IMPROVEMENTS OF GLOBAL PERFORMANCE SYSTEM (GPS) *SOFTWARE* APPLIED TO HSEQ MANAGEMENT SYSTEM IN AN OIL AND GAS

MELHORIAS DO *SOFTWARE* DO SISTEMA DE DESEMPENHO GLOBAL APLICADO AO SISTEMA DE GERENCIAMENTO DE HSEQ EM UM SETOR DE PETRÓLEO E GÁS

MEJORAS DE *SOFTWARE* DEL SISTEMA DE RENDIMIENTO GLOBAL APLICADO AL SISTEMA DE GESTIÓN HSEQ EN UNA INDUSTRIA DE PETRÓLEO Y GAS

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ABSTRACT

Purpose: Verify the impacts after implementing a software for HSEQ (Occupational Health, Safety, Environment and Quality) Management in an Oil and Gas Services Company and compare it against the available scientific publications, and therefore propose improvement actions to the software.

Methodology: The methodology used was the applied, descriptive, exploratory, survey, with quantitative and qualitative approach. Based on the literature review, a questionnaire was created and sent to a sample of software users about the use, benefits and improvements opportunities for GPS.

Originality: No work with practical results was found for the computerization or digital transformation usage of the HSEQ Management System.

Results: The lack of an electronic management system in HSEQ Department was a constant cause of nonconformities at Superior Energy Services. Therefore, during the research the advantages highlighted by the users were: environmental resources preservation, agility on information transfer process and processing, reduce the need for physical storage of printed documents and process improvement the implementation of improvements. As barriers, the users highlighted: lack of full knowledge on how to use some features, user´s poor training and software not synchronized with Outlook.

Contributions: It is expected that the proposed plan improvement opportunities to be implemented in the GPS DataStation software at Superior Energy Services can also be implemented in other organizations where this system is already in use or intended to be implemented.

Keywords: Integrated Management System. Information Technology. Oil and Gas Market. HSEQ. Occupational Health. Occupational Safety.

RESUMO

Objetivo: Verificar os impactos após a implantação de um *software* de Gestão de HSEQ (Saúde Ocupacional, Segurança, Meio Ambiente e Qualidade) em uma Empresa de Serviços de Óleo e Gás e compará-los com as publicações científicas disponíveis, para assim propor ações de melhoria do *software*.

Metodologia: A metodologia utilizada foi a aplicada, descritiva, exploratória, *survey*, com abordagem quantitativa e qualitativa. Com base na revisão da literatura, um questionário foi elaborado e enviado a uma amostra de usuários de *software* sobre o uso, benefícios e oportunidades de melhorias para o GPS.

Originalidade: Não foram encontrados trabalhos com resultados práticos para a utilização da informatização ou transformação digital do Sistema de Gestão de HSEQ.

Resultados: A falta de um sistema de gestão eletrônico no Departamento de HSEQ foi uma causa constante de não conformidades na *Superior Energy Services*. Portanto, durante a pesquisa as vantagens apontadas pelos usuários foram: preservação dos recursos ambientais,

agilidade no processo de transferência e processamento das informações, redução da necessidade de armazenamento físico de documentos impressos e melhoria do processo a implantação de melhorias. Como barreiras, os usuários destacaram: falta de conhecimento completo sobre como usar alguns recursos, treinamento deficiente do usuário e *software* não sincronizado com o *Outlook*.

Contribuições: Espera-se que as oportunidades de melhoria do plano proposto a serem implementadas no *software* GPS DataStation na Superior Energy Services também possam ser implementadas em outras organizações onde este sistema já esteja em uso ou pretenda ser implementado.

Palavras-chave: Sistema de Gestão Integrado. Tecnologia da Informação. Mercado de Petróleo e Gás. HSEQ. Saúde Ocupacional. Segurança Ocupacional

RESUMEN
Objetivo: Verificar los impactos luego de la implementación de un software de Gestión HSEQ (Salud Ocupacional, Seguridad, Medio Ambiente y Calidad) en una Empresa de Servicios de Petróleo y Gas y compararlos con las publicaciones científicas disponibles, con el fin de proponer acciones de mejora del software.

Metodología: La metodología utilizada fue aplicada, descriptiva, exploratoria, encuesta, con un enfoque cuantitativo y cualitativo. Con base en la revisión de la literatura, se elaboró un cuestionario y se envió a una muestra de usuarios de software sobre el uso, los beneficios y las oportunidades de mejora del GPS.

Originalidad: No se encontraron estudios con resultados prácticos para el uso de la informatización o transformación digital del Sistema de Gestión HSEQ.

Resultados: La falta de un sistema de gestión electrónica en el Departamento de HSEQ fue una causa constante de no conformidades en Superior Energy Services. Por lo tanto, durante la investigación, las ventajas señaladas por los usuarios fueron: preservación de los recursos ambientales, agilidad en el proceso de transferencia y procesamiento de información, reducción de la necesidad de almacenamiento físico de documentos impresos y mejora del proceso de implementación de mejoras. Como barreras, los usuarios destacaron: la falta de conocimiento completo sobre cómo usar algunas funciones, la capacitación deficiente del usuario y el software no sincronizado con Outlook.

Contribuciones: Se espera que las oportunidades para mejorar el plan propuesto que se implementará en el software GPS DataStation en Superior Energy Services también se puedan implementar en otras organizaciones donde este sistema ya esté en uso o se pretenda implementar.

Palabras clave: Sistema Integrado de Gestión. Tecnología de la información. Mercado de Petróleo y Gas HSEQ. Salud Ocupacional. Seguridad Ocupacional

1 INTRODUCTION

In their studies, Wold and Laumann (2014) mention that the Security Management Systems based on Information Technology (IT) contain procedures, security standards, checklists and descriptions of how different tasks should be performed.

Berman (2012) indicates that the digital transformation may bring opportunities for companies to modify and boost their businesses; therefore, the use of software has become constant in improving and optimizing processes. According to Matt, Hess and Benlian (2015) and Hess, Matt, Benlian and Wiesböck (2016), there are frequent initiatives to explore new technologies and their derived benefits made by companies of the most different areas.

Following this trend, the Occupational Health, Workplace Safety, Environment and Quality (HSEQ) sector seeks in customized programs, specific needs to promote its core activity. This sector [HSEQ] has as its main goal, the prevention of accidents and occupational illnesses, the protection of the environment and the promotion of products and services supplied with quality by the organization.

Fernández-Muñiz, Montes-Peón and Vázquez-Ordás (2012) maintain that a series of studies has discovered that a positive secure environment influences a safe behaviour and, consequently, reduces the number of accidents and incidents.

Therefore, the use of a HSEQ management software may be another tool to establish the Parast portfolio in the oil industry, since, according to the author: the importance of operations/processes, the high levels of standardization and the emphasis on efficiency, make the petroleum industry a suitable environment for testing a variety of operational and managerial theories (Parast & Adams, 2012).

For this reason, it is essential that the oil industry, being a protagonist of the global economy, identifies and promotes the prevention of factors that may influence the health and safety of the people involved in this segment (Nielsen, Tvedt, & Matthiesen, 2013).

In this context, Superior Energy Services (SES), founded in 1988 in New Orleans, United States of America (USA), offers solutions related to drilling and production to the producers of energy in the Oil & Gas segment, through its numerous Business Units (BU) in almost all areas of the world. SES has opted for a strategy of growth by means of acquisitions and mergers and, maintaining a style of decentralized management, thus allowing more independence to its Business Units (Superior Energy Services, 2018).

SES established a HSEQ Management System (SGHSEQ) at a corporate / global level (in other words, at their head office in the USA), but this system was not adapted for operations in Brazil neither was centralized in an integrated management software. Therefore, a significant number of files, in paper or electronic format, were decentralized, non-compliant with standards and uncontrolled. Such a great quantity of decentralized and non-standardized files and documents became inefficiently analyzed and treated.

The constant loss of information (sometimes stored in personal computers), rework with records in multiple locations, failure to take advantage of intra or extra sectorial benchmarking practices, slow approval or use of obsolete copies of documents, associated with difficult access to information, were the constant instigators of non-conformities in the organization.

Mustafa (2015) suggests in his studies that with the advent of technology, organizations started to operate in an interconnected network environment creating activities, which were value adding.

As mentioned in the SES Annual Report (2013), starting of 2012, SES decided to intensify their international expansion and Latin America (LATAM), including the Macaé Operations Base - Rio de Janeiro/RJ, was chosen as a laboratory for the implementation of an integrated management system, covering the support sectors, amongst them the HSEQ Department. It is noteworthy that, in addition, the certification in ISO 9001: 2008 was necessary, a standard that requires many process controls and evidence of compliance with its requirements.

With this decision [to implement an integrated management system], the generation, consolidation and analysis of information for making decisions would be extremely slow if kept manually and / or non-computerized, given the amount and variety of information.

Due to this necessity, the HSEQ Department in Brazil looked for a software capable of meeting this requirement. The natural way was to customize the GPS software that was already in use by some of the SES BUs in the USA.

Although the software, which had its initial implementation at SES, in 2013, apparently has gained greater responsiveness for SGHSEQ, and it is necessary to find out if the users' experience matches or not the results from the search based on the existing scientific production.

Therefore, the present research analyzed the impacts of the application of the HSEQ Management software, GPS (Global Performance System) at Superior Energy Services (SES), identifying the advantages and barriers facing the researched scientific literature and proposing improvement actions for SES.

The importance of this study is because organizations take advantage of the benefits arising from the introduction of IT to computerize their HSEQ Integrated Management Systems. In line with the reality of the market, this topic has been discussed in the academic environment, conferences and in specific publications. However, it can be noted that, although this subject is widely discussed, in general or individually, during the exploratory research, no work with practical results was found for the computerization or digital transformation usage of the SGHSEQ.

Further to this introduction, this research comprises the following sections: the second section presents the HSEQ Management Systems and GPS DataStation Software; the third section registers the Challenges, Barriers and Advantages of the Computerization of Management Systems; in the fourth section, the Research Methodology is examined; in the fifth section, the Analysis and Discussion of the Results and, finally, in the sixth section, are the final considerations concerning the whole work.

2 HSEQ MANAGEMENT SYSTEMS AND GPS DATASTATION SOFTWARE

It is clear that the classic objective of a HSEQ Management System is to contribute to the prevention of occupational accidents, occupational diseases, damage to the environment and improvement of the quality of processes and products.

The management system is defined by the International Labor Organization (2001) as being a set of interrelated or interactive elements to determine Occupational Health and Safety (OHS) policies and objectives and the means to achieve these objectives.

Usually, organizations have some type of management system. The formal or informal nature of such systems is dependent on the scope and context of the organization. Therefore, organizations continually evaluate the environment in which they are included and evolve with their management system according to the needs and expectations of the interested parties (International Organization for Standardization, 2018).

Currently, technological progress and the pressure of intense competition bring swift changes in conditions, processes and work organization (International Labor Organization,

2001). Koivupalo, Sulasalmi, Rodrigo and Väyrynen (2015) endorsed the content of the ILO publication by emphasizing that organizations, who are successful in improving their standards actively, follow the safety, health and environmental factors.

Moraes, Vale and Araújo (2013) pointed out that the non-fulfilment of such demands can negatively affect the strategy of the organization, which can generate "non-tariff" trade barriers in certain markets, thus creating difficulties for organizations that do not meet the minimum requirements of environmental areas and occupational health and safety.

According to these assumptions, it is clear that in the last decades several new factors have been added to traditional market demands. The computerization of the HSEQ Management System was also an innovation perceived as necessary by the organizations, as shown in some studies raised in this research.

The authors Lança and Brito (2017) pointed out after the application of case studies at a mining company, the need to implement a computer program that would incorporate information systems and enable the influx of relevant information, in a simple and immediate way, to the interested parties of the management system.

Sui, Ding and Wang (2018) presented their work affirming that the computerization of HSE data has facilitated the sharing of information and statistical analysis, consequently promoting cooperation between departments as well as promoting management efficiency, so as to enable the integrated certification of ISO 14001 and OHSAS systems 18001, as well as simultaneously enabling the implementation of the International Atomic Energy Agency's safety standards at an atomic energy plant in China.

Berezyuk, Rumyantseva and Chebotareva (2017) devoted themselves to studying the relation of increased industrial safety with the implementation of integrated management systems (ISO 9001, ISO 14001 and OHSAS 18001) and improvements by using a software in the training of workers and using the integrated system by the employees.

It is important to mention that the GPS software used in the computerization of the SGHSEQ, works on the web base and was developed in 1998 by the British company DataStation (DS) (DataStation, 2018). According to the developer, this software "empowers the transformation and growth of your business by offering a package of integrated services" (DataStation, 2019). The solutions are presented aiming to attend the general public and, if

necessary, adjustments and customizations are made to the software according to the specific needs of each client.

The developer presents, as some of the main benefits of using GPS, the automation of tasks performed through the GPS that, if done manually, would take a lot of time. For example, calculation of the Frequency Rate of Incidents.

Examples of benefits include: standardization of documents, data and information; access to a single database and remotely (online); improved risk management of the organization; promotion of electronic communication and less need for physical space and management of document storage, printing and circulation of paper.

Besides having several tools of its own, the software allows the integration with other areas (ERP) and applications, aiming at an instant access to important information necessary for decision-making and, therefore, demonstrating a competent management.

The main tools and applications of the GPS are highlighted below: Reporting of Acts, Unsafe Conditions and Behavioural Auditing; Document Library; Incident Register; Calendar; Training; Management of Change (MOC); Reports / Key Performance Indicators (Reports / K.P.I.).

At SES, the GPS software is accessible to all employees. They receive a user and password to access the software, with different levels of access for Information Security reasons.

According to the GPS developer, with this application organizations can centralize records and projects for the entire facility and work areas; plan, schedule and record maintenance routines and compliance with security tasks and audits; manage tool data, plants and equipment data and assign and keep track of actions; produce lifecycle cost models for tools and equipment; report, investigate and manage accidents and non-conformities; manage and provide online training solutions; demonstrate compliance and manage compliance with regulations and requirements; graphically analyse plant data in real time and make management reports.

3 CHALLENGES, BARRIERS AND ADVANTAGES OF COMPUTERIZING MANAGEMENT SYSTEMS

Islam and Tabassum (2015) describe as barriers to the implementation, the limited data transfer capacity of the Internet and the high cost of the software development and

infrastructure, in their studies concerning computerization of the Health System in Bangladesh.

The use of information technology and technological tools (ICT) applied to the educational area in Ghanna was the object of the studies of Natia and Al-Hassan (2015). They found that the use of ICT for learning is important as it guarantees unrestricted access to important information and, consequently, development of the areas being studied. On the other hand, they indicated that lack of access to the internet, electricity problems, insufficient number of computers and technical knowledge of teachers (users) are barriers to the use of ICT in distance education (eLearning).

Pissaia, Costa, Moreschi and Rempel (2016) ask the following questions when studying the systematization of nursing assistance: What are the main difficulties encountered during the implementation of the Systematization of Nursing Assistance with the help of computing devices in the unit? What is the importance of information technology for the implementation of the Systematization of Nursing Assistance? and, What changes has the Systematization of Nursing Assistance brought to the assistance offered in the unit?

They considered as advantages of computerization that "the aid of information technology offers support in enabling the client to have a broader vision, therefore, making it possible for them to understand and professionally consider the best practice to be adopted", "agility in seeking client information through records clearly used by professionals, contributing to their subsequent discussion" (Pissaia *et al*., 2016).

Another relevant aspect of the use of technologies is "the integration of behaviours performed by the teams, adjusting continuous communication to the success of the care offered" and, "a wide interaction of exchanges of knowledge and experiences that improve the models used by the services", amongst other things. As for the difficulties, they found "discomfort due to the new practical and scientific requirements that the teams developed during their assistance", "a great reluctance regarding the adherence to the computerized SAE, especially during its implementation process as it was an innovative model for the professionals".

Husain and Nazim (2015) discovered during research on computerization in libraries that the lack of specialization and skills of employees working in these institutions, and investments in infrastructure are barriers to the implementation of these computerization

processes. The main challenges found by the authors to computerization were: Lack of ICT training for employees, Low level of ICT skills by users, Unfamiliarity of ICT benefits, Lack of Infrastructure and Resources, Resistance of employees to using ICT and Lack of Policies and Strategies for using the ICTs.

Badri, Boudreau-Trudel and Souissi (2018) express concern in their research with the aspects of occupational health and safety in the industry context 4.0. They emphasize that it is fundamental for the maintenance of the advances gained up to the present date in occupational health and safety, the need to consider these aspects in industry 4.0.

Table 1 presents a summary with the main difficulties/barriers and advantages with their respective authors.

Table 1
Difficulties/barriers and advantages in the computerization of systems

	Description
Difficulties/Barriers	Lack of Infrastructure and Resources
	Low level of ICT skills amongst users
	Limited internet data transfer capacity
	High Infrastructure costs
	Cost of software development
	Lack of access to internet
	Lack of electricity
	Insufficient quantity of computers
	Low technical knowledge of users
	Reluctance to adhere to computerization
	Employees resistance to use ICT
	Lack of ICT training for employees
	Lack of knowledge of the benefits of ICT
	Lack of Policies and Strategies for the use of ICT
Advantages	Unrestricted access to important information
	Development in study areas
	Assistance for making decisions
	Agility in finding information
	Improvement and integration of communication between teams
	Interaction of knowledge and experience exchange

Source: Prepared by the Authors (2020)

4 RESEARCH METHODOLOGY

The range of the objectives proposed by this research was conceived according to the following steps:

1st stage: A bibliographic research was carried out in order to provide the theoretical basis for the literature review. This was carried out by selecting publications available in the CAPES Periodicals Portal, with searches carried out in Scopus (Elsevier) and Web of Science bases from March 2019 to February 2020. Additionally, technical and scientific literature and portals of the area, object of this study, were added to this research. The reading of the articles and publications from the selection was performed targeting publications with greater assertiveness and observance to the studied problematic situation. The literature review grouped them by categories and the most adherent themes of this research were discussed.

2nd stage: Following the literature review and additional researches, surveys were developed. These surveys were used to collect data from GPS users in order to capture their experience in using the software, in the process of computerizing the management system and adherence to the survey of the scientific research conducted. Before the survey was sent to the entire target audience, a pre-test was conducted with 10 GPS DataStation users.

The survey test focused on the population of users at the Macaé base's GPS DataStation of the organization that was the object of the survey, Superior Energy Services to which the survey was sent (Google Survey Forms). The list of employees was gathered by the researcher himself using the GPS software, Users - Users module.

In this study, the total research universe was extended to all of the 96 employees of the SES Macaé Base (Population) and all of them were considered users (managers, supervisors and ordinary users) of the GPS DataStation software. From this group of 96 users, 46 answers were obtained, corresponding to 48% of the population.

From the total universe of the survey (96 employees), 29 users are leadership level (managers, supervisors). For these, a second survey was applied with questions concerning these positions. In this case, out of the 29 surveys sent, 17 answers were obtained, corresponding to 58%. Table 2 shows a summary of the surveys answered.

Table 2

Summary of the answered surveys

	Total Survey Universe	Surveys answered	Percentage Answered
Total Users	96	46	48%
Leadership position	29	17	58%

Source: Prepared by the authors (2020)

To perform this research, a question survey was used (applied through Google Forms) as a data collection tool. Using the link https://www.google.com/forms/about/ for the technical preparation and the question survey was sent between October 3 and 15, 2019.

The purpose of the survey was to obtain from GPS DataStation users (of different levels) their perception regarding the benefits, difficulties and opportunities for improvement that the software provides in relation to their daily activities, and to serve as a basis for proposing the improvement plan.

We used a revision of the literature to prepare the surveys, constituted of closed and open questions, in order to capture the benefits and opportunities to improve the application of the GPS DataStation software at Superior Energy Services. The following two surveys were created:

HSEQ Computerization Management System – Use of DataStation, directed to all Users (including the Leaders) and,

HSEQ Computerization Management System - Use of GPS DataStation / Leaders, specifically directed to the Leaders.

Such distinction was necessary because, according to the literature review, there were issues that could only be noticed by positions of leadership. For example, to detect if there was some kind of resistance on the part of those being led during the implementation of the computerized system.

Although there was discrepancies, both surveys shared questions and were composed by evaluating the general aspects, implementation and use, and the degree of user satisfaction concerning the modules and tools of the GPS DataStation software.

3rd stage: With the data collected, the results were tabulated and analysed to obtain the perception of those who answered regarding the use of the software and adherence to the results of the scientific survey. The information from the 2 (two) groups (Users/Leaders)

were obtained directly from the googleforms.com link and others treated by means of comparative tables.

Descriptive statistics were used for the closed questions. Graphics and tables show the frequency analysis and the quantitative results. Content analysis dealt with the open questions, which according to Bardin (2006), corroborates to sort out uncertainties and enhance the interpretation of the collected data.

From the data analysis, the proposals, actions for the improvement of the GPS DataStation software and, in the sequence, the conclusions of the research were presented. There is a description of the analysis of these results in section 5 below.

5 ANALYSIS AND DISCUSSION OF RESULTS

Subsequently, you will find a presentation of the analysis and discussion of results from the mapping of the perception of the SES GPS users regarding the advantages and barriers of the implementation of this software and computerization of the management system in comparison to the literature. The survey was applied from October 3 to 15, 2019.

In order to conduct the survey in a manner aligned with the exploratory research, the survey was divided into two groups, as follows: a) Use of DS Users (General Public) and b) Use of DS Users (Leaders). Managers/Supervisors may have answered the survey twice: both as General Public as well as Leaders.

5.1 Analysis of the results of the general public

For this group (Leaders/Ordinary Users), the question survey was sent to 96 (ninety-six) respondents, of which 46 responded. The analysis of these results is presented below.

Figure 1 (Question 1) shows the distribution of respondents by position, with 39.1% being Assistant/Auxiliary/Engineer/Operator; 34.8% Coordinator/Leader/Supervisor; 17.4% Managers and 8.7% Intern/Young Apprentice. Therefore, it can be observed that most participants of this research are Assistant/Auxiliary/Operator.
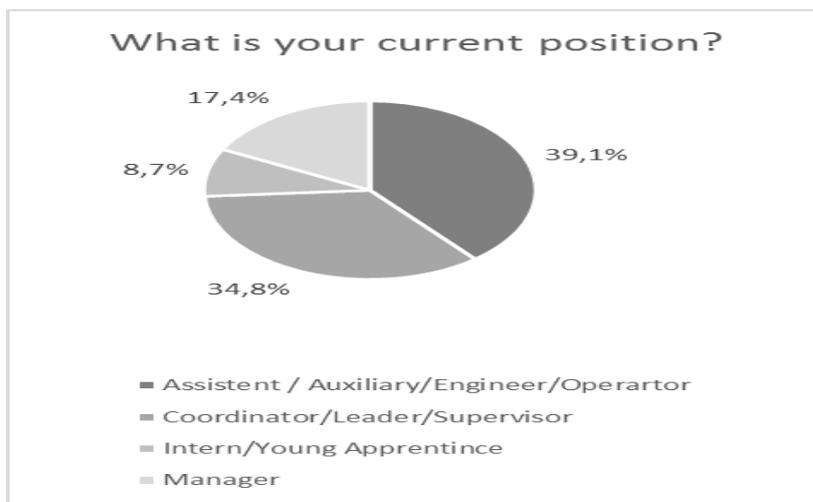
Figure 1. Position
Source: Prepared by the authors (2020)

Question 2 asked the respondent's Department/Sector. It was found out that the vast majority of respondents (73.9%) are Operational and the remaining 26.1% represent the Administrative sectors of the company.

Question 3: respondents were asked to identify which DS module/tool they use most frequently. The results are shown in Figure 2.
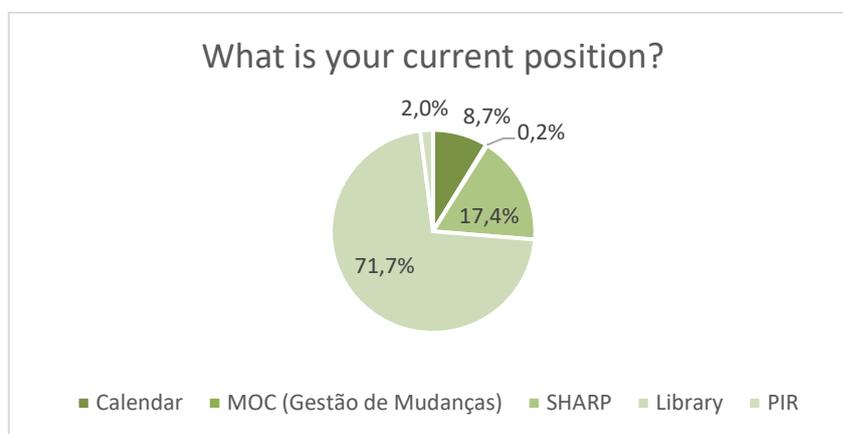
Figure 2. Department/Sector
Source: Prepared by the authors (2020)

From the analysis of Figure 2 it can be observed, that the Library module is the most frequently used (71.7%) with a wide margin of difference to the SHARP module, second most used with 17.4%.

Respondents were also asked in Question 4 about the training given for the use of DataStation. It can be perceived by the answer that 80.4% responded positively.

Husain and Nazim's research 2015 revealed that the employees lack of specialization and skills were barriers encountered in the process of computerization in libraries, of which the authors highlighted, amongst other items, the lack of ICT training for employees and the low level of ICT skills of the users.

For that reason, we can presume that the training issue, as far as the organization object of this research is concerned, was not considered a barrier or a problem by the users.

In Question 5, the respondents were asked what barriers/difficulties they encountered when using the GPS DataStation software. For 43% of the respondents, there were no barriers of any kind when using the GPS DataStation software.

Some Barriers/Difficulties found in the literature revision were corroborated by the answers of GPS DataStation users, as shown in Table 3.

Table 3
Comparative Literature Barriers/Difficulties versus User Responses

Difficulties/Barriers	Difficulties/Barriers(Respondents)
1. Lack of Infrastructure and Resources	-
2. Low level of skills of ICT by users	-
3. Limited internet data transfer capacity	Oscillation network speed
4. High infrastructural costs	-
5. Software development cost	-
6. Lack of access to internet	-
7. Lack of electricity	-
8. Insufficient computers	Availability of computers for access
9. Low technical knowledge of users	Knowledge in the use of the tool
10. Reluctance to adhere to computerization	-
11. Resistance of employees to use ICT	-
12. Lack of ICT training for employees	-
13. Lack of knowledge on the benefits of ICT	-
14. Lack of Policies and Strategies for ICT use	-

Source: Prepared by the authors (2020)

Furthermore, besides the barriers/difficulties listed in the literature revision, the following items were identified as barriers by users: lack of integration with Outlook,

language barrier, support from the developers to update the tools in accordance with the needs of the management system, lack of a version for offline use and the lack of an App to be used in smartphones or tablets.

Question 6 asked respondents, how many computers were available to access DataStation, and the vast majority (95.7%) responded positively.

In their studies on the use of information technology and technological tools (ICT), Natia and Al-Hassan (2015) observed that, among other factors, insufficient computers are barriers to the use of ICT in distance education (*eLearning*).

In this research, as verified by data collection, this item was not considered a barrier by DataStation software users.

In Question 7, respondents were asked if they would have difficulties in finding information when using the software. The majority, 87% of the respondents, do not have any difficulties.

In Question 8 respondents were also asked about the Internet connection speed when using DataStation,and 76.1% considered it satisfactory.

Islam and Tabassum (2015) reported limited Internet data transfer capacity as barriers to implementation in their studies on the computerization of the health system in Bangladesh. In this research, which is the subject of this study, the vast majority of survey respondents indicated that the speed of the Internet is satisfactory.

Employees were also asked, in Question 9, about the advantages of using DataStation in their activities. Some of the advantages found in the literature review were confirmed by the answers of the GPS DataStation users, as shown in Chart 3.

In Table 4, the users have given innumerable responses that were confirmed by the research of the literature review. It should be observed that, in addition to the items presented in the literature review, the employees emphasized as advantages of the use of GPS DataStation: interactivity with other processes, convenience, saving paper, the usefulness of the tool in audits and process monitoring.

Table 4

Comparative advantages of literature versus user response

Advantages	Advantages (Respondents)
1. Unrestricted access to relevant information	Remote access to information. Easy access to documents. Allows greater independence and easy access to procedures and documents essential to the performance of my position in the company.
2. Development in the areas under study	Performing online training. Organization of courses. Update and knowledge in trainings. Knowledge and practices applied in the company.
3. Assistance for making decisions	Assists the actions of professionals concerning compliance with the procedures.
4. Agility in the search of information	Agility in searching and obtaining information and documents. Finding documents more easily in moments of internal, external or customer audits. Organization of the archives. Compiled information. Concentration of a variety of information in a single system, the helpfulness of the system of easy communication. Organization, facility and security of processes and documents. Quick and practical access to operational documentation.
5. Improvement and integration of communication between teams, interaction of knowledge exchange and experience	To know, to seek the procedures related to our activity and company policies, to report deviations to be addressed. Fill out and send the reports when performing tasks for inspection. Always have the latest version of documents available.

Source: Prepared by the authors (2020)

In Question 10, users were asked to recommend improvements to the DataStation modules. Several improvement actions were recommended, among them, those highlighted in Table 5.

Table 5

Recommendations for improvements

Module/Assembly	Improvements
Training	Increase the availability of online training
SHARP	Improve formatting Simplify viewing
MOC	Simplify
LIBRARY	Alphabetical order Revision of Documents Create a Map to enable automated control Create a search engine for the search of documents in general
PIR	Simplify the process
Dashboard	Be friendlier
KPI	Sales data tracking Creation of management reports with quantitative summaries
Calendar	Upload several photos simultaneously

Source: Prepared by the authors (2020)

In addition to the items highlighted in Table 5, users also recommended more agility in administrator services, integration with Outlook and the development of an application of access to the DataStation.

The Library module was the one that received more suggestions for improvements. Interestingly, this same module was identified as the most utilized by users (71%). Therefore, in the proposal of the action plan, these suggestions received priority.

Through Question 11, it was sought to understand the perception of the users concerning computerization (paper x electronic) of the management system. For this reason, the following question was asked: *Do you see more advantages or disadvantages in applying DataStation in your daily activities?*

When analyzing the answers obtained, it can be observed that the majority (94%) of the users have the perception that the computerization of the management system brings more advantages. Among the answers, the following stand out: the reduction of the need to use printed documents promoting environmental preservation, the agility in the processes of information transfer, the speed and agility in the search and processing of information, the reduction of the need for physical space for storage of printed documents and the implementation of improvements of processes.

5.2 Response analysis - leaders

For this group (Leaders), the survey was sent to 29 respondents, of which 17 responded. The following is an analysis of these results.

In Question 1, respondents were asked to identify their respective positions.

The distribution of respondents by position was such: 47.1% Coordinator/Leader/Supervisor and 52.9% Managers. It was observed that most of the survey participants are Coordinator/Leader/Supervisor.

Following to this, question 2 of the survey asked about the Department/Sector to which the respondent belonged. It was determined that 76.5% are leaders in the administrative area and 23.5% in the operational area.

As shown in Table 6, the leaders were also asked in Question 3 about the main difficulties/barriers observed in the computerization of the SGHSEQ in their units/departments.

The Barriers/Difficulties in the implementation of the GPS DataStation software pointed out by 74% of the respondents were compared to the results achieved from the literature revision, as shown in Table 6.

Table 6

Comparison of software implementation barriers/difficulties versus leaders' response

Difficulties/Barriers	Difficulties/Barriers (Respondents)
Lack of Infrastructure and Resources	-
Low level of ICT skills by users	Lack of familiarity with computer/internet
Limited capacity of internet data transfer	-
High infrastructure costs	-
Software development cost	-
Lack of access to internet	-
Lack of electricity	-
Insufficient Computers	-
Low technical knowledge of users	Difficulty in using the training module Availability of training for contractors
Reluctance to adhere to computerization	Used to using other tools. Such as Excel sheets.
Employees resistance to use ICT	Employee resistance to learn to use a new tool or simply resistance to changes
Lack of ICT training for employees	Insufficient training
Lack of knowledge on the benefits of ICT	Lack of communication
Lack of Policies and Strategies for ICT use	System not integrated with Outlook

Source: Prepared by the authors (2020)

With the comparative in Table 6, it can be concluded that this research confirms the difficulties encountered by researchers, as raised in the literature revision.

Pissaia *et al.* (2016), when studying the systematization of nursing assistance, asked the following question: *What are the main difficulties found during the implementation of the Systematization of Nursing Assistance with the help of computerization in the unit?* Besides the positive aspects, they verified that there was a great reluctance to use the computerized system, mainly during the implantation phase as it was a novel model for the professionals.

Along the same lines, Husain and Nazim (2015) found in the research about computerization in libraries that there was a certain resistance from employees to use ICT.

However, this study, when asking the leaders, in Question 4, about possible resistance from their respective employees in the implementation of the software, it was found that only the minority, 11.8%, evidenced resistance, while 88.2% did not. Once again, the results of this research contradict the research of the exploratory study.

Subsequently, in Question 5, leaders were asked about their workers knowledge concerning the use of the DS and, in this case, 82.4% answered that their teams have mastered the software, against 17.6% who answered negatively.

In Question 6, the leaders were asked about the DS integration or not, with the other software or control programs of the company. It is observed that most leaders agree that the DataStation software provides an integration with the other company, since 72 % of the answers were positive.

Question 7 was asked with the intention of getting to know the modifications that the computerization of the HSEQ management system provided to the Unit/Leaders Department.

Amongst the answers, all of them positive, one can highlight the agility and ease in the processes of searching for information, organization of documents, improvement in controls and standardization of processes, periodic activities and documents, increase of operational efficiency and expediency in carrying out training.

In Question 8, leaders were questioned about the importance of computerizing the HSEQ management system. The totality of the answers were positive with emphasis on the integration and democratization of access to information, increase of organizational knowledge, optimization of time, help in taking decisions, increase in the quality of data, amongst others. Among them, the following statement stands out: "*The computerization of the SG allows better traceability of information, increases the quality of stored data enabling better analysis and decision making"*.

The leaders' opinion about DataStation's contribution in exchanging knowledge between Departments/Units was included in Question 9. In the answers, 99% of the leaders agreed that DataStation contributes to this exchange.

The response to any suggestions and requests made by the leaders to the system administrators was checked in Question 10. As could be observed in the answers, 88% of the leaders agreed that their requests and suggestions have been answered.

5.3 Proposed improvement actions for Superior Energy Services

Amongst the actions suggested by GPS DataStation users, one can observe a coincidence with the literature. Amongst them, we can mention the studies of Natia and Al-Hassan (2015) who recognized that the use of information technology applied to the educational area *(eLearning)* is important for the learning process, because it ensures unrestricted access to important information and, consequently, to the development in the areas under study.

The limited data transfer capacity of the Internet can be considered as a barrier to the implementation of computerized management systems, as described by Islam and Tabassum (2015).

Pissaia *et al.* (2016) verified in their studies that users indicated "agility in the search for information" as an advantage in the computerization of health processes. Therefore, it is justifiable that DataStation users indicate the need to simplify processes and develop more agile information seekers.

From the analysis of the results, it was possible to create Table 7 with suggestions for improvements to the GPS DataStation software.

Table 7

Proposed improvements to the GPS DataStation software

Module/Subject	Improvement Proposal
Training	Increase the availability of training online
SHARP	Improve formatting and presentation Simplify viewing of card
MOC	Simplify approval processes
LIBRARY	Include searcher for documents in general Include automated map for the control of documents Include document revision Put documents in alphabetical order
PIR	Simplify the stages
Dashboard	Improve layout for easier browsing
KPI	Track sales data Create management reports with quantitative summaries
Calender	Enable simultaneous upload of photos
General	Create an application for use in smartphones or tablets Provide navigation bars in Portuguese Provide computers for access Improve agility of support offered by the developers Improve stability and connection speed Enable the use of the software offline Promote Outlook integration Promote more training in using the tool

Source: Prepared by the authors (2020)

6 CONCLUSION

The objective of this work was to map the users' perception of the GPS DataStation software, which is used to computerize the HSEQ management system at Superior Energy Services, concerning the advantages and barriers of using this software, as well as to propose improvement actions to the GPS DataStation software.

Initially, a literature review was performed by means of publications available in the *Scopus* database and in the *Web of Science*. At this stage, many documents related to the computerization of systems were found, however few were dedicated to the discipline of HSEQ. Therefore, studies from other areas were used for comparative purposes.

Amid the main barriers cited in the literature, one can emphasize the lack of infrastructure and resources, lack of knowledge and resistance of users to use computerization. As advantages, agility in the search for information and unrestricted access to it were identified, according to the literature revision.

In the survey, amongst the advantages mostly mentioned by users, they evidenced the reduction of the need to use printed documents, therefore promoting environmental preservation, the agility in the processes of information transfer, the speed and agility in the search and processing of information, the reduction of needing a physical space for printed documents and, the implementation of processes improvement. As to the barriers, it is worth highlighting the knowledge involving the total use of the tool, the insufficient training of users and the system not integrated with Outlook.

By analysing the users' responses, coincidences were identified concerning the barriers described in the literature such as Connection Speed, Computer Unavailability and User Knowledge. The analysis of these same answers were the basis for proposing improvement actions in the GPS DataStation software. The advantages: the users' answers coincided with the literature in: Unrestricted Access to Information, Development, Assistance with Decision Making, Agility in searching for information and Improvement of communication and exchange of experiences between teams.

For this reason, we hope that this research will contribute to the improvement of the application of GPS DataStation software at *Superior Energy Services* and at other institutions where it is applied, as well as serve as a basis for developers and managers to take into account the opinion of what is relevant to users and leaders when implementing softwares for

the computerization of the HSEQ system. Therefore, it is expected that these barriers, extracted from the practical application, will not be experienced by future businesses.

We also hope that this research will help researchers and managers to study more closely the barriers and advantages of computerizing HSEQ systems.

For future work we propose that researches are developed aiming to correlate through probability samples, the level of maturity of the HSEQ organizational principles, considering the human factor, with focus on the individual empowerment of employees and decentralization of responsibility as a critical factor for the success of HSEQ management systems.

REFERENCES

Badri, A., Boudreau-Trudel, B., & Souissi, A. S (2018). Occupational health and safety in the industry 4.0 era: a cause for major concern? *Safety Science*, 109, 403-411, doi: 10.1016/j.ssci.2018.06.012

Bardin, L. (2006), *Content Analysis*. Lisboa: Edições 70.

Berezyuk, M., Rumyantseva and Chebotareva (2017). Improvement of an integrated management system resulting in higher industrial safety efficiency. *International Journal of Safety and Security Engineering*, 7(4), 612–626, doi: 10.2495/SAFE-V7-N4-612-626

Berman, S. (2012). Digital transformation: opportunities to create new business models. *Strategy & Leadership*, 40(2), 16-24, doi: 10.1108/10878571211209314

DataStation (2018). *Welcome to DataStation*: your information on line. Retrieved December 11, 2018, from https://www.datastation.co/

DataStation (2019). Why DataStation? Retrieved December 11, 2018, from https://www.datastation.co/DSInfo/why-datastation.html

Fernández-Muñiz, B., Montes-Peón, J. M., & Vázquez-Ordás, C. J. (2012). Safety climate in OHSAS 18001-certified organisations: Antecedents and consequences of safety behaviour. *Accident Analysis & Prevention*, 45, 745–758, doi: 10.1016/j.aap.2011.10.002

Hess, T., Matt, C., Benlian, A., & Wiesbock, F. (2016). Options for Formulating a Digital Transformation Strategy. *MIS Quarterly Executive*, 15(2), 123-139, doi: 10.7892/BORIS.105447

Husain, S., & Nazim, M. (2015). Use of different information and communication technologies in Indian academic libraries. *Library Review*, 64(1/2), 135–153, doi: 10.1108/LR-06-2014-0070

International Labour Organization (Org.) (2001). *Guidelines on occupational safety and health*: *ILO-OSH*. International Labour Office, Geneva, Switzerland.

International Organization for Standardization (2018). *The Integrated Use of Management System Standards (IUMSS)*. Retrieved January 11, 2019, from https://www.iso.org/files/live/sites/isoorg/files/store/en/PUB100435_preview.pdf

Islam, S. M. S., & Tabassum, R. (2015). Implementation of information and communication technologies for health in Bangladesh. *Bulletin of the World Health Organization*, 93, 86-89, doi: 10.2471/BLT.15.153684

Koivupalo, M., Sulasalmi, M., Rodrigo, P., & Väyrynen, S. (2015). Health and safety management in a changing organisation: Case study global steel company. *Safety Science*, 74, 128–139, doi: 10.1016/j.ssci.2014.12.009

Lança, A., & Brito, I. (2017). Proposta de Sistema de Informação para a Disseminação da Informação num Sistema de Gestão Integrado QSA. *Atas da Conferência da Associação Portuguesa de Sistemas de Informação*, 17, 233-244. Retrieved November 11, 2019, from http://revista.apsi.pt/index.php/capsi/article/view/638/572

Matt, C., Hess, T., & Benlian, A. (2015). Digital Transformation Strategies. *Business & Information Systems Engineering*, 57 (5), 339-343, doi: 10.1007/s12599-015-0401-5

Moraes, C. S. B., Vale, N. P., & Araújo, J. A. (2013). Sistema de Gestão Integrado (SGI) e os benefícios para o setor siderúrgico. *Revista Metropolitana de Sustentabilidade*, 3 (3), 29–48.

Mustafa, R. (2015). Business model innovation: Pervasiveness of mobile banking ecosystem and activity system – an illustrative case of Telenor Easypaisa. *Journal of Strategy and Management*, 8 (4), 342-367, doi: 10.13140/RG.2.1.1416.8160

Natia, J. A., & Al-Hassan, S. (2015). Promoting teaching and learning in Ghanaian Basic Schools through ICT. *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* 11 (2), 113-125.

Nielsen, M. B., Tvedt, S. D., & Matthiesen, S. B. (2013). Prevalence and occupational predictors of psychological distress in the offshore petroleum industry: a prospective study. *International Archives of Occupational and Environmental Health,* 86(8), 875–885, doi: 10.1007/s00420-012-0825-x

Parast, M. M., & Adams, S. G. (2012). Corporate social responsibility, benchmarking, and organizational performance in the petroleum industry: A quality management perspective. *International Journal of Production Economics*, 139(2), 447–458, doi: 10.1016/j.ijpe.2011.11.033

Pissaia, L. F., Costa, A. E. K., Moreschi, C., Rempel, C. (2016). Sistematização da assistência de enfermagem: impacto da informática e os desafios na qualidade da assistência. *Revista Saúde.com,* 12(4), 737-743.

Sui, Y., Ding, R., & Wang, H. (2018). An integrated management system for occupational health and safety and environment in an operating nuclear power plant in East China and its management information system. *Journal of Cleaner Production*, 183, 261–271, doi 10.1016/j.jclepro.2018.02.101

Superior Energy Services (2013). Annual Report. Retrieved December 11, 2018, from https://ir.superiorenergy.com/static-files/43cd57d4-2276-40d6-af6b-e97b1e8004ff

Superior Energy Services (2018). *Superior Energy - Company History.* Retrieved December 11, 2018, from https://superiorenergy.com/about/

Wold, T. and Laumann, K. (2014). *End User Involvement in the Development of Procedures and Safety Management Systems*. Paper presented at the PSAM12 - Probabilistic Safety Assessment and Management, 22-27 June, Honolulu, Hawaii, EUA.