




Article

Evaluation of the Training Process of Health and Safety at Work in Industry through Digitalization—Case Study: Position in Organization

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Abstract: This study analyses the opinion of 200 employees who participated in the first online training in the field of occupational health and safety systems (OSHS) from Romania, for which an online platform was used, with the records on electronic files with a qualified electronic signature. The usefulness of this online training was analyzed based on the voluntary answers of the participants to a questionnaire related to 14 questionnaire items (QIs). In order to correctly interpret the results of the applied test, a statistical processing of the answers was carried out, and the following were calculated (using SPSS 23.0 software): the factor analysis, the Kaiser–Meyer–Olkin (KMO) test, the Bartlett’s test, the extraction method, the Principal Component Analysis (PCA), the Cronbach alpha test and the Kruskal–Wallis *H*-test. The calculations highlighted two essential strategies: “Availability for online training” (S1) and “Challenges of online training” (S2). The conclusion of this study provides an overview of the importance of online training strategies in OSH activity and can help researchers and practitioners to improve this activity, reducing the rejection of its use among managers and authorities, thus providing a new reference for future research.

Keywords: safety; training; digital platform; questionnaire; essential strategies; decision making



Citation: Mureșan, P.-I.; Milosan, I.; Pavalache-Ilie, M.; Gabor, C.; Oancea, G. Evaluation of the Training Process of Health and Safety at Work in Industry through Digitalization—Case Study: Position in Organization. *Appl. Sci.* **2024**, *14*, 8502. <https://doi.org/10.3390/app14188502>

Academic Editor: Roger Narayan

Received: 19 August 2024

Revised: 16 September 2024

Accepted: 19 September 2024

Published: 20 September 2024



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1. Introduction

In the new social context that has imposed measures of social distancing and isolation, access to online courses and training through the use of e-learning platforms has proved useful for both the general public and the elderly even in the post-pandemic period [1–3].

As a result of a long period of regulation of occupational health and safety activity, which provided the obligation to fill out training records exclusively using “pen and ink”, the imperative need to optimize occupational health and safety documents management emerged.

In the case of the classical training, some more important inconveniences can be observed:

- A significant amount of time spent on travel within the country or locally to the business premises of the companies;
- Significant costs for the purchase of paper, printing equipment and supplies and their maintenance. The consumption of paper in large quantities for documentation and training sheets constitutes a real issue in the protection of the environment, which should be a constant concern of all economic agents;
- The number of workers who can participate in training simultaneously is limited to a maximum 20 people;

- The training is conducted for groups of up to 20 people, who have different abilities to process and retain the information;
- The training is entered exclusively in the training records with a holographic signature;
- The workers have to travel to the training room, consuming time and fuel resources and, therefore, financial resources for transportation;
- In the event of a checkup, the company's representatives have to travel to Territorial Labor Inspectorate offices to present the documents requested by labor inspectors, which implies spending time and fuel.

The optimization of this process must have in mind a wide applicability, addressing all categories of participants in the work process: employers, employees, workers and government authorities with responsibilities in the field of occupational health and safety, the prevention and extinguishing of fires and labor relations.

In terms of management process optimization, the management of occupational health and safety-related documents can be very efficiently achieved using the electronic management of documents, with digital distance learning being effective distance and involving low costs [4–6].

The importance of digital platforms has been highlighted in various studies, covering multiple fields of activity such as entrepreneurial activities [7–10], business strategies [11,12], Open Platform Communication [13,14], education [15–17], digital divide research [18–20], industrial processes [21,22] and others.

According to specialized studies [23,24], the safety training remains an important means to improve safety at the workplace. According to previous studies [24,25], workers think that training is the most important factor that makes the workplace safer.

The present study is also based on the data provided by the statistical documents of labor inspection at the national level. In these documents, it is emphasized that in the first place, at the top of the most frequent problems in the field of health and safety at work, one finds the improper/incomplete training of workers in the field of OSH, with a percentage of 15% from all the problems.

Following the completion by the company "Consultia" Srl Brasov (Romania) of the first online training in the field of occupational health and safety systems (OSHS) from Romania, for which an online platform was used (SSM.ro) with the records on electronic files with a qualified electronic signature, a questionnaire was made available for the trainees who wanted to voluntarily express their opinion (200 participants) about this new method (feedback from the client).

One should mention that the electronic signature was made available by a provider of electronic signatures that was certified by the European Union according to regulation eIDAS.

In this context, this empirical test has the goal of analyzing the usefulness of online employee OSH training for companies using such training, which integrates technical and non-technical skills (NTS) [24,26].

For this purpose, the first online platform from Romania in the field of OSH, which is called SSM.ro, was created.

In order to correctly interpret the results of the applied test, in accordance with others papers, a statistical processing of the answers of 200 respondents on the online input of specific OSH regulations was carried out.

The purpose of the research is dual, being made up of two components:

- 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 advantages and difficulties perceived by the users of the SSM.ro platform, in order to improve the platform, as well as to identify ways to improve online OSH training.

The conclusions of the study provide an overview of strategies to improve online training activity in the OSH business.

The overview of this study can help researchers and practitioners in the field of OSH to improve this activity, reducing the rejection of its use among managers and authorities, thus providing a new reference for future research.

2. Theoretical Background

2.1. Strategies Regarding Digital Occupational Health and Safety Training

The process of the administration and management of the files in the occupational health and safety system (OSH) could be optimized efficiently by referring to digital services and the electronic administration of documents.

A good way to mitigate some of the challenges of the transition from classical to online instruction in the field of OSH is by means of an early information stage. The rate of success of this action depends on the level of planning and organization of the company and on the way in which the employees understand and apply the new instruction method in line with the legislation in force [27–29].

According to the specific literature [30,31], it is evident that trained workers have greater confidence in managing the various challenges they face at their workplace, which denotes a high competence due to the transfer achieved during training.

Digital training can be performed at any time during the day [24], as the SSM.ro platform operates 24 h a day, providing flexibility for the training/sign-up time.

The work efficiency of the OSH inspector working digitally increases exponentially. More training can be accomplished in a shorter period of time. The number of clients that can be processed by an OSH inspector is much higher. Thus, the profit of the external occupational health and safety service increases.

With OSH documentation uploaded to the SSM.ro platform and training taking place online, digitized OSH work can be carried out for clients with business premises located practically anywhere in the world. Therefore, an elimination of “downtime” caused by the travel of the OSH inspector to the business premises of economic operators is realized.

The work of the OSH inspector is mainly carried out online. Paper consumption is almost completely eliminated. The present study involved nearly zero costs for paper and printing equipment or related consumables and maintenance. Thus, the environment is protected by limiting paper consumption.

There is no limit to the number of people who can receive the course topic and training instructions at the same time. As the training (going through the course) and solving the test questionnaire, which confirms the assimilation of the training, is carried out individually by each worker, they have the opportunity to further study the instructions received and to solve the questionnaire in a timeframe adapted to the capacity of each person who is trained to understand and acquire the information.

The training is recorded remotely, the time required to sign a document using an 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 a holographic signature.

Online training is extremely mobile. Workers are trained remotely, wherever they are, by simply logging in from any device such as a smart phone, tablet, laptop or PC with an internet connection, without having to travel to the training room.

All electronically signed documents can be made available to labor inspectors online, and the documents required to carry out the inspections initiated by labor inspectors will also be verified online.

2.2. Research Main Objective and Hypothesis

The main objective of the research is a *review of the software platform users in OSH online training*.

The activities carried out to achieve this main objective are as follows:

- Identifying a set of variables that differentiate the satisfaction associated with online training and using the electronic signature to record the OSH 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;
- A preliminary data review aimed at checking the internal consistency of the questionnaire, respondents' features, the dissemination of data and Relative Importance Index calculation (IIR);
- An exploratory factor analysis (EFA) aimed at checking relevant correlations between the dependent variables and the independent variables researched;
- Identifying the difficulties felt by the trainees following the online training, and the analysis of the independent variables by applying the Kruskal–Wallis *H*-test with pair comparisons;
- Collecting proposals for improving online training;
- Analysis and interpretation of results.

In accordance with the data of the theoretical model of “Safety Climate and Performance Presented” by Griffin and Neal [32] who assumed that a safe performance includes compliance (related to the job task) and participation (context) and also based on experience, the authors of this paper stated the following hypotheses:

Hypothesis 1 (H1). Employee satisfaction associated with online training on the SSM.ro platform varies depending on their role in the organization.

Hypothesis 2 (H2). Employee satisfaction associated with online training on the SSM.ro platform differs depending on seniority at work.

Hypothesis 3 (H3). Employee satisfaction associated with online training on the SSM.ro platform varies depending on their level of education.

Hypothesis 4 (H4). Employee satisfaction associated with online training on SSM.ro platform varies by age.

Hypothesis 5 (H5). Employee satisfaction associated with online training on SSM.ro platform differs by gender.

Since it is part of a larger research regarding the evaluation of the training process of health and safety at work in industry through digitalization, in this paper only Hypothesis 1 (H1) will be analyzed and tested.

3. Methodology

3.1. Research Participants

The population investigated in the study was comprised from one of the most important industrial and representative companies in the Brasov region.

The sample size was $N = 225$ employees trained online on the specifics of OSH. All participants received an email with information about the study and their right to withdraw from the study at any time.

The 225 participants were trained through the SSM.ro platform between 28 September 2023 and 13 February 2024.

In the end, a total of 204 employees expressed their willingness to participate in the online survey, and a total of $n = 200$ valid questionnaires were collected. This study was conducted after obtaining approval from the Ethics Committee of S.C. CONSULTIA SRL Brasov (Romania), Application No. 904/15 September 2023.

The respondents' profile is presented in Table 1.

Table 1. Respondents' profile.

Attributes	Categories	n = 200	
		n	%
Position in Organization	Manufacturing Team Leader	30	15.0
	Technical–Economic and Socio-Administrative Personnel (TESA)	70	35.0
	Production Worker	100	50.0
	Total	200	100.0
Work Experience	<5 years	28	14.0
	5 ÷ 10 years	68	34.0
	>10 years	104	52.0
	Total	200	100.0
Educational level	Vocational school	35	17.5
	High school	96	48.0
	College	39	19.5
	Master	30	15.0
	Total	200	100.0
Age (years)	<35 years	60	30.0
	35 ÷ 45 years	65	32.5
	45 ÷ 55 years	43	21.5
	>55 years	32	16.0
	Total	200	100.0
Gender	Males	79	39.5
	Females	121	60.5
	Total	200	100.0

Analyzing the data presented in Table 1 with the profile of the respondents, it can be noted the majority of respondents come from the following categories: workers (50.0%); work experience of more than 10 years (52.0%); college educational level (48.0%); age between 35–45 years (32.0%); and females (60.5%).

3.2. Research Instrument

Understanding the importance of using online employee training in the field of OSH, this study uses a survey as the research method, and the research instrument used in this approach was the questionnaire [33–35].

3.2.1. Constructing the Questionnaire Survey

The objectives of the questionnaires were as follows:

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

An assessment of employee satisfaction associated with OSH training was carried out using a questionnaire developed for this research.

The development of the questionnaire process activities followed the steps shown:

1. Literature study of the online training processes of OSH;
2. Constructing the initial questionnaire survey (version 1);
3. Experts' analysis;
4. Constructing the questionnaire survey (version 2);
5. Piloting the questionnaire;
6. Constructing the final questionnaire survey (version 3).

The items were developed in accordance with the data presented in the literature [32–37] and on the basis of experience in the field of OSH.

Following the study of references regarding OSH training, the authors of the research developed a base of items related to the satisfaction associated with classic and online training. The starting point was the survey conducted by Jain [38] on the satisfaction and effectiveness perceived by high school students in online learning. For the present research, the items were formulated in accordance with occupational health and safety training.

The questionnaire was drawn up based on over 20 years of experience of the employees of “Consultia” SRL Brasov, Romania, as well as taking into account the information provided in the specialized literature, and it was structured in such a way as to obtain important information relevant for a sustained analysis of the online training of employees in the field of OSH [39,40].

The questionnaire was developed in order to measure the key aspects with regards to the online instruction of OSH, and it contains a total of 14 questionnaire items (QIs), indicators related to 2 directions considered strategic for the analysis: “Availability for online training” and “Benefits of online training reported”.

A total of 14 questionnaire items (QIs) presented in Table 2 were selected to assess the importance of online OSH training, taking into account the data presented by Griffin and Neal [32], Vigoroso et al. [33], Hutchenson and Sofroniou [34], Wannas and Ghannouchi [35], Flin and Maran [36] and Mariani et al. [37].

Table 2. Questionnaire items (QIs) in the analysis of OSH online training.

Code	Questionnaire Items (QIs)
I.01	I use frequently the internet
I.02	I use internet easily
I.03	I find easy the registration/training/testing steps in the SSM.ro platform
I.04	I think that I increase my knowledge through online training, compared to other forms of training
I.05	I think that using an electronic signature to record OSH training is more useful than a paper signature
I.06	I think that online OSH training is a better method compared to traditional (face-to-face) training
I.07	I think that traditional training (face-to-face/classroom) is better than online training
I.08	I think that video conference training provides a better experience than traditional (face-to-face) training
I.09	I am satisfied with the online training
I.10	I am satisfied with understanding the material in the online training
I.11	I am satisfied with the accountability in complying with OSH requirements provided by the online training
I.12	I am satisfied with the clarification of misunderstandings of OSH legislation provided by the online training
I.13	I am satisfied with the online training in order to test the knowledge acquired in the online training
I.14	I am satisfied with the online training in general

The survey adopted a 5-point Likert-type response scale to measure satisfaction, efficiency and agreement with the values [24,38,41–44], ranging from 1 = strongly disagree to 5 = strongly agree.

3.2.2. Experts’ Analysis

There followed the assessment of the questionnaire items in version 1, at 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 and 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 3, the questionnaire had 14 items on online training.

Table 1 highlights the presence of the following items:

- Two items about the 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 (I.03, I.04, I.05);

- Eight items to assess the satisfaction with occupational health and safety training (I.06, I.07, I.08, I.09, I.10, I.11, I.12, I.13, I.14).

3.2.3. Piloting the Questionnaire

To test the questionnaires, they were applied to a group of 10 employees from another service organization who were trained in online OSH. They were asked by the doctoral student to answer the questionnaires and to comment on the clarity of the items and possible difficulties in understanding them.

Two problems related to the clarity of the wording were pointed out and corrected, obtaining the final versions of the questionnaires, which were later used for data collection.

However, in accordance with Antonsen [45], we are aware of the fact that the 14 questionnaire items (QIs) can be completed or modified, since this field of OSH is very important and the instruction of the workers has to be continuously updated. Nonetheless, we consider that this empirical test is a beginning for the digitalization of OSH.

Special attention was paid to the ease of understanding of the questionnaire by the respondents, analyzing the identification and correct framing, as well as acceptance of the process variables. The scoring of each question was conducted in such a way that the respondents' answer could be identified as being as close as possible to their will, thus facilitating their confidence in the score.

3.3. Analyzed Variables

The variables used in this empirical research, in accordance with the specialized literature [46,47], are divided into the following categories:

- Nominal variables: position in company and gender;
- Ordinal variables: work experience, educational level (studies) and age.

From the point of view of the relationship between them, the variables are divided into 2 categories:

- Dependent variables made up of the 14 items presented in Table 2;
- There are 5 independent variables used, namely position in company, work experience, educational level (studies), age and gender of participants.

4. Survey Results and Analysis

The interpretation of the results obtained was then carried out by applying different assumptions and statistical analysis procedures. Increasing the score means increasing the importance of the analyzed factor for occupational health and safety.

The survey results and analysis activities followed the principal steps shown:

1. Preliminary data analysis;
2. Agreement analysis;
3. Exploratory factor analysis.

4.1. Preliminary Data Analysis

According to the specialized studies [24,37,41,42,48–52], a "Preliminary data review" was conducted using the Statistical Package for the Social Sciences (SPSS 23.0, IBM, Armonk, NY, USA, 2015) software application, following the steps shown:

1. Reliability analysis (Cronbach's alpha test);
2. Descriptive statistics analysis;
3. Relative Importance Index Analysis;
4. Checking normality of data distribution.

4.1.1. Reliability Analysis (Cronbach's Alpha Test)

The first analysis performed immediately after receiving and validating the answers to the final questionnaire was to check the internal consistency of the section of the online

training questionnaire (items I.01–I.14) and also the section regarding the satisfaction associated with this type of training (items I.09–I.14).

In this case, it was verified that the questions of the section were formulated in such a way that they refer only to a single reality studied in accordance with the general objective of the research, namely: the satisfaction of the online training of employees in OSH. A Cronbach's alpha value of 0.75 or more is accepted as a rule to denote an agreeable level of reliability [48]. The results of the Cronbach's alpha value for all fourteen items (I.01–I.14) are 0.82, and for the six items (I.09–I.14) regarding the satisfaction of the online training of employees, the value is 0.95; the level of reliability is very good, specific to situations where important decisions must be made, and as a result, the data were reliable and valid [35–37,42].

4.1.2. Descriptive Statistics Analysis

In this stage, the values of the mean score ranking technique and standard deviation were adopted to determine the relative significance of the fourteen items. Additionally, for a better analysis of the homogeneity of the experimental data, the coefficient of variation (CV) was also calculated. The coefficient of variation (CV) was calculated as the ratio between the standard deviation and the arithmetic mean; $CV = (\text{standard deviation}/\text{sample Mean}) \times 100\%$.

The scores of the data collected from employees are presented in Table 3.

Table 3. Data scores collected from employees.

Code	Questionnaire Items (QIs)	Mean	Standard Deviation	Coefficient of Variation [%]	Rank
I.01	I use frequently the internet	4.66	0.669	14.382	1
I.02	I use internet easily	4.42	0.660	14.935	2
I.03	I find easy the registration/training/testing steps in the SSM.ro platform	4.33	0.715	16.543	3
I.04	I think that I increase my knowledge through online training, compared to other forms of training	4.11	0.712	17.337	10
I.05	I think that using an electronic signature to record OSH training is more useful than a paper signature	4.21	0.793	18.839	5
I.06	I think that online OSH training is a better method compared to traditional (face-to-face) training	4.06	0.738	18.201	12
I.07	I think that traditional training (face-to-face/classroom) is better than online training	2.60	0.978	37.673	14
I.08	I think that video conference training provides a better experience than traditional (face-to-face) training	3.91	0.803	20.542	13
I.09	I am satisfied with the online training	4.11	0.596	14.530	11
I.10	I am satisfied with understanding the material in the online training	4.17	0.640	15.370	6
I.11	I am satisfied with the accountability in complying with OHM requirements provided by the online training	4.12	0.651	15.822	8
I.12	I am satisfied with the clarification of misunderstandings of OSH legislation provided by the online training	4.12	0.611	14.855	9
I.13	I am satisfied with the online training in order to test the knowledge acquired in the online training	4.16	0.643	15.468	7
I.14	I am satisfied with the online training in general	4.23	0.685	16.198	4

In the case of the present research, it is noted that the coefficient of variation (CV) had values between 14.382 (I.01) and 37.673 (I.07), so we can define the parameter reproducibility as good when the CV was between 10–20% for most factors and acceptable (when the CV was between 20–30%) for indicators I.08 and not acceptable when the $CV > 30$ (the case of

I.07). So, we can conclude that the indicators have a good/acceptable spread value (except item I.07), and therefore the mean is representative.

4.1.3. 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 this test, the null hypothesis of normality data distribution $(H_0)_N$ 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 $(H_0)_N$ is rejected, and in this case the alternative hypothesis $(H_1)_N$ is accepted, because statistical significance was obtained.

When the significance threshold value ' $p > 0.05$ ', then the null hypothesis $(H_0)_N$ is accepted since statistical significance was not obtained.

The results of the Shapiro–Wilk test (a test considered as more powerful in determining normality by statisticians [53–55]) indicate that none of the variables is normally distributed, all variables having p -value < 0.001 .

4.1.4. Relative Importance Index Analysis

This study agrees with the view that using the mean in addition to the standard deviation of each single factor's attribute is not a suitable way to evaluate the overall rankings as they do not reflect any relationship between them.

The suggested method for sorting the indicators is using the Relative Importance Index (RII) [56,57].

As a result, this study used the Relative Importance Index (RII) to define the comparative ranking of the delay indicators, which can be calculated with the formula of Equation (1):

$$\text{Relative Importance Index (RII)} = \frac{\sum W}{A + n} = \frac{1n_1 + 2n_2 + 3n_3 + 4n_4 + 5n_5}{5 * n}; (0 \leq RII \leq 1) \quad (1)$$

where

W = the weight that was given to each delay factor by the respondent within the range {1, 2, 3, 4, 5}, multiplied by the number of respondents $\{n_1, n_2, n_3, n_4, n_5\}$ for each factor; n_1 = number of respondents who strongly disagree; n_2 = number of respondents who disagree; n_3 = number of respondents who neither agree nor disagree; n_4 = number of respondents who agree; n_5 = number of respondents who strongly agree; A = highest weight (in this study: 5); n = overall number of respondents (in this study: 200).

The ranking of the assessment of the 14 items (I.01 ÷ I.14) using the Relative Importance Index (RII) is presented in Table 4.

According to the specialized studies [51,54,55], the values of the Relative Importance Index (RII) can be classified into 5 levels of importance: high ($0.8 \leq RII \leq 1$), high-medium ($0.6 \leq RII < 0.8$), medium ($0.4 \leq RII < 0.6$), medium-low ($0.2 \leq RII < 0.4$) and low ($0 \leq RII < 0.2$). Analyzing the results presented in Table 4, it is noted that the 14 items fall into the following levels of importance: high importance (I.01 ÷ I.06, I.09 ÷ I.14), high-medium importance (I.08) and medium importance (I.07), their classification being made according to the value of the calculated ratios, thus obtaining values for the IIR between 0.931 (I.01—first ranked) and 0.519 (I.07—last ranked).

Table 4. Results for Relative Importance Index (RII), and Kruskal–Wallis *H*-test.

Cod Items	Percentage of Respondents Scoring (%) for Likert Scale Priority					RII Score	Rank	Kruskal–Wallis <i>p</i> -Value
	1	2	3	4	5			
I.01	0	10	21	160	740	0.931	1	<0.001 *
I.02	0	2	48	324	510	0.884	2	<0.001 *
I.03	0	6	60	344	455	0.865	3	<0.001 *
I.04	0	6	96	424	295	0.821	10	0.002 *
I.05	0	10	93	324	415	0.842	5	<0.001 *
I.06	0	4	129	388	290	0.811	12	<0.001 *
I.07	25	146	192	136	20	0.519	14	0.007 *
I.08	1	16	132	408	225	0.782	13	0.001 *
I.09	0	0	78	508	235	0.821	11	0.108
I.10	0	2	72	464	295	0.833	6	0.042 *
I.11	0	2	87	464	270	0.823	8	0.432
I.12	0	0	81	492	250	0.823	9	0.329
I.13	0	2	75	464	290	0.831	7	0.117
I.14	0	0	87	384	375	0.846	4	<0.001 *

* The Kruskal–Wallis *H*-test result is significant at the significance level at *p*-value < 0.05.

4.2. Agreement Analysis

To determine whether there were different opinions (any significant differences in their perception) regarding online training between participants with different positions in the organization (manufacturing team leader, TESA and production worker), as well as to test Hypothesis 1 (H1), the Kruskal–Wallis *H*-test was applied.

Hypothesis 1 (H1). Employee satisfaction associated with online training on the SSM.ro platform varies depending on their role in the organization.

The Kruskal–Wallis *H*-test (sometimes also called the “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 [28,46,58–64]. The results of the Kruskal–Wallis *H*-test are shown in Table 4. Table 4 shows that within the items presented above, there are significant results after applying the Kruskal–Wallis *H*-test ($p < 0.05$); there are different opinions between the participants in the online training with different functions in the organization, a fact noted for items I.01 ÷ I.08, I.10 and I.14. After applying the Kruskal–Wallis *H*-test, to perform the Pairwise Comparisons and to identify possible differences between the independent variables (team leader, TESA and production worker), a post hoc Dunn’s multiple comparison test was performed [46,62]. The results for post hoc Dunn’s multiple comparison test are shown in Table 5.

Therefore, in conformity with the Dunn test results, Table 5 highlights the presence of the following statistical differences between the production worker and manufacturing team leader in I.02, I.03, I.05 and I.14. Additionally, it identified statistical differences between the production worker and TESA in I.01, I.02, I.03, I.04, I.05, I.06, I.08 and I.14. In addition, it indicated statistical differences between the manufacturing team leader and TESA in I.01, I.02 and I.07.

Table 5. Results for post hoc Dunn's multiple comparison test.

Code	Questionnaire Items (QIs)	Worker/ Team Leader	Worker/ TESA	Team Leader/ TESA
I.01	I use frequently the internet	0.525	<0.001 *	0.037 *
I.02	I use internet easily	0.001 *	<0.001 *	0.041
I.03	I find easy the registration/training/testing steps in the SSM.ro platform	<0.001 *	<0.001 *	0.516
I.04	I think that I increase my knowledge through online training, compared to other forms of training	0.620	0.001 *	0.585
I.05	I think that using an electronic signature to record OSH training is more useful than a paper signature	0.012 *	<0.001 *	1.000
I.06	I think that online OSH training is a better method compared to traditional (face-to-face) training	0.065	<0.001 *	1.000
I.07	I think that traditional training (face-to-face/classroom) is better than online training	0.691	0.051	0.013 *
I.08	I think that video conference training provides a better experience than traditional (face-to-face) training	0.084	0.001 *	1.000
I.10	I am satisfied with understanding the material in the online training	0.200	0.081	1.000
I.14	I am satisfied with the online training in general	0.012 *	<0.001 *	1.000

* Significant difference level at $p < 0.05$.

4.3. Exploratory Factor Analysis

The data analysis method used in this study is an exploratory factor analysis which aims to rank the importance of key influencing indicators. Using Principal Component Analysis reduces the number of variables used initially (to increase the speed of data processing) by considering a reduced number of representative variables. Strategic directions are also determined by identifying hidden patterns in the relationships between data.

4.3.1. Correlation Matrix Analysis

Using SPSS 23.0 software [24,37,41,42,48–52], we determine the first correlation matrix for the 14 QIs (I.01 ÷ I.14). First, the calculated significance values are analyzed from the analysis of the "significance values" data presented in the second part of the table specific to the correlation matrix (Sig 1-tailed); it can be observed that in addition to the values of <0.001, some values of 0.001, 0.002 were also obtained, plus 0.014 and 0.144. The value of 0.144 (specific to item I.07) proves that the statistical significance threshold ($p < 0.05$) was not met, stating that the correlation is not significant for item I.07 (there is no significant link between the item I.07 and the other variables), and therefore the calculation will be redone with the removal of item I.07.

Second, we analyze the first part of the table (Correlation); it can be noted that all the values of item I.07 are negative compared to the positive values of the other 13 items, which demonstrates the increasing trend of the results of the 13 items in contradiction with the decreasing trend of the results of item I.07 (inverse proportionality).

The results obtained in the calculation of the final correlation matrix after removing item I.07 are presented in Table 6.

Analyzing the data presented in Table 6, the correlation matrix, the following aspects can be observed:

- From the analysis of the significance of the values ("significance values") data presented in the second part of the table specific to the Sig 1-tailed correlation matrix (one-way significance threshold), it is observed that most of the values of the variables are <0.001 or 0.001, so the condition has been met of the statistical significance threshold ($p < 0.05$);
- The final result (present at the bottom of the table) is 2.25×10^{-5} (Determinant = 2.25×10^{-5}) greater than the value of 0.00001, so there is no situation of multicollinearity for the items (multicollinearity occurs when a group of independent variables are strongly

correlated with each other), which means not having to eliminate any item from the questionnaire;

- From the analysis of the values of the correlation coefficients (in the first part of the table—Correlation), no values higher than 0.900 are observed, which means that there is no question of the singularity of the data (a fact that does not indicate a high correlation between the items); the highest value in the table is 0.817.

Table 6. Correlation matrix for 13 QIs.

	I.01	I.02	I.03	I.04	I.05	I.06	I.08	I.09	I.10	I.11	I.12	I.13	I.14	
Correlation	I.01	1												
	I.02	0.693 *	1											
	I.03	0.634 *	0.763 *	1										
	I.04	0.477 *	0.526 *	0.604 *	1									
	I.05	0.336 *	0.474 *	0.552 *	0.575 *	1								
	I.06	0.323 *	0.437 *	0.518 *	0.649 *	0.658 *	1							
	I.08	0.213 *	0.290 *	0.375 *	0.412 *	0.511 *	0.551 *	1						
	I.09	0.355 *	0.398 *	0.520 *	0.554 *	0.506 *	0.466 *	0.376 *	1					
	I.10	0.333 *	0.465 *	0.541 *	0.590 *	0.565 *	0.544 *	0.439 *	0.784 *	1				
	I.11	0.334 *	0.413 *	0.502 *	0.581 *	0.556 *	0.562 *	0.404 *	0.719 *	0.762 *	1			
	I.12	0.331 *	0.428 *	0.443 *	0.527 *	0.582 *	0.565 *	0.431 *	0.697 *	0.747 *	0.800 *	1		
	I.13	0.312 *	0.391 *	0.458 *	0.536 *	0.498 *	0.448 *	0.397 *	0.718 *	0.817 *	0.810 *	0.773 *	1	
	I.14	0.371 *	0.563 *	0.544 *	0.589 *	0.613 *	0.631 *	0.604 *	0.666 *	0.738	0.729 *	0.728 *	0.717 *	1

* $p < 0.05$; Determinant = 2.25×10^{-5} .

4.3.2. KMO and Bartlett’s Test Analysis

Before performing the factor analysis, it is important to check whether the data are suitable for such an analysis. We apply the Kaiser–Meyer–Olkin (KMO) test, and if we obtain a value close to 1, then the factor analysis leads to “distinct and reliable factors” [34]. In our case, we obtain the value of 0.874, which is a “superb” value according to Hutcheson and Sofroniou [34]. For the Bartlett test, the null hypothesis states that the original correlation matrix is an identity matrix (which means that all correlation coefficients are null). In the case of factor analysis, it is necessary to have some associations between variables. Therefore, it is necessary that the Bartlett test is “significant”, i.e., “the significance value” is less than 0.05 ($p < 0.05$) [28]. In our case, $p < 0.001$, so the data obtained are suitable for factor analysis.

4.3.3. Principal Component Analysis

Next, we use Principal Component Analysis (PCA) to determine the components and reduce the data. Specifically, the extraction method is PCA, and the factor rotation method is varimax with Kaiser normalization [59,60], shown in Table 7.

Using the Principal Component Analysis (PCA) method, 13 components (13 QIs) were generated. As can be seen in Table 7, only the first two components meet the selection criterion (eigenvalues ≥ 1). These components can be analyzed in terms of the correlation of each Key Performance Indicator (KPI) with the component. Each of the 13 QIs that are left after eliminating I.07 has a loading associated with each of the 13 components.

The Extraction Sums of Squared Loadings columns provide the values for the eigenvalues (Total column), the explained variance (% of Variance column) and the cumulative variance (Cumulative % column) in the context of the initial solution, before rotation.

The variance explained by each factor is distributed as follows: the first indicator, 58.220% and the second indicator, 11.299%. Both indicators explain 69.519% of the variance analyzed.

The Rotation Sums of Squared Loadings columns show the values for both indicators, but after applying the rotation procedure. In the context of the same total variance (69.519%), a redistribution of the variance explained by each indicator can be observed, as follows: the first indicator, 44.415% and second indicator, 25.105%.

As can be seen, with the rotation method, the first indicator loses its saturation level in favor of the second indicator.

Table 7. Total variance with Principal Component Analysis (PCA).

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.569	58.220	58.220	7.569	58.220	58.220	5.774	44.415	44.415
2	1.469	11.299	69.519	1.469	11.299	69.519	3.264	25.105	69.519
3	0.995	7.656	77.175						
4	0.559	4.300	81.475						
5	0.431	3.318	84.793						
6	0.387	2.981	87.774						
7	0.344	2.646	90.420						
8	0.292	2.242	92.663						
9	0.260	2.000	94.663						
10	0.218	1.674	96.337						
11	0.196	1.506	97.843						
12	0.147	1.128	98.971						
13	0.134	1.029	100.00						

Extraction method: Principal Component Analysis.

4.3.4. Scree Plot Analysis

Next, we also analyze the “scree plot” (Figure 1). This is a plot of the eigenvalues corresponding to the number of “QIs” [46].

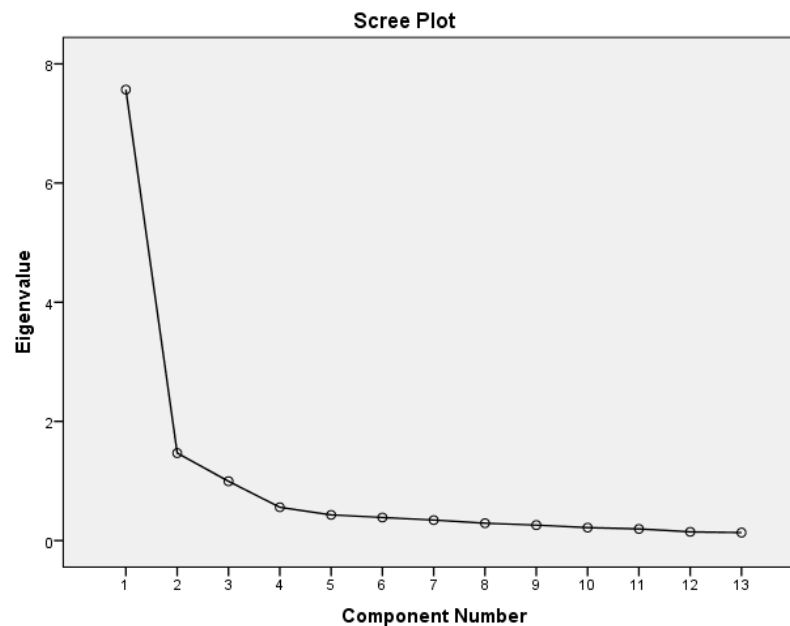


Figure 1. Scree plot for QI Analysis.

Analyzing this plot, we noticed that “the eigenvalue curve began to bend out at the second component”. It follows that we should note only two components.

4.3.5. Summary Factor Analysis

We also notice that “the rotation converged in 3 iterations”.

There are two Strategic directions (S1, S2) with eigenvalues which are greater than 1.00 and which explain 69.519% of the total variance. This is greater than the threshold of 60% which is required for satisfactory construct validity [48].

Table 8 shows the results from the rotated component matrix. It can be noted that all values are greater than 0.45 [48].

Table 8. Summary of factor analysis.

Code	Questionnaire Items (QIs)	KPI Loadings	Eigenvalue	PVE	CPVE	Cronbach's Alpha
Strategic direction 1: Availability for online training		-	5.774	44.415	44.415	0.930
I.13	I am satisfied with the online training in order to test the knowledge acquired in the online training	0.869				
I.11	I am satisfied with the accountability in complying with OHM requirements provided by the online training	0.865				
I.12	I am satisfied with the clarification of misunderstandings of OSH legislation provided by the online training	0.858				
I.10	I am satisfied with understanding the material in the online training	0.857				
I.14	I am satisfied with the online training in general	0.797				
I.09	I am satisfied with the online training	0.795				
I.05	I think that using an electronic signature to record OSH training is more useful than a paper signature	0.607				
I.08	I think that video conference training provides a better experience than traditional (face-to-face) training	0.602				
Strategic direction 2: Challenges of online training		-	3.264	25.105	69.519	0.864
I.02	I use internet easily	0.862	-	-	-	-
I.01	I use frequently the internet	0.846	-	-	-	-
I.03	I find easy the registration/training/testing steps in the SSM.ro platform	0.815	-	-	-	-
I.04	I think that I increase my knowledge through online training, compared to other forms of training	0.565	-	-	-	-

Notes: PVE = percentage of variance explained; CPVE = cumulative percentage of variance explained; extraction method = Principal Component Analysis; rotation method = varimax with Kaiser normalization.

The first direction strategy accounted for 44.415% of the variance (with rotation sums of square loadings) and contains the QIs I.13, I.11, I.12, I.10, I.14, I.09, I.05, I.06 and I.08. This strategic direction 1 will be called “Availability for online training” (S1).

The second direction strategy accounted for 25.105% of the variance (with rotation sums of square loadings) and contains the QIs I.02, I.01, I.03 and I.04. This strategic direction 2 will be called “Challenges of online training” (S2).

According to the data presented in Table 7, the Cronbach’s alpha coefficient value for strategic direction 1 is 0.930. This index does not increase if any indicator is removed. The value of Cronbach’s alpha for strategic direction 2 is 0.864. This index also does not increase if we remove any indicator. In both cases, we obtain a value higher than 0.70, which shows that the items have a high internal consistency.

5. Discussion

The innovation of this study lies in the implementation of Romania’s first online training program in the field of occupational health and safety systems (OSH). To support the

study, an online platform (SSM.ro) was developed and utilized, with all records maintained in electronic files containing a qualified electronic signature.

5.1. (H1) Hypothesis Discussion

Regarding the agreement analysis, in the case of Hypothesis 1 (H1): “Employee satisfaction associated with online training on the SSM.ro platform varies depending on the role in the organization”, the Kruskal–Wallis H-test was conducted to determine any statistically significant differences between two or more groups of an independent variable. Additionally, a post hoc Dunn’s multiple comparison test was performed to find the mean differences among groups of independent variables belonging to the attribute of “position in the organization”. After performing the calculations, certain values fell below 0.05 (the significance threshold at $p < 0.05$), indicating substantial differences in the opinions of employees with different roles within the company. Consequently, the null hypothesis can be rejected for the following comparative scenarios:

- Production Worker/Manufacturing Team Leader: QIs I.02 ($p = 0.001$), I.03 ($p < 0.001$), I.05 ($p = 0.012$) and I.14 ($p = 0.012$);
- Production Worker/TESA: QIs I.01 ($p < 0.001$), I.02 ($p < 0.001$), I.03 ($p < 0.001$), I.04 ($p < 0.001$), I.05 ($p < 0.001$), I.06 ($p < 0.001$), I.08 ($p = 0.001$) and I.14 ($p < 0.001$);
- Manufacturing Team Leader/TESA: QIs I.01 ($p = 0.037$), I.02 ($p < 0.041$) and I.07 ($p = 0.013$).

The results can be explained by the fact that the respondents, regardless of their position in the organization, differ in terms of age, educational level, work experience and gender. Therefore, the responses to the questionnaire emerged due to their varying levels of adaptability, as well as their cognitive abilities.

5.2. Study Limitations

The specific limitations of the study are evaluated in relation to its objectives, which focus on the digitization of occupational health and safety (OSH) activities. Several limitations of the study were identified:

- In accordance with Antonsen [45], we are aware of the fact that the 14 questionnaire items (QIs) can be completed or modified, since this field of OSH is very important, and the instruction of the workers has to be continuously updated. Nonetheless, we consider that this empirical test is a beginning for the digitalization of OSH. In accordance with Antonsen [45], we acknowledge that the 14 questionnaire items (QIs) could be expanded or adjusted, given the critical nature of OSH and the need for ongoing updates to worker training. However, we view this empirical test as an initial step toward the digitalization of OSH activities.
- Technology adoption and digital skills

Resistance to change: In this study, some participants, regardless of their position within the organization, may be resistant to change, which hinders or slows the adoption of digital technologies and processes. This can be explained by differing levels of adaptability and cognitive abilities, or a relatively low level of digital skills.

5.3. Future Development Directions

For future developments, there are several potential directions to enhance and expand the platform’s functionality, such as the following:

- Training and coaching:

In the future, we aim to incorporate online training of the employees in the field of OSH, supplemented by engaging presentation materials (such as game technology-based safety training platforms). This approach is expected to enhance understanding, making the concepts more accessible to all employees and improving the overall learning experience. Moreover, in order to complete the statistical analysis of the experimental data, we intend to use regression models and also SEM.

- Integrating or connecting 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.

- Collaboration features:

Collaborative workspaces: Create virtual working libraries where users can share documents and 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: Use artificial intelligence algorithms to provide real-time predictive analytics and recommendations to users.

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

- Support and community:

Extensive Support: Create 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: Expand the existing online community and assign a specialized moderator to oversee it. Within the online community, users can exchange experiences, solutions and best practices related to SSM, thereby enriching the platform and fostering a collaborative environment.

These are just a few of the development directions that could significantly transform the SSM.ro platform into an essential tool for optimizing the management and effectiveness of occupational health and safety in various industries. By doing so, the platform would provide exponentially significant value to its users.

6. Conclusions

The social and economic dynamics of 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 and socialize; in other words, it has made us reorganize our lives by reducing physical interaction.

Why has the digitization of occupational health and safety and the online training of workers digitization 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 provides the answer to all these questions, making it possible to transform or adapt various economic and social processes in line with new social and organizational standards.

The main theoretical contributions of this study are as follows:

- The use of the online tool was a success, appreciated by all participants in the training, as demonstrated by the high average scores of the questionnaire responses (Table 3). Notably, all the questions related to satisfaction with the online training (I.09–I.14) had average scores ranging from 4.11 to 4.23, falling between 4 (agree) and 5 (strongly agree).
- The positive feedback on online participation was also attributed to the following factors:
 - The method offered more flexibility, allowing trainees to record and review the training whenever they found it useful.
 - Participants felt more comfortable because they could choose the location from which they attended the training sessions.
 - This approach fostered a greater sense of independence in the learning process.

- A set of variables that differentiate the satisfaction associated with online training and the use of electronic signatures for recording OSH training in the training records were identified with a potential influence on the quality of training.
- Two strategic directions were identified, namely “Availability for online training” (S1) and “Challenges of online training” (S2).
- This 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.
- The state authorities and business environment should be encouraged 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.

In the future, we intend to have the online training of the employees in the field of OSH accompanied by various presentation materials (such as game technology-based safety training platforms), which could lead to a better understanding that is easy for everyone and would facilitate the learning of the ideas transmitted by the training.

Author Contributions: Conceptualization, P.-I.M., I.M. and M.P.-I.; methodology, P.-I.M., I.M. and M.P.-I.; software, P.-I.M., I.M. and M.P.-I.; validation, P.-I.M., I.M., M.P.-I., C.G. and G.O.; formal analysis, I.M. and M.P.-I.; investigation, P.-I.M., I.M., M.P.-I., C.G. and G.O.; resources, P.-I.M.; data curation, P.-I.M.; writing—original draft preparation, P.-I.M., I.M. and M.P.-I.; writing—review and editing, P.-I.M., I.M. and M.P.-I.; visualization, P.-I.M.; supervision, I.M., M.P.-I., C.G. and G.O.; project administration, P.-I.M.; funding acquisition, P.-I.M. All authors have read and agreed to the published version of the manuscript.

Funding: The APC was funded by the Transilvania University of Brasov.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from “CONSULTIA SRL” Brasov. The data are not publicly available due to some data being proprietary or confidential in nature. Therefore, the data may only be provided with restrictions (e.g., anonymized data).

Acknowledgments: The authors want to thank to “CONSULTIA SRL” Brasov for providing the data processed in the work, as well as the “SSM.ro” site for the support provided during the development of their solution.

Conflicts of Interest: The authors declare no conflicts of interest.

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