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Design of the Occupational Health and Safety Management System Based on the ISO 45001:2018 Standard, Adjusted to the Needs of an Association of Waste Pickers in the City of Bogotá

Julieth Alarcon, Angie Garavito, Pablo Velasquez, Angelica Santis*

Universidad Cooperativa de Colombia, Avenida Caracas 37-63, Bogota
angelica.santisn@ucc.edu.co

The Occupational Health and Safety Management System is a fundamental tool that identifies, evaluates, and controls the risks and dangers to which they are exposed to workers in work environments. Also, it permits companies to develop improvement plans and activities in compliance with the country's government regulations, regardless of the size and economic activity of each one.
In Bogotá, there is an association of waste pickers, constituted as a household public service company. They are mainly dedicated to promoting, integrating, organizing, facilitating, representing, and guiding waste pickers by trade to collect, classify, and dispose of usable solid waste. Given the activity they carry out, there is concern about the deterioration of the health conditions of the workers or, in many cases, the occurrence of work accidents, which entail different problems for the company. It is noteworthy that some risks to which the company's workers are exposed in the exercise of their work include: the risk of contamination, intoxication, infection, skin lesions, and deterioration of skin integrity due to the non-use of personal protection elements (PPE) and biohazard from contact with hazardous waste or residues.
Based on the above, it is essential to establish management systems for the well-being and health of workers; therefore, this work focuses on the design of the Occupational Health and Safety Management System (OHSMS) based on ISO 45001: 2018. The system's adoption offers the necessary instruments to help identify, control, and mitigate the risk factors inherent in the work activity. Additionally, it is intended that workers can have safe workspaces with the promotion of good practices in favor of environmental and occupational care in the exercise of their work, avoiding penalties for non-compliance with this.

1. Introduction

In the ancient world, productive activities were directly associated with risky, arduous tasks that implied great physical efforts; hence all work was related to slavery or people from the population of lower socioeconomic strata. However, there are some indications of occupational health and safety actions in Egyptian civilization (such as scaffolding, harnesses, among others, for the construction of pyramids and sphinxes) that were subject to the criteria of the project managers (Ribotta, 2019). Towards the Renaissance, Agricola and Paracelsus refer in their studies to the different diseases and problems caused by mining activity, which gave way to more studies related to the safety and health of workers (Tepper, 2010). Thus, during the seventeenth century, Bernardo Ramazzini's work on occupational health stands out, where he analyzes more than 54 professions (Tadesse and Admassu, 2006). So, in the 18th century, during the development of the Industrial Revolution, when new technologies and forms of labor were developed, it was possible during the work hours to identify the needs of employees, which facilitated the improvement of working and human conditions. From this moment, a transition was carried out in terms of labor, machinery, and work, emerging new social groups that promoted the development of new methodologies and treaties for the performance of work activities and worker well-being (Stearns, 2020). However, despite the above, occupational health presents a period of stagnation until the end of the 19th century (a period where health and safety conditions decreased as the

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number of workers in the city increased, and scenarios of abuse and exploitation occurred (Arias Gallegos, 2012). Given the previous labor dynamics, and because of many problems that still arose in labor matters, union movements were created for workers' societies to ensure the well-being of workers and ensure decent conditions of occupational safety and health (Llanos Encalada, 2016). So, in 1919, the International Labor Organization-ILO was established, which ensures social justice and international labor standards (Liukkunen, 2021). Over the years, the emergence of a series of norms and standards integrated into systems focused on managing health and safety at work to help reduce workplace accidents, illnesses, and deaths (Castiblanco et al., 2020). These norms and standards have been created due to technological advances, industrialization, globalization, more complex supply chains, among other situations (Jones, 2017). These standards and norms are often specific to each productive sector, and some are certifiable by accredited certification bodies.
This work focuses on designing the Occupational Health and Safety Management System (OHSMS) based on ISO 45001: 2018, adjusted to the needs of an association of waste pickers in Bogotá. Since the association's waste pickers (during the exercise of their work) are exposed to risks of contamination, intoxication, infection, skin lesions, and deterioration of skin integrity due to the non-use of personal protection elements (PPE) and the Biohazard from contact with hazardous waste or residues. In addition, this implies a significant concern for the company, mainly because of the deterioration of workers' health conditions or work accidents. In this respect, applying standards such as ISO 45001 could become a point of reference for organizations that at some point may aspire to operate in the international area (Lopez, 2016).

2. Methodology

The work will focus on a company located in Bogotá, which is mainly dedicated to promoting, integrating, organizing, facilitating, representing, and guiding waste pickers by trade to collect, classify, and dispose of usable solid waste.
The work will be developed through a systematic, explicit, and complete process that will be carried out to identify, evaluate, and synthesize all the information obtained from the company. The pertinent information will be collected that will allow acquiring the results of the current state and constructing, together with the company's work team, action plans, and programs in favor of caring for the safety and health of the company's personnel. It will be done through interviews, surveys of managers, staff, and workers, and direct observation. The OHSMS design will be carried out in three phases, as presented in Figure 1.

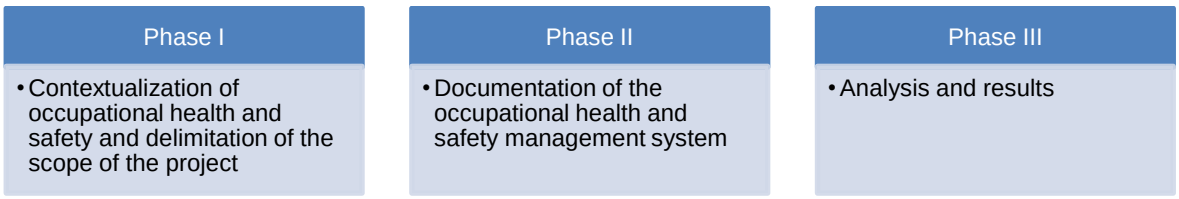

Figure 1: Development phases

3. Results

The company's OHSMS design will allow a clear advance in organizational and legal matters (Ramos et al., 2020). It will provide the basis to perform well in recycling, recovery, classification, and transformation of usable waste, maintain a record and order in document management, and comply with legal requirements.
For the development of Phase I, a SWOT Matrix was used, which turned out to be an excellent tool for the initial diagnosis of the company. It was possible to see in detail the strengths, weaknesses, opportunities, and threats profiles of the company, as well as the needs of the company, which gave way to take the respective corrective and preventive actions, below, in Table 1, the matrix of the organization is listed.

An initial evaluation of the OHSMS was carried out, and the information was collected using a survey. For the survey, the requirements contemplated in the ISO 45001 standard (ISO, 2018) and the country's current regulations were considered. The following standards were evaluated: Resources, Comprehensive management of the occupational health and safety system, Health management, Hazard and risk management, Threat management, OHSMS verification, improvement. The criteria and actions presented in Table 2 were established to evaluate the standards.

Table 1: SWOT Matrix

Strengths	Weaknesses	Opportunities	Threats
Provision of collector services: • Promotes social development • Guides and trains waste pickers by trade • Contributes to the care and cleaning of public areas of the city	Hazardous solid waste management: • High turnover of recycling staff • Generate work-related accidents or occupational diseases due to the level of healthy complexity • Low or no investment by private companies because they are small companies • Limited usable use	Waste management deficit: • Promote awareness campaigns and environmental care • Reduce cross-contamination of organic and inorganic waste • Facilitate the waste sorting process	Pollution of natural resources due to ignorance: • Oversaturating landfills • Increase accidents and/or diseases of people • Unleash controversy and discussions in the environment
Continuous improvement: • Increase team performance • Reduce costs and times in processes • Increase effectiveness and quality in processes	Manual of functions, standardization of processes, and management system: • There is no clarity in the description and facilitation of the activities of each position • Monitoring and control of activities • Reduction in quality assurance in service provision	Inclusion of collection points at the regional level: • Expand the brand in the waste collection process • Greater quantity in capturing usable waste • Higher profit percentage	Local collapse and measures of the mayor's office for COVID-19: • Reduce budgets for waste collection and treatment projects • Change the agreements established with the state • Reduce operational expenses in human resources
Social integration and Zero Waste programs: • Improves order and agility in the waste classification and waste management • They do their jobs better by reducing process errors • Greater motivation and optimal work environment	Tight spaces and old technology: • It may occur bottlenecks in the different processes • Incur in debts for the improvement of the physical plant • Generate penalties for non-compliance with industrial health and safety regulations	Legal measures decreed for waste collection: • Certify the company by ISO 9001 Standards • Obtain recognition for environmental care • More significant investment by the state to improve internal processes	Regulations decreed for the collection and waste management: • Generate fines and penalties for the company for non-compliance • Generate misinformation in the use and exploitation of waste • Losing collection contracts with the state
Organizational efficiency: • Improves order and agility in the waste classification and waste management • They do their jobs better by reducing process errors • Greater motivation and optimal work environment	Techniques in waste collection and classification: • A high percentage of waste generated delaying processes • Design of collection routes to optimize times • The generation of alliances for collection with industrial companies is needed	Percentage of usable waste: • Collect a more significant number of usable wastes for transformation • Reduce the amount of material in different environments • Greater profitability in waste collection and recovery	Existence of organic and hazardous waste: • Increase the percentage of CO_2 and toxic gases • Make it challenging to classify usable and non-usable waste • Generate pollution in the ecosystem
Collection, classification, and disposal of usable waste: • Improves the perception of operable users regarding logistics • Offers guarantees and decent work to waste pickers • Generate more employment including all social benefits • Reduces the percentage of pollution with waste that can be used	Billing and collection of cleaning providers in Bogotá: • Delay in payments to waste pickers due to delays in money transfers from sanitation and sewerage providers • Resources are limited • The payment rates for the provision of service are meager	Artificial intelligence and automation (streamlined and industrialized systems): • Improve waste sorting processes • Reduce time and movement in separation of materials • Optimize shredding and packaging processes	Market prices equal to or lower than those offered: • To lose • Reduce the number of purchases of usable material • Delaying payments for public services

Table 2: Type of Valuation by Standard

CRITERIA	ASSESSMENT	ACTION
If the score obtained is less than 60 %	CRITICAL	1. Carry out and have an Improvement Plan immediately at the disposal of the entity in charge of protecting the country's workers. 2. Send to the respective Occupational Risk Administrator to which the employer or contractor is affiliated a progress report within a maximum term of three (3) months after the self-assessment of minimum standards has been carried out. 3. Annual monitoring and formal visitation plan to the company with critical evaluation by the entity in charge of the protection of the country's workers
If the score obtained is between 60 and 85 %	MODERATELY ACCEPTABLE	1. Carry out and have an Improvement Plan at the disposal of the entity in charge of protecting the country's workers. 2. Send a progress report to the Occupational Risk Administrator within a maximum term of six (6) months after the self-assessment of minimum standards has been carried out. 3. Formal visitation plan by representatives of the Ministry of Labor
If the score obtained is greater than 85 %	ACCEPTABLE	1. Maintain the qualification and evidence at the entity's disposal in charge of protecting the country's workers and include in the Annual Work Plan the improvements established by the evaluation.

In Table 3, the results of the evaluation are presented.

Table 3: Type of Valuation by Standard

STANDARD	Maximum value (%)	Obtained Value (%)	PHVA cycle
Resources	10	1	Plan
Comprehensive management of the occupational health and safety system	15	1	
Health management	20	18	Do
Hazard and risk management	30	14.5	
Threat management	10	0	
OHSMS verification	5	0	Check
Improvement	10	0	Act

It was found that the company has documents that include information such as the medical profiles of the workers, delivery of PPE, sociodemographic description and basic sanitation for the operation, legal matrix, report and investigation of accidents, incidents, and occupational diseases, among others. With this information, the company obtains a 34.5 % compliance percentage of the OHSMS, as contemplated in the ISO 45001 standard and the OHSMS regulations that the country has. It shows that the system's assessment is at a CRITICAL level.

Based on the initial diagnosis, the development of Phase II was established. It was directly related to the documentation that the company is not complying with. It is to avoid sanctions or fines exposure since some documents are related to non-compliance with the standards established for the OHSMS. Table 4 specifies the documents that were defined according to each of the phases of the PDCA cycle.

Table 4: Documents required for OHSMS

Plan	Do	Check	Act
Resources: • Responsible OHSMS • Responsibilities in the OHSMS • Resource allocation • Affiliation to Occupational Risks • Identification of High Risk Workers • Formation of Joint Committee on Occupational Health and Safety-JCOHS • JCOHS training • Labor Coexistence Committee • OHSMS training • Induction in OHSMS Comprehensive Management of OHSMS: • OSH Policy • OHSMS Objectives and Goals • Initial Evaluation OHSMS • Workplan • Conservation OHSMS documentation • Accountability • Identification of Legal Requirements • Communication in OHSMS • Purchasing Management in OHSMS • OHSMS Supplier Selection and Evaluation • Change management	Health Management • Health conditions at work • Report and Investigation of Occupational Accidents and Diseases • Health Surveillance Mechanisms Hazard and Risk Management • Hazard identification • Hazard Control Threat Management • Emergency plan • Emergency Brigade	Check • OHSMS indicators • OHSMS audit • Review by Senior Management	Monitoring Matrix Corrective and preventive actions and improvement actions of the OHSMS

With the documentation created for the management system, a new evaluation is carried out to carry out Phase III; from there, the results of the standards according to the PDCA cycle are presented in table 5.

Table 5: Valuation Results by PDCA Cycle

	Maximum value (%)	Obtained value (%)
PLAN	25	18.5
DO	60	47
CHECK	5	1.25
ACT	10	7.5

Then, as presented in Table 5, with the development and compliance of the Occupational Health and Safety Management System, a management level of 74.25 % would be obtained, which corresponds to a MODERATELY ACCEPTABLE assessment according to the information from Table 2. Consequently, with the suggested design, the company still needs 25.75 % to achieve 100 % compliance in management.

4. Conclusions

According to the initial diagnosis of the organization, it can be concluded that it has the necessary resources for the implementation of the OHSMS. However, they must assign a person to be dedicated to this process. Also, the company must guarantee the continuous improvement of the OHSMS, maintaining the implementation and compliance with the minimum standards established by the ISO 45001 standard and the regulations that the country has contemplated in safety and health at work. Likewise, documentary supports are made for each standard organized in the PDCA cycle, the management system manual, and the final evaluation, which will serve as input to implement the occupational health and safety management system.

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