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INDUSTRIAL ENGINEERING

Degree of implementation of occupational Safety and health management systems (OSHMS), in the metalworking industries of the south-central region of Caldas – Colombia

INGENIERÍA INDUSTRIAL

Nivel de implementación del sistema de gestión en seguridad y salud en el trabajo, en las empresas del sector metalmecánico de la región centro sur de Caldas- Colombia

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Abstract

Colombia has some mandatory regulations for all companies, regardless their business area or their economic activity respect to Occupational Safety and Health. In this project, it was reported the results of the degree of implementation of the Occupational Safety and Health Management Systems (OSHMS) with regard to the level of obligation required by law. The data was collected from Social Security Institute survey-type instrument adapted by Autonomous University of Manizales experts; and validated through pilot testing. Throughout a convenience sampling, 26 companies in the metal/ mechanical industry of the South-central region of Caldas were evaluated. Small companies showed major gaps compared to the medium and large businesses in term of the degree of implementation of the Occupational Safety and Health Management Systems (OSHMS). Features related to compliance with the requirements of appointing staff, function assigning of the Joint Committee on Occupational safety and health, well established occupational safety and health policies, well defined spaces for first aid care; and high qualified staff to design, implement and maintain the system.

Keywords: *Compliance level, job safety and health, metal/mechanical industry.*

Resumen

En términos de seguridad y salud en el trabajo Colombia cuenta con una normativa de carácter obligatorio para las organizaciones, independiente del sector y la actividad económica que realicen. El presente proyecto reporta los resultados del nivel de implementación del sistema de seguridad y salud en el trabajo con respecto al grado de obligatoriedad que exige la ley. La recolección de la información fue desarrollada mediante la aplicación de un instrumento del Instituto del Seguro Social, adaptado por expertos de la Universidad Autónoma de Manizales y validado mediante pruebas piloto. Dicho instrumento fue aplicado por medio de un muestreo por conveniencia a 26 empresas del sector metalmecánico de la región centro sur de Caldas. Las pequeñas empresas muestran brechas con respecto a las medianas y grandes en el nivel de implementación del sistema de gestión de seguridad y salud en el trabajo, en aspectos como cumplimiento en los requisitos de elección y funciones del comité paritario de Seguridad y Salud en el trabajo, política definida de Seguridad y Salud en el trabajo, espacios definidos para la atención de primeros auxilios, y personal encargado del sistema sin las competencias para diseñar, implementar y mantener el Sistema.

Palabras clave: *Nivel de cumplimiento, sector metalmecánico, seguridad y salud en el trabajo.*

1. Introduction

Occupational health research is a key issue to effectively foster public and private policies on occupational safety and health Benavides & Maqueda (2003). The importance of occupational health has been present for some time, since having a job is a substantive activity of human beings, Jaramillo & Gomez (2008). Companies, regardless of the work they do, run the risk that their employees have accidents at work or get an occupational disease due to their work or the way they do it, the use of machinery, the equipment, the tools, the raw materials and supplies, the length of time exposed to risk factors and individual susceptibility.

Furthermore, markets internationalization, the opening of borders, the new technological advances and the government dynamics require companies to protect their employees within a framework of occupational safety and health, Jaramillo & Gómez (2008); Grillo (2013); Shin (2013), therefore, work nature, and the way it is organized is changing, it is customer oriented and depends on the use and updating of the employees knowledge, Rial (2006).

It can also be stated that workforce is as diverse as the productive system of a country is heterogeneous and that there are high-tech production systems with modern forms of organization and division of labor, despite the workplaces with old fashion production forms, Betancourt (1999). That is why all companies must ensure their employees and others who may be affected perform their duties safely in any event, Soler & Esengeldiev (2014). Also, workforce is aging, rate of working women is rising, working is performed under poor conditions, which has spread over small companies, and therefore it is more difficult to monitor health and working conditions. This has led to constant changes implementation in the Occupational Safety and Health Management Systems (OSH-MS) that adjust current contexts, because depending on the productive sector, the size of the company, the types of employees and the level of assessment and intervention are different. Falagán et al. (2000); Betancourt, (1999)

Rojas & Velandia (2012) made a review over 202 articles in five databases, looking for theoretical and conceptual gaps evidence regarding OSH-MS. They found the peak in research is presented on the subject in the past three decades, further before 2007, there was no standard and accepted Occupational Safety and Health Management Systems (OSHMS) in the world; therefore, companies had to create their own models or management systems, Fernandez (2007). This situation is due to the efforts of SST have been considered isolated actions and have focused on technical aspects, leaving aside the organizational and human aspects (Fernandez et al., 2006); However, in recent decades it has been raised organizational, cultural and management issues that play a major role in causing accidents, Reason (1990). It was until 2001 when the International Labour Organisation (ILO) provided a guidelines regarding Occupational Safety and Health Management Systems (OSHMS) (2001); Robson et al. (2012), in order to manage the actions and programs required to guarantee the welfare of the working population for companies.

In the past 30 years the Industrial Safety and Occupational Health has taken greater importance within industrial sectors with the aim of raising public awareness on the protection of employees. Colombia has been updating its legislation following British and German models, Lizarazoa et al. (2011). At the same time, legislation imposes on directors the responsibility of guaranteeing the safety and health of employees under their direction, thus, from a practical point of view, management needs to identify how to allocate scarce resources in the best possible way, ensuring the lowest number and severity of injuries suffered by their employees, Fernandez et al. (2006). Law 9 of 1979 by the Colombian Congress was the first approach of the government to protect occupational health of workers, "the occupational health of worker is a prerequisite for the socio-economic development of the country; its preservation and conservation are social and health interest activities with the participation of the government and individuals" Colombian congress (1979). The Colombian legal framework is currently ruled by the laws, resolutions, decrees and codes that are depicted in Table 1.

Table 1. Legal Framework

Law 9 of January 24 of 1979	Rules to preserve protect and improve individual's health at work.
Resolution 2400, May, 22, 1979	Industrial Security Act
Decree 614, 1984:	Basis for the organization and public and private management of occupational health.
Resolution 2013 June 6, 1986	Regulations of the organization and functioning of committees of Medicine Hygiene and Industrial Security at workplace.
Resolution 1016 March 31, 1989	Regulates the organization, functioning and the way Occupational health programs are to be developed by managers.
Resolution 8321 August 4, 1983	Rules the protection and hearing conservation, health and welfare of workers
Resolution 1792 May 3, 1990	Defines values for occupational exposure to noise.
Resolution 6398 December 29 1991	Procedure on Occupational Health (Entrance Examinations in the Company)
Decree 1477 August 5, 2014	Whereby the table of occupational diseases is issued
Decree 1607 July 31 2002	The classification table of economic activities for the General Occupational Hazards System is modified
Decree 1772, 1994:	Amount of the contribution to the Risk and Labor Administrators (ARL)
Resolution 1401 2007:	Investigation of accidents.
Law 1429 2010:	Whereby the requirement to register medicine, hygiene and safety committees at the Ministry of social protection is removed as requested by resolution 2013 of 1986
Resolution 1409 July, 23, 2012:	Whereby the safety regulations established to protect against falls in working at heights.
Decree 1281,1994	Regulates high-risk activities
Decree 1831,1994	Issues the table of economic activities for the general system of occupational hazards
Labor Code	Multiple standards on Occupational Health are determined
Law 1562 July 11, 2012	Whereby the occupational hazards system is modified and other provisions on occupational health are issued
Decree 1443 July 31, 2014	Whereby provisions for the implementation of Occupational Safety and Health Management Systems (OSHMS) are issued.

Table 2. Evaluation of the development of the Occupational Safety and Health program

SECTIONS	N°	EVALUATION CRITERIA
Structure of the program	1	Existence, disclosure and coverage of OSH Policy
	2	Existence of the joint committee of SST and compliance functions
	3	Appointing staff responsible for designing and implementing the OHSMS
	4	Time devoted staff appointed to the program
	5	If those functions are defined and written for the OSH staff in charge
	6	If there is allocation of budget for the development and implementation of OHSMS
	7	If there is defined spaces for first aid care and training
	8	Availability of technological resources for quantitative risk evaluation
	9	Evaluation of health conditions for implementing surveillance programs
Evaluation process	1	If in the preparation of the evaluation of working conditions or risk landscape , the company incorporates aspects according to the regulations
	2	If you have a disease profile that includes behavior, overall absenteeism , labor and if the joint committee participation OSH
Evaluation of planning	1	If there are specific objectives of the program and they respond to the diagnosis of working conditions
	2	If goals are measurable, achievable and if the diagnosis of working conditions was taken into account for the definition of such goals
	3	If there is a schedule of activities and this has defined objectives and staff in charge
Evaluation of working conditions	1	If there is risk control factors that are classified as priority
	2	If there is a written training procedure for the workplace
	3	If selection and supply of personal protection garments is done according to technical criteria and there is adequate replacement
	4	If standards or standards based on the analysis of the positions, precautions measures and personal protection garments are done
	5	If personnel services, such as restrooms, dressing rooms lockers and cafes comply with current legislation
	6	If emergency plan exists and meets vulnerability analysis procedures for emergency response teams, brigades and drills.
	7	If there is an occupational evaluation and test guide according to occupational exposure risks
	8	If he entrance examination takes into account the profile of the position and the risks they will be exposed as well as individual personal characteristics
	9	If workers exposed to risks know the risks they are exposed, if they undergo the required tests and protocols for epidemiological surveillance
	10	If there is a monitoring process, recovery, rehabilitation, reintegration and resettlement when health conditions require them
	11	If there is accident investigation in accordance with existing legislation and if there is monitoring of the implementation of corrective measures.
	12	If accidents at workplace are reported, recorded and monitored.
	13	If there is a research process of diagnosed diseases, and if it meets a methodology for comprehensive analysis of causes and if corrective action is done
	14	If OSM committee is involved in the investigation of accidents and occupational diseases and if it monitors the implementation of corrective measures
	15	If there is an inspection plan that includes critical areas, and defined periodicity according to criticality; If there is a participation in inspections OSM committee
	16	If there is a plan of preventive maintenance to machinery and equipment, facilities and risk control systems at source and environment
	17	If there is signaling and demarcation according to current regulations

Over time companies have assumed Occupational Safety and Health Management Systems (OSHMS), (previously known as Occupational Health Program)

as an expense, and it has been one of the first budgets to be cut down on or cut out in times of austerity; but fortunately this paradigm has been changing,

and many companies, mostly medium and large ones, are already aware of the benefits for the company, society, the employees and their families and the competitiveness in an increasingly demanding market. This has led to implement OSHMS through the PDCA cycle. A lot of research studies state that a good safety management leads to reduce accident rates, and also to improve productivity that results in financial and economic profits for the company, HSE (1997); Manzanedo, et al. (1996); Niederleytner et al. (1996); EU-OSHA (1999); Ashford (1999); Narocki (1999); Blanco (2000); Gil (1999); Smallman & John (2001); Bestraten et al. (2001).

In this work, we aim to identify the degree of implementation of OSHMS taking into account the assessments of organization, the process, the planning and the working conditions within the companies in the metal-working industry in the South-central Region of Caldas-Colombia.

2. Methodology

This project shows a quantitative, descriptive research, developed in the manufacturing companies of the metal/ mechanical industry in Caldas, Colombia. The population for this research was delimited to the South-Central region that corresponds to the municipalities of Manizales, Villamaría and Chinchiná. They comprise the 85% of industrial production of the state (Centre for Competitive Thinking Strategies, 2011). The sample included 26 companies chosen through a convenience sampling, supported in the following aspects: Availability of the company, quality of the information and the participation of the metal/ mechanical industry of the National Learning Service (SENA). Large, (25%), medium (21%) and small (54%) companies were included according to the industry classification for Colombia (Colombian Congress, 2004).

Primary data was collected by applying a survey-type instrument adapted by experts from the Autonomous University of Manizales. The document of Social Insurance Institute, "Evaluation of the development of occupational health program for large companies" was taken as reference. This document has four sections: Structure of the program, Evaluation process, Evaluation of planning and the Evaluation of working conditions. (see Table 2).

2.1. Structure of the survey-type instrument

The data collection tool is structured into 4 sections. Each section comprises some evaluation criteria which qualification is between the values of 0 (for non-compliance) and 5 (total compliance) and integer intermediate values for partial compliance; the section of the structure of the program evaluates 9 criteria and 29 characteristics, evaluation of processes consists of 2 criteria and 17 characteristics, planning was structured in 3 criteria and 12 characteristics and finally to assess working conditions took 17 criteria and 83 features.

3. Results and discussion

3.1 Structure evaluation

How it was mentioned, the structure evaluation enables us to identify compliance or non-compliance of features related with: occupational health policy, security and health joint committee (responsible of SGSST and its functions), commitment time to the program, defined spaces for immediate response and prevention meetings, financial and physical resources, and worker health condition evaluation. Table 3 shows the compliance percentages for the nine evaluated criteria of the program structure. Large and medium companies have compliance percentages higher than 70% for all criteria, and for small companies wide from 46 to 69 the compliance percent. It has to be highlighted that small companies show highly deficiencies in existence criterion, dissemination and cover of SST policies respect to medium and large companies due to they just try to satisfy the law requirements omitting dissemination. Due to small company sizes, just 48,2 % of them have claimed to assign development, and execution program budget. Other result show that 41,16% of small companies are available quantitative evaluation technologic resources for risk evaluation, as well as, the 68% comply with functions and election requirements of security and health joint committee at work. A high percentage of all studied companies (large 85%, medium 80% and small 69%) the commissioned personal for security and health at work, does not have the adequate competences to design, to implement and to maintain all the system or the enough time because of they have to share time in different company activities not related with the system.

Table 3. Compliance criteria sections OSHMS

SECTIONS	EVALUATION CRITERIA	% COMPLIANCE		
		LARGE	MEDIUM	SMALL
Structure of the program	1	90 %	93 %	46 %
	2	100 %	76.5 %	62 %
	3	85 %	80 %	69 %
	4	100 %	85 %	57.5 %
	5	100 %	70.43 %	50.17 %
	6	90 %	85.35 %	48.2 %
	7	77.5 %	90 %	62 %
	8	80 %	80 %	41.16 %
	9	85.25 %	86 %	74 %
Evaluation pro- cess	1	92 %	91.6 %	69.24 %
	2	83.64 %	85.58 %	59.18 %
Evaluation of planning	1	68.5 %	87.57 %	60.2 %
	2	56.5 %	75.3 %	46.54 %
	3	86.56 %	90.6 %	59.4 %
Evaluation of working condi- tions	1	77.4 %	87.6 %	58.3 %
	2	79.5 %	88.58 %	45.6 %
	3	83.6 %	86.6 %	55.4 %
	4	80 %	92.4 %	47.6 %
	5	74.3 %	88.7 %	68 %
	6	79.3 %	82.3 %	48.8 %
	7	76 %	89.6 %	55.3 %
	8	72 %	89.3 %	48 %
	9	74.3 %	86.7 %	69 %
	10	80.3 %	87.5 %	62.6 %
	11	88.3 %	91 %	54.7 %
	12	72.3 %	74 %	40.6 %
	13	76.02 %	81 %	58.7 %
	14	80.4 %	88.2 %	68.75 %
	15	77.6 %	74 %	54.15 %
	16	75 %	76.4 %	60.3 %
	17	83.7 %	84.95 %	57 %

3.2 Process evaluation

In this stage, job conditions and risk factor panorama were evaluated by minimum number of standard nor mativity compliance. Morbidity profile was verified (in some cases its existence) in order to determine the participation degree of joint committee on occupational safety and health. Results can be shown in Table 3. For large

and medium companies, first criterion results overcome the 91 % of compliance meanwhile small companies cannot achieved the 70 % of compliance; and for the second criterion, the morbidity profile, absenteeism and attendance reporting in the joint committee on occupational safety and health for large, medium and small companies are 83.64%, 85.58% and less than 60% respectively.

3.3 Planning evaluation

Timeline, planned objectives and goals are verified in this stage (if they were designed following working conditions diagnosis). Table 3 shows that the lower compliance percentage is obtained by the second criterion where the three kind of companies obtained compliance values of 56.5%, 75.3% and 46.54% for large, medium and small companies respectively. The proposed goals and the possibilities to be obtained were not shared with the personal and have not taken into account to diagnose the work conditions. Generally, medium companies obtained best compliance percentages for the aforementioned three criteria respect to large and small companies. Major gaps are presented in small companies.

tion guidelines, well defined procedures for work accident investigation, work troubleshoot, joint committee on occupational safety and health participation in the investigations, preventive maintenance plan, adequate signaling, inspection plans, mental and physical rehab plans. Table 3 consolidates all evaluation criteria and compliance percentages separately by company size. All companies have deficiencies registering, reporting and following work accidents. General compliance is not greater than 74 %, and it is presumed that these responsibilities are load to working risk management (ARL). Table 3 also shows the low level in all companies size for critical areas inspection plans (15) and preventive maintenance plan existence (16)

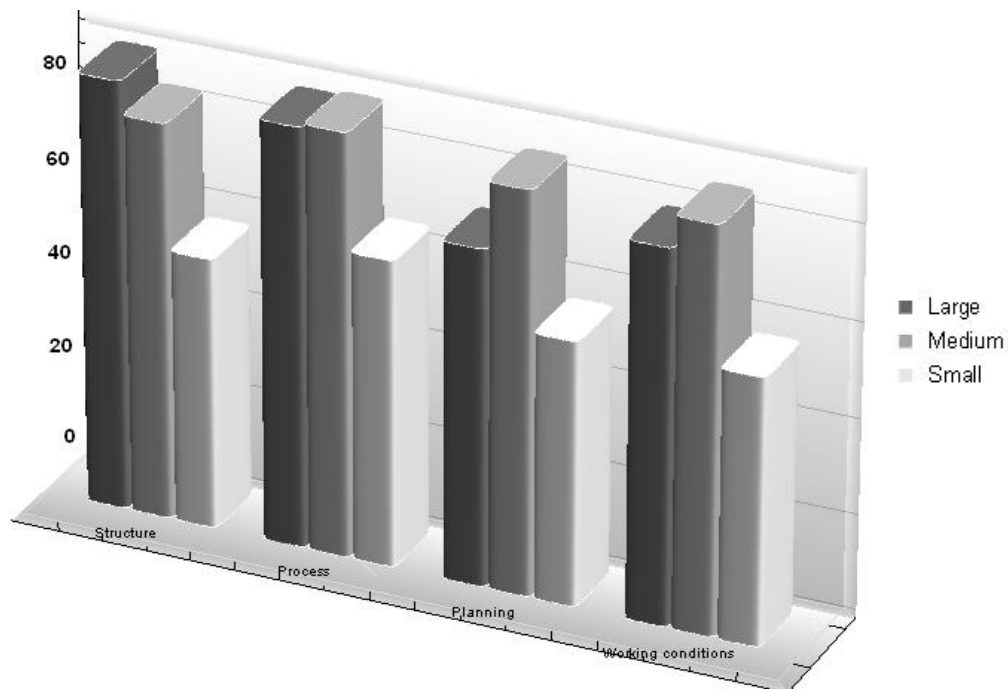


Figure 1. Average fulfillment for each stage on the total of companies.

3.4 Working conditions evaluation

Major criteria and characteristic are presented in this item. Actual worker conditions and working environment are evaluated. This evaluation is composed by degree of implementation of identified risk factor control over the environment or source, degree of workplace training, risk knowledge which the worker is exposed, selection of personal protection elements, well defined standards and policies, personal services like sanitarium and closets, emergency plans, admission exams, evalua-

3.5 Average fulfillment for each stage on the total of companies

The average of fulfillment of each of the stages, in the total number of companies, shows very similar differences between evaluation of the working conditions and the evaluation of planning. The most significant difference is the evaluation of the structure and the smallest difference is the evaluation of process. Average results of each of the stages are as follows and are shown in figure 1.

The average evaluation of the structure of all the companies is 76.11%, with higher and lower values of 89.75% and 56.67% respectively.

The average evaluation of the process in all the companies is 80.2%, with higher and lower values of 88.59% and 64.21% respectively.

The average evaluation of planning in all the companies is 70.39%, with higher and lower values of 84.39% and 55.38% respectively.

The average evaluation of the working conditions of all companies is 73.28, with high and low values of 85.21% and 56.1% respectively.

3.6 Degree of implementation

Based on the results obtained, it was determined that the average compliance rate of OSHMS implementation, groups of companies, classified by the law 905 of 2014, Figure 2.

The results obtained were:

Large companies $X = 81.66\%$, medium companies $X = 85.25\%$, Small companies $X = 58.97\%$.

Due to significant differences in the degree of compliance with OSHMS in the same group of companies according to their size, mainly small and medium ones, the standard deviation for each group of companies was calculated with the following results.

Among large companies $\sigma = 9.59$

Among medium companies $\sigma = 11.2$

Among small companies $\sigma = 25.37$

There are significant deviations among companies belonging to the same classification and they are very representative among the small ones, which means they are small companies with good levels of compliance but there are also companies with insufficient levels, which even disregard the law.

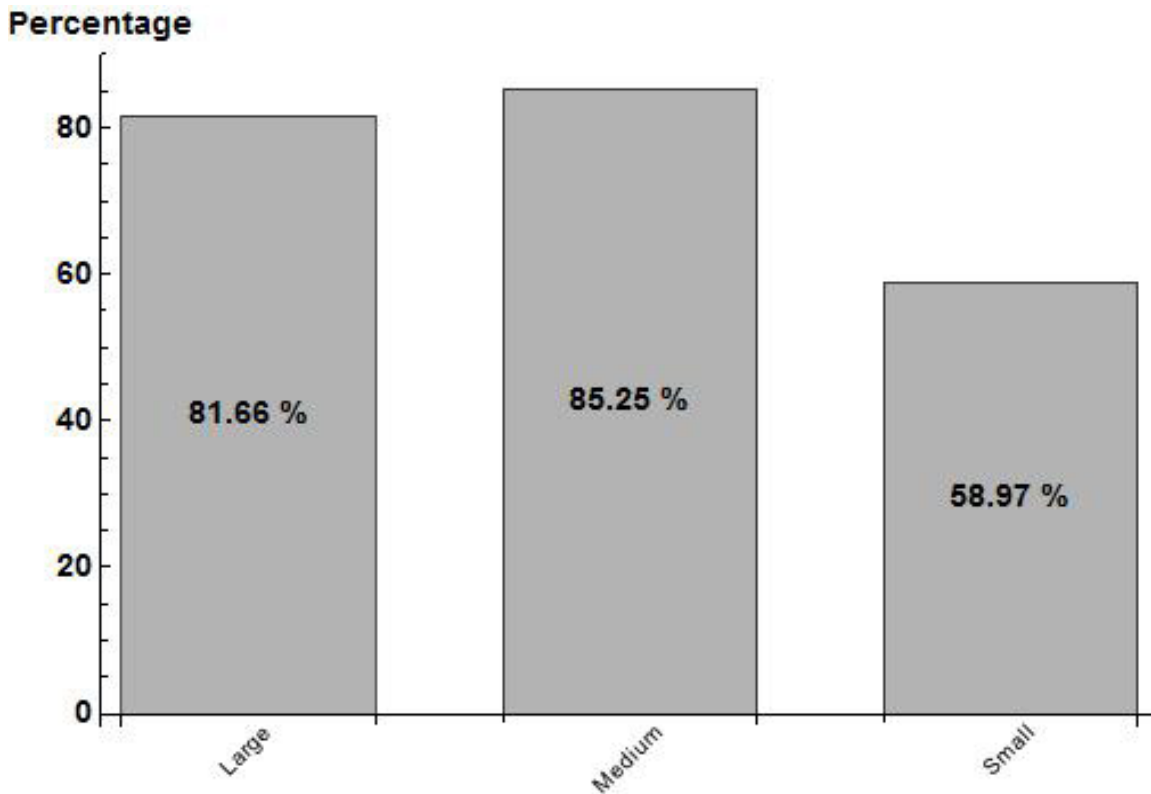


Figure 2. Percentage of OSHMS implementation.

4. Conclusions

Small companies show the lowest level of compliance with regulatory and legal features in all stages of the system compared to medium and large companies. Also, there are no significant differences between large and medium companies regarding the implementation of OSHMS, or any of their stages. The level of compliance according to the legislation and rules for the evaluated large and medium companies exceeds 81% (large companies 81.66% and medium ones 85.25%), although they are 59 % below if compared to companies categorized as small (58.97%).

Small companies do not have staff or budget allocated to the exclusive operations for occupational safety and health. These activities are appointed to people who do not have the skills required for the area and in all cases must perform other activities within the company.

In Colombia it is mandatory for the companies to recruit their workforce to the Administrators of Occupational Risks (ARL) which, among other activities, provides advice and support to companies in managing occupational hazards such as: Set goals, establish and comply the schedule of activities OSH, design and implement an inspection plan, create a joint committee on occupational safety and health, design emergency plan and perform simulations, design and implement a signaling system, establish safety standards for operations and human behavior, designate spaces for first aid care, conduct research of accidents and occupational diseases according to the legislation, design, implement and maintain an inspection plan, perform entrance examinations that comply with the requirements, create and evaluate the morbidity profile, create and execute maintenance plans, and identify priority risks to keep them controlled. These items showed low levels of compliance in this study.

The standard deviations show that within a company classification, companies have significant changes in their levels of compliance, the most representative case is in small companies

according to the observed average compliance levels in all aspects evaluated, which was over 88%, and others below 26%, mainly due to non-evaluation features of planning regarding the setting of objectives, goals and schedule of activities. Another problem identified was the indifference of many companies in terms of safety and health care of employees, since they view it just as a requirement or an obligation to comply with the law, in other cases, the companies know the law although they do not meet the minimum requirements.

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