, which were, in their turn, supplemented by the issuance of GD 259/2022. By supplementing the aforementioned normative acts, the possibility of using electronic signatures and, implicitly, digital solutions in the management of activities related to occupational safety and health was regulated. In this context, in addition to the possibility of using legally valid electronic documents in the management of the employment relationship, changes have also been made to the obligation to record the training in the field of occupational safety, which, until the advent of GD 259/2022, required the use of only documents drawn up in lettered format and signed "with a ballpoint pen or pencil". Allowing the use of an electronic signature in drawing up and legally validating documents relating to the recording of OSH' training (training record) was likely to contribute to changing the approach to meeting legal obligations regarding workers' training, after a period of more than 50 years in which the only way of drawing up the individual training record was to use standardized documents that required manual fill in using a ballpoint pen or pencil.

- We believe that the inclusion in the normative acts regulating the occupational safety and health activity of provisions allowing the alternative use of electronic documents, in relation to the use of documents in letter format, gives the possibility to all those who want to use the online environment for the management of specific activities, to do so in full compliance with the legal provisions in the field and with the possibility that documents issued, signed and managed electronically be recognized as valid and produce the effects provided by law.
- The benefits of digitizing occupational safety and health are multiple. By using the SSM.ro application it is possible to issue, communicate and sign any document electronically. One of the most important components of the SSM.ro application is the possibility to generate and send by sms/email any type of training required by the legislation on occupational safety and health, informative materials related to the rules of conduct and protective measures (the transmitted materials can be in pdf, audio, video, pps format). Also, using the SSM.ro platform, employers can submit work instructions, operational procedures, technical solutions, contracts and any other documents that serve to carry out the activity in full compliance with the rules on occupational safety and health.
- Another very important aspect related to the use of the online environment, especially in the process of remote training of workers, is the possibility to electronically sign documents drawn up and transmitted to them in electronic format. Thus, any document drawn up, signed and transmitted in electronic form complies with the requirements imposed by the legislation in force in order to produce the legal effects underlying the obligation imposed by law. To make sure that the provisions related to the use of electronic documents are fully transposed into practice, the SSM.ro platform has developed the possibility for all OSH /labor related documents to be made available to labor inspectors through it, and the documents required for the checks initiated by labor inspectors will be checked online. The users (companies) of the application can allow authorized access of labor inspectors to the platform, in the section

dedicated to document control, where all electronic documents of the user company bearing electronic signature in accordance with the provisions of the E.U. Regulation No. 910/2014 and Law No. 455/2004 on time stamp are stored. Thus, labor inspectors can use the online environment in the control activity, under legal conditions, without the need to physically interact with the employer in order to provide the documents necessary for the control.

- Digitization of activities related to the employment relationship is of particular importance on multiple levels of economic activity. This way of working promotes greater flexibility in terms of time and space but, at the same time, it also requires the identification and development of intelligent solutions to provide the necessary IT mechanisms to ensure that specific occupational health and safety obligations are met, regardless of the type of employment contract that the employer and employee choose to conclude, including those types of employment contract whereby remote work may be employed.
- The main beneficiaries of this application are companies and organizations of various sizes, OSH specialists and consultants, OSH managers in companies, legal representatives and managers of companies, workers and institutions with control attributions in OSH field.

7.2. Personal contributions

- One of the important personal contributions is to encourage the state authorities and the business environment to take an important step towards digitization, by initiating and supporting legislative changes that allow the digitization of OSH activity, and by presenting the advantages that this way of working brings to those who choose to work using digital technology. [Annex 1]
- Through the initiatives and projects we have supported, we have succeeded in drawing attention to the importance of modernizing the traditional processes for ensuring compliance with the obligations imposed by occupational safety and health legislation. We have promoted innovative digital solutions that not only improve efficiency and document management, but also contribute to a safer and better managed working environment. Collaboration with various organizations and institutions has been essential in demonstrating the long-term benefits of this digital transformation, both economically and in terms of increasing the uptake of knowledge imparted to workers through specific training processes.
- There is no doubt that the speed of communicating information through the use of OSH management platforms enables better and more efficient communication between employees, employers and authorities, which contributes significantly to increasing OSH awareness and responsibility.
- If I spoke above about actual achievements, materialized in the development of the SSM.ro platform and the involvement in the modification of the legislative framework, I cannot fail to mention the beginnings of this path, in relation to which I must emphasize that very few of those who interacted with the idea of digitization of the OSH activity believed in the success of this approach. The further steps taken during the doctoral study, materialized both in the completion of the legal framework with clarifications that allow the digitization of this activity, as well as the development, in parallel, of the technical solution that would allow the

practical implementation and highlight the usefulness of these provisions, represent the most important achievements from the beginning of the doctoral study to date.

- At the end of the journey, I am happy to conclude that tens of thousands of employees now benefit from modern and more efficient means of training, thousands of companies are managing their OSH activities using the online environment, and the authorities responsible for managing and controlling the way in which the obligations arising from specific legislation on health and safety at work are fulfilled can carry out checks on documents drawn up in electronic format, bearing valid electronic signatures and made available to them through platforms that ensure the digitization of OSH, including the SSM.ro platform.
- The activity of disseminating the progress made in the development of the SSM.ro platform and the correct interpretation and application of the legal provisions regarding the digitization of the OSH activity, have transformed the vision that, 5 years ago, was the foundation of the doctoral study and the doctoral thesis, into a daily reality that has become a natural and effective option for more and more employers in Romania, from the most diverse fields of activity, most of them representing national first-tier companies. In this context, I would like to mention Autoliv Romania, which made a significant contribution to supporting the research related to the doctoral study and which, following the conclusions of the tests carried out within the company, identified the benefits of digitizing occupational health and safety at work and decided to take the necessary steps to put this way of working into practice.
- Practical and applied contributions:

- A set of variables that differentiate the satisfaction associated with online training and the use of electronic signature for recording OSH training on the training records were identified with potential influence on the quality of training;
- Benefits/ advantages experienced by learners as a result of online training were identified;
- Preliminary data review was performed in order to check the internal consistency of the questionnaire, the characteristics of the respondents, to check the normality of the data distribution and to calculate the Relative Importance Index (RII);
- Exploratory Factor Analysis (EFA) was carried out in order to verify the relevant correlations between the dependent and independent variables investigated;
- Assumption testing was performed by comparing the effectiveness perceived by the learners for classroom and online training (Wilcoxon test for dependent variables);
- The difficulties experienced by learners following online training were identified and the independent variables were analyzed by applying the Kruskal-Wallis H-test and Mann-Whitney U-test with pairwise comparisons;
- Collecting proposals for improving online training;
- Review and interpretation of the results has been carried out;
- The training method offered by SSM.ro, which implies the active involvement of the worker in the training process and testing the level of assimilation of the knowledge resulting from the training, represents a substantial contribution to the joint effort of employers, designated workers and the SEPP to prevent the occurrence of events that result in the impairment of workers' health or loss of life.

- By using the functions of the SSM.ro platform, the possibility has been created to diversify and increase the number of training sessions for workers. Reducing the amount of information conveyed through training and increasing the frequency of training is likely to make it easier to understand and assimilate the information conveyed;
- The information provided by the SSM.ro platform in the form of a report allows the designated OSH worker and the workplace manager to analyze a series of statistical data related to the training process, so that they have the possibility to customize the training materials according to the comprehension and assimilation capacity of each worker. To this end, the SSM.ro platform provides information on when the worker accessed the training material, the time it took to go through it, the mistakes made in the test to assess the knowledge assimilated and the number of tests the worker had to take in order to obtain the score required to access the next training material or to sign the individual training record.
- The worker's electronic file has been created, representing the private virtual space to which the worker has exclusive access. Putting the employee's personal file in electronic format is an alternative way of meeting a legal obligation incumbent on the employer, and free and permanent access to all documents related to the conclusion, amendment, execution, suspension and termination of the employment contract, as well as to all instructions, materials and documents of the OSH is a benefit for the worker who no longer has to request, if necessary, a copy or a copy of the documents that have been brought to his attention or that he has signed electronically.
- Making available, remotely, all documents necessary for the control or investigation of events by labor inspectors or other persons with control competence.

## 7.3 Results dissemination

Results dissemination regarding the use of the software platform in the process of training and recording of digital training in industrial sector OSH was perhaps the most important part of the allocated time and aimed at creating the highest visibility and widespread adoption of the solutions offered by the digitization of the activity.

Creating a new digital culture in OSH processes has been a big challenge for me, which involved publishing articles, organizing and participating as a speaker at numerous congresses, conferences, seminars, webinars, national and international workshops, where I presented case studies, research results, functionalities and innovations brought by the SSM.ro platform.

Scientific and Technical Publications:

**International Conferences, Indexed Web of Science (ISI)-Proceedings ISI**

**1. Mureșan, P.I.,** Milosan, I., Senchetru, D., Machedon, T.P., Oancea, G. **(2019):** *Study of health and safety in the manufacturing industry using Pareto analysis,* ISI Proceedings-Conferinta Internationala Modern Technologies in Manufacturing (MTEM 2019), Cluj-Napoca, Volume 299, p. 1-8, Article

number 05008, ISSN: 2261-236X, DOI: 10.1051/matecconf/201929905008, **WOS:**000568128200057, ISBN:978-2-7598-9083-5, ISSN: 2261-236X

https://www.matecconferences.org/articles/matecconf/abs/2019/48/matecconf_mtem2019_05008/matecconf_mtem2019_05008.html

BDI-indexed scientific journals

**1. Mureșan, P.I.,** Milosan, I., Senchetru, D., Reit, A., **(2020):** *Avoiding Occupational Diseases in Industry by Adapting the Training Methods to the New Technologies,* BDI Journal: RECENT Vol. 21, no. 2(61) p.59-59. ISSN 1582-0246, https://recentonline.ro/2020/061/Muresan-R61.pdf

BDI indexing (According to Commission 16 - Industrial Engineering): **Index Copernicus, Ulrichsweb**.

**2. Mureșan, P.I.,** Milosan, I., Machedon-Pisu, T., Reit, A., Senchetru, D., Oancea, G. **(2021):** *Avoiding workplace accidents in the industry by adapting training methods to the new technologies,* Proceedings of 10th International Conference on Manufacturing Science and Education (MSE 2021MATEC Web Conf. Sibiu), v. 343, 10024, p.1-6, eISSN: 2261-236X.

**BDI indexing: EBSCO**

https://www.matecconferences.org/articles/matecconf/abs/2021/12/matecconf_mse21_10024/matecconf_mse21_10024.html

**3. Mureșan, P.I.,** Milosan, I., Chirila, A. **(2021):** *Digital Platform for the Optimization of Occupational Health and Safety Systems Specific to the Industrial Area - Part I* ; Jurnal BDI :RECENT Vol. 22, no. 3(65), p. 111-119, ISSN 1582-0246, link: https://www.recentonline.ro/2021/065/Muresan-R65.pdf

BDI indexing (According to Commission 16 - Industrial Engineering): **Index Copernicus, Ulrichsweb**.

**4. Mureșan, P.I.,** Milosan, I., Chirila, A. **(2022):** *Digital Platform for the Optimization of Occupational Health and Safety Systems Specific to the Industrial Area - Part II* ; Jurnal BDI :RECENT Vol. 23, no. 1(66), p. 13-20, ISSN 1582-0246, https://www.recentonline.ro/2022/066/Muresan-R66.pdf

BDI indexing (According to Commission 16 - Industrial Engineering): **Index Copernicus, Ulrichsweb**.

Participation in National Congresses, Conferences, Webinars and Worshops:

Over the years, the topic of digitization of the OSH activity has been debated on several levels, including events, webinars, workshops, conferences or congresses.

In addition to the numerous events organized with 100% involvement, I have also participated in other events where I was invited as speaker or co-organizer.

Some of the events I have attended as speaker, organizer or co-organizer:

- **14 May 2020** - "Digitalization of occupational safety and health activity - a necessity in the context of CODIV-19", webinar, organizer Mureșan Petru.

- **July 3, 2020** - **"**Digitalization is coming - Benefits & Challenges in the context of the COVID-19 pandemic", online event organized by the EU OSHA Focal Point - Romania & the National Institute for Research - Development for Labour Protection "Alexandru Darabont" (INCDPM) in partnership with the Labour Inspectorate & the Romanian Association for Occupational Safety and Health (ARSSM).
- **31 July 2020** – "Management of occupational diseases in the context of the COVID-19 crisis", online event organized by the EU OSHA Focal Point - Romania & the National Research and Development Institute for Labour Protection "Alexandru Darabont" (INCDPM).
- **October 20, 2020** – "Healthy workplaces make your job easier!", webinar dedicated to the European Week for Safety and Health at Work, the campaign of the European Agency for Safety and Health at Work 2020-2022. Online event organized by Prahova Territorial Labour Inspectorate.
- **23 October 2020,** "National Partners Network", event organized by the EU OSHA Focal Point - Romania & the National Research and Development Institute for Labour Protection "Alexandru Darabont" (INCDPM).
- **October 26, 2020,** "Healthy workplaces make your job easier!", webinar dedicated to the European Week for Safety and Health at Work, the campaign of the European Agency for Safety and Health at Work 2020-2022. Event organized by the Territorial Labour Inspectorate Sibiu.
- **30 October 2020** - "Digitalization - Benefits & Challenges related to telework", online event organized by the EU OSHA Focal Point - Romania & the National Research and Development Institute for Labour Protection "Alexandru Darabont" (INCDPM).
- **13 November 2020** – **"**ESENER 3. Psychosocial Risks at Work - Romania", event organized by the EU OSHA Focal Point - Romania.
- **26 November 2020** – **"**National Conference to launch the EU OSHA 2020-22 Campaign on musculoskeletal disorders - Romania", webinar organized by the EU OSHA Focal Point - Romania.
- **11 December 2020** – **"**Managing occupational diseases in the context of the COVID-19 crisis in companies", webinar organized by the EU OSHA Focal Point - Romania.
- **26 April 2021** – **"**National Network Meeting of the EU OSHA Focal Point Romania", webinar organized by the EU OSHA Focal Point Romania.
- **18 May 2021** - "Digitization of employment relations and occupational health and safety activity, applicability and practical solutions in the context of new legislative regulations", webinar organized by Muresan Petru.
- **October 18, 2021**- "Healthy workplaces make your job easier!", webinar dedicated to the European Week for Safety and Health at Work, the campaign of the European Agency for Safety and Health at Work 2020-2022. Online event organized by Olt Territorial Labour Inspectorate.

- **02 November 2021**- "Digitizing the activity of SSM/PSI/HR" addressed to employers, managers, external occupational safety and health services, specialists in OSH and H.S.M. and H.R. in the public and private sector.
- **03 November 2021** - "Digitizing the activity of SSM / PSI / HR according to Law 208/2021 - SSM.ro Platform", online workshop, organized by Mureșan Petru.
- **November 05, 2021** - "Healthy workplaces make your job easier!" webinar dedicated to the European Week for Safety and Health at Work, the campaign of the European Agency for Safety and Health at Work 2020-2022. Online event organized by Botoșani Territorial Labour Inspectorate.
- **09 December 2021** - "Digitizing the activity of SSM/PSI/HR ", online workshop organized by Mureșan Petru.
- **04 March 2022** - "Changes and legislative novelties in the field of Occupational Safety and Health" online event organized by the Labour Inspectorate.
- **July 18, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions" offline event, organized by Cursuri Sud-Vest in Ploiești.
- **July 20, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Cluj Napoca.
- **July 21, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Oradea.
- **July 22, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Baia Mare.
- **September 19, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Zalău.
- **September 20, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Hunedoara.
- **September 21, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of the activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Timișoara.
- **September 23, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of the activity - Theoretical and practical solutions - legal provisions" offline event, organized by Cursuri Sud Vest in Resita.
- **October 03, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Suceava.

- **October 04, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of the activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Piatra Neamț.
- **October 06, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Iași.
- **October 07, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Bacău.
- **November 09, 2022** - "Legislative changes and news in the field of occupational safety and health - 2022. Digitalization of activity - Theoretical and practical solutions - legal provisions" offline event, organized by Cursuri Sud-Vest in Buzău.
- **November 24, 2022** - "EU OSHA 2020 - 2022 Campaign Closing National Seminar at national level. Results & Future Directions", offline event organized by the EU OSHA Romania Focal Point.
- **February 21, 2023** - "Legislative changes and news in the field of occupational safety and health - 2022/2023. Digitalization of the activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Mehedinți.
- **28 Apirlie 2023** - **"**National Occupational Safety and Health Congress", offline event organized by ARSSM.
- **June 21, 2023** - "Legislative changes and news in the field of occupational safety and health - 2022/2023. Digitalization of the activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Constanța.
- **June 26, 2023** - "Legislative changes and news in the field of occupational safety and health - 2022/2023. Digitalization of activity - Theoretical and practical solutions - legal provisions", offline event, organized by Cursuri Sud-Vest in Tulcea.
- **05 October 2023** - "Safety and health at work in the digital age - European Agency for Safety and Health at Work Campaign 2023-2025", webinar organized by the Labour Inspectorate and ITM Dâmbovița.
- **10 October 2023** - "Occupational safety and health in the digital age - European Agency for Safety and Health at Work Campaign 2023-2025", webinar organized by the Labour Inspectorate and ITM Bihor.
- **17 October 2023**- "Occupational safety and health in the digital age - European Agency for Safety and Health at Work Campaign 2023-2025", webinar organized by the Labour Inspectorate and ITM Timis.
- **24 October 2023** - "Occupational safety and health in the digital age - European Agency for Safety and Health at Work Campaign 2023-2025", webinar organized by the Labour Inspectorate and ITM Galati.
- **02 November 2023**, ONLINE NATIONAL SEMINARS - EU OSHA - ROMANIA FOCAL POINT organized by the European Agency for Safety and Health at Work.
- **23 November 2023** - "Occupational Safety and Health in the Digital Age", National Offline Conference to launch the EU OSHA 2023 - 2025 Campaign, organized by the European Agency for Safety and Health at Work.

- **05 April 2024** - "National Congress of SSM Smart & Safe Work 2024**",** online event organized by Mureșan Petru at the Aula of Transilvania University Brasov.
- **09 April 2024** - "Digitizing the OSH/PSI/HR activities", online workshop organized by Muresan Petru.
- **25-26 April 2024** - "Occupational health and safety in the age of digitalization", ofline event organized by the Association for the Study of Professional Labour Relations, Targoviste Romania.

Digital Marketing:

Digital marketing campaigns, including blog articles, social media posts and articles in press and TV to draw attention to the platform and the digitization of the OSH activity, were carried out.

Organizing in April 2024 in the Aula of Transilvania University of Brasov the National Congress on Occupational Safety and Health - "Smart & Safe Work 2024"

In addition to the official note, the organization and participation in this congress had the role of being able to make various connections with OSH specialists, to present the platform and create new opportunities for dissemination of the project of digitization of OSH activity.

During this event, which was attended by over 450 participants, 30 speakers and 30 exhibition stands, the exhibition stand and the presentation of the SSM.ro platform had an important place.

Certainly, these dissemination strategies and channels have ensured and will ensure a spread of the results and will contribute to increase the awareness and adoption of digital solutions in OSH.

## 7.4 Study limitations

The specific limitations of the study are considered in the context of the objectives of the study, namely the digitization of occupational safety and health (OSH) activities. In the following, I expose some possible limitations of this study:

Technology adoption:

Resistance to change: Some employees and even managers in companies and organizations may be resistant to change, which prevents or slows the adoption of digital technologies and processes.

Digital skills: An important barrier among managers and employees is a relatively low level of digital skills.

**Intuitive accessibility and functionality**:

Technical compatibility: the possibility that some devices with which employees and managers have access to the platform may not be compatible or that the operating activities on the devices may not be up-to-date.

User interface: If the platform interface is not intuitive, users may have difficulty using it. The interface should be as user-friendly as possible, and the graphics should have common elements familiar to users.

Financial costs:

Platform implementation and maintenance costs may initially be considered an impediment to OSH digitization, however it is important to emphasize that while these costs may initially be incurred in the implementation of OSH digitization, they are immediately recovered through process efficiencies, error reduction and long-term savings from automation.

Legislation and regulations:

Legislative compliance and legislative changes: increased duration for employers to be aware of the legislative changes allowing the digitization of the SSM activity and the need to constantly update the platform with legislative changes.

Data security:

Confidentiality of information: the platform collects a lot of personal data, which requires a high degree of care to ensure the confidentiality of the stored information.

Cybersecurity risks: Cyber-attacks as well as unauthorized access to data on the platform are a considerable risk to be considered.

Data accuracy:

Data quality and completeness: It is important that the data entered for each employee is correct and fully corresponding to the employee, otherwise there is a possibility of errors in the documents created using the platform.

Scalability:

Scalability and technical performance: The scalability of the platform is essential to make it accessible to a growing number of users and companies. Response times and performance must be satisfactory as the number of users will grow.

Continuous feedback and development:

Feedback: Users' reluctance to give relevant and constructive feedback so that new modules and functionalities can be programmed and developed in the platform to improve its quality.

User suggestions are absolutely necessary to implement and test new features.

Taking these limitations into account and addressing them constructively can contribute to the long-term efficiency and development of the platform.

## 7.5 Future development directions

Due to the inherent difficulties of access to the company in which the research was conducted and difficulties arising from internal regulations and GDPR legislation, it was not possible to compare the evaluation results obtained by the two training methods separately. Such a comparison would have allowed the two training methods to be compared in terms of their effectiveness. It is therefore recommended that the organization should conduct such a study in the future.

If traditional training generates better results than online training, a diagnosis of the causes of this difference would be needed in order to make online training more effective so that the actual results for employee safety and satisfaction are improved.

Given the results materialized in the completion of the legal framework in Romania with the possibility of using information technologies in the management of occupational safety and health, as well as the development of the SSM.ro platform, we intend to continue the development process of the platform, in accordance with the requirements that are imposed by the dynamics of various work processes, in parallel with the continuous dissemination of ways to correctly use digital solutions and the benefits that can result from the adoption of OSH digitization.

For future developments there are several directions with potential to improve and extend the platform functionalities, such as:

Extended functionalities:

Advanced reporting tools: Create new reporting tools, allowing users to generate detailed and advanced reports for any kind of document generated and uploaded on the platform.

Training and coaching: Integrate and develop more interactive online training and coaching modules for employees. We propose that, by using the SSM.ro platform, it will be possible to train and test workers in other areas related to OSH (e.g. training in the field of emergency situations and fire prevention and control), and at the end of the training to be able to perform an automated analysis and evaluation of the knowledge assimilated by the trainee.

Integrate or connect via APIs with HR platforms: This would primarily enable an expansion of the external prevention and protection services' client portfolio, as well as a unified data management. It would also be useful to integrate or connect other applications and platforms used by companies.

Mobility and accessibility:

Mobile app: As we have found from the feedback that most users access the platform from mobile devices, this underlines the need and usefulness of developing a mobile app for easier access to the platform.

Accessibility for people with disabilities: Implementation of functionalities, most likely voice, to enable and ensure accessibility to the platform for users with various disabilities.

Regulatory compliance and cyber security:

Improving cyber security: Implement advanced security standards and measures. The focus will be on two-factor authentication, data encryption and the development of up-to-date solutions for continuous security monitoring.

Updates required by legislation: the platform has to keep up with each amendment/completion of the legal framework, by transposing them into functions to ensure that the new provisions are implemented.

Collaboration features:

Collaborative workspaces: Create virtual working libraries where users can share documents, discuss and manage various OSH related projects.

Notifications and alerts: Develop multiple types of notifications and alerts, aiming to make them customizable for important goals and deadlines.

Analytics and artificial intelligence:

Predictive analytics: Using artificial intelligence algorithms to provide real-time predictive analytics and recommendations to users.

Virtual Assistants: Integration of virtual assistants to answer users' questions and provide support in using the platform.

Personalization and User Experience:

Customization: Providing new ways to customize the interface and functionality tailored to each organization's requirements.

UI/UX enhancement: Continuously optimizing the user interface and user experience to make the platform more intuitive and easy to use.

Support and Community:

Extensive Support: Creating a detailed platform guide, video tutorials and a live chat, all with the aim of providing the most punctual support to users' requests.

Online community: Develop the existing online community and assign a specialized moderator to it. Within the online community, users can share experiences, solutions and best practices related to SSM and thus the platform.

These are just a few of the development directions that can directly contribute to the transformation of the SSM.ro platform into an essential tool for optimizing the management and effective management of occupational health and safety in industry and beyond, while providing exponentially significant value to its users.

## BIBLIOGRAPHY (Selection)


[ALA20] Alaimo C., Kallinikos J., Valderrama E. *Platforms as service ecosystems: Lessons from social media. Journal of Information Technology*, ISSN 1466-4437, v. 35, n. 1, p. 25-48, 2020.

[BAL16] Bala, J. *Contribution of SPSS in Social Sciences Research. International Journal of Advanced Research in Computer Science*, v. 7(6), p. 250-254, 2016.

[CON18] Constantinides P., Henfridsson O., Parker G.G. *Introduction - Platforms and infrastructures in the digital age. Information Systems Research*, ISSN 1526-5536, v. 29, n. 2, p. 381-400, 2018.

[CLI13] Clinciu, A. I. *Applied Statistics in Psychology*, "Transilvania" University of Brașov, ISBN 978-606-19-0239-2, 2013.

[DAR01] Darabonț, A. and others, *Managementul securității și sănătății în muncii*, vol 1 and 2, AGIR Publishing House, Bucharest, 2001.

**[MUR19] Mureșan, P.I.,** Milosan, I., Senchetru, D., Machedon, T.P., Oancea, G. ***Study of health and safety in the manufacturing industry using Pareto analysis,*** ISI Proceedings-Conferinta Internationala Modern Technologies in Manufacturing (MTEM 2019), Cluj-Napoca, Cluj-Napoca, Volume 299, p. 1-8, Article number 05008, ISSN: 2261-236X, DOI: 10.1051/matecconf/201929905008, WOS:000568128200057, (indexed ISI WoS-CPCI), 2019.

**[MUR20] Mureșan, P.I.,** Milosan, I., Senchetru, D., Reit, A., Avoiding Occupational Diseases in Industry by Adapting the Training Methods to the New Technologies, BDI Journal: RECENT Vol. 21, no. 2(61) p.59-59, (Indexed BDI: Index Copernicus, Ulrichsweb), 2020.

**[MUR21b] Mureșan, P.I.,** Milosan, I., Machedon-Pisu, T., Reit, A., Senchetru, D., Oancea, G.: ***Avoiding workplace accidents in the industry by adapting training methods to the new technologies,*** Proceedings of 10th International Conference on Manufacturing Science and Education (MSE 2021MATEC Web Conf. Sibiu), v. 343, 10024, p.1-6, eISSN: 2261-236X. (Indexed BDI: EBSCO), 2021.

**[MUR21a] Mureșan, P.I.,** Milosan, I., Chirila, A. ***Digital Platform for the Optimization of Occupational Health and Safety Systems Specific to the Industrial Area*** - Part I ; BDI RECENT Journal Vol. 22, no. 3(65), p. 111-119, (Indexed BDI: Index Copernicus, Ulrichsweb), 2021.

**[MUR22] Mureșan, P.I.,** Milosan, I., Chirila, A. ***Digital Platform for the Optimization of Occupational Health and Safety Systems Specific to the Industrial Area*** - Part II; Jurnal BDI RECENT Vol. 23, no. 1(66), p. 13-20, (Indexed BDI: Index Copernicus, Ulrichsweb), 2022.

[W1] https://osha.europa.eu, accessed 01.2023.

[W15] www.inspecțiamuncii.ro, accessed 06.2023

[W16] https://www.safework.ru/, accessed 02.2023

[W17] https://www.spss-tutorials.com/kruskal-wallis-test-in-spss/, accessed 01.2023

[ZAH22] Zahar Djordjevic, M.; Djordjevic, A.; Klochkova, E.; Misic, M. *Application of Modern Digital Systems and Approaches to Business Process Management*. Sustainability, 14, 1697, 2022.

[GD1] ******Law no 455 of July 18, 2001 on electronic signature, accessed on 10.2019

[GD4] ***Law no. 319 of July 14, 2006 on safety and health at work, accessed 02.02.2019

[GD5] ***Government Decision no. 1425 of October 11, 2006 for the approval of the Methodological Norms for the application of the provisions of the Law on safety and health at work no. 319/2006, accessed 02.2019

[GD6] ***Government Decision no. 259 of April 20, 2022 amending and supplementing the Methodological Norms for the application of the provisions of the Law on safety and health at work no. 319/2006, accessed on 04.2012

[GD7] ***Law no. 208 of July 22, 2021 for the approval of Government Emergency Ordinance no.

36/2021 on the use of electronic signature in the field of employment relations and amending and supplementing certain normative acts, accessed 07.07.2021

[GD8] ***Government Emergency Ordinance no. 36 of May 6, 2021 on the use of electronic signature in the field of labor relations and amending and supplementing some normative acts, accessed on 05.2021

[GD09] ***Law no. 53 of January 24, 2003 - Labor Code (republished, with subsequent amendments and additions), accessed 02.2023

[GD10] ***Law no. 81 of March 30, 2018 on the regulation of telemarketing, accessed on 03.03.2019

[GD11] *** Law No. 214/8 July 2024- on the use of electronic signatures, time stamps and the provision of trust services based on them (entry into force: October 8, 2024), accessed 07.2024