

Characterization of a computer tool for Industrial Security Management in MSME's

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Abstract: In the present work, a study is carried out on companies in the state of Colima with the purpose of compiling the characteristics that must be contained in a computer tool capable of facilitating the administration of industrial safety. With the design characteristics detected, it is intended to establish the basis for an automation proposal that benefits Micro, Small & Medium Enterprises with a tool tailored to the normative, procedural and operational reality of the Mexican environment, so that its extrapolation to the rest of the country is totally feasible since the regulatory framework of reference is federal and the legal implications to which its application impacts apply throughout the national territory.

Keywords: Health and Safety, Information Technology, MSME's, Security Management.

I. INTRODUCTION

At present, accidents and occupational diseases constitute up to 10% of the value of the Global Gross Domestic Product (GDP) worldwide, only in Latin America there are 36 work accidents per minute, which makes occupational safety and health have become a topic of interest [1]. In Mexico, according to data from the National Institute of Statistics Geography in Informatics (INEGI), there are approximately 4 million 15 thousand business units, of which 99.8% are Micro, Small & Medium Enterprises (MSME's) that generate 52% of the Gross Domestic Product (GDP) and 72% of employment in the country [2]. In the last 30 years, safety and hygiene have become a very important issue [3], regardless of the turn to which the company belongs, however,

despite the fact that the Ministry of Labor and Social Welfare (STPS) provides basic programs for the self-management of safety and hygiene, the administration of this process is done manually based on a guide that is provided by the same Secretariat and its monitoring, control and compliance depend on the level of document organization who has who is coordinating it [4]. According to the report of the [5] based on the section of accidents and illnesses at work, 837, 502 employers and 16, 803, 995 workers affected have been reported on average. In relation to the accident assessment, 400, 947 workers have been mentioned; for diseases it mentions a figure of 8, 301; 25, 214 disabilities were indicated and finally deaths at work were 1, 012. Likewise, labor risks were reported by economic activity of the same year and in second place is the construction of buildings and civil engineering works with 32, 319 cases representing 7.9% and the incidence rate is 3 per 100 lockers Therefore, the problem of occupational accidents in the industries is a focus of attention, since its results, infer in the way in which the structures and processes of the company are organized to perform the work. By not presenting a process of occupational safety management in companies, it consequently brings a series of high costs, first to workers as the first affected, second to organizations, followed by affecting communities and countries [6], [7]. Industrial safety aims to establish the necessary measures for the prevention of accidents and occupational diseases, aimed at ensuring the provision of work is carried out under conditions of safety, hygiene and environment suitable for workers, in accordance with the provisions of the Law Federal Labor and International Treaties concluded and ratified by the Estes's Unidos Mexicanos in such matters. It is an obligation that the law imposes on employers and workers and must also be organized within certain fees and operated within certain procedures. The employer will be obliged to observe, in accordance with the nature of its negotiation, the legal precepts on hygiene and safety in the facilities of its establishment, and take appropriate measures to prevent accidents in the use of machines, instruments and work materials, as well as to organize in such a way that it results in the greatest guarantee for the health and life of workers, and of the product of conception. Information and Communication Technologies (ICT) have generated a great impact on the functioning of organizations and have even altered their own structure, causing various effects, depending on the role they play within the organization. According to organizational trends and the use of technologies, automation leads to a reduction in failures in the processes of monitoring and document control,

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since it itself provides improvement tools that directly affect the efficient use of resources of every organization.

In Mexican business reality, regulatory compliance to meet the requirements of the 41 Official Mexican Standards (NOM) of the STPS, is time-consuming and leads to a large number of opportunities for error, due to the huge number of requirements requested. However, the fact that it is a difficult management situation does not exempt companies, even being (MSME's), from the responsibility of fulfilling these requirements since when they are breached it is assumed that a risk to integrity is being generated physical of the employees of that organization and as such the STPS sanctions it. As a consequence of the regulatory breach, companies must first correct non-compliance and, in the second instance, pay the fine to which creditors are made who, after the Labor Reform of 2010, can exceed one million pesos.

Enrolling in the Safety Self-Management program before the STPS implies that the MSME's submit and update annually some documents that the standards indicate and thus prevent them from performing labor inspections. Through an electronic search, it was detected that in México there is no technological system or tool that is based on the STPS Regulatory compliance and that helps companies to keep up to date their documentation on Occupational Safety and that those existing in the world, do not have the regulatory approach that is requested in México. On the other hand, these tips of studies are scarce in our country [8], [9] and in particular those that focus on the analysis of small and medium enterprises [10]. It aims to establish the basis for an automated proposal to provide MSMEs with a tool designed to suit the normative, procedural and operational reality of the Mexican environment.

II. METHODOLOGY

For the development of this study, two hypotheses were planted based on the fact that at present the MSMEs of the State of Colima invest more than 20 thousand pesos per month in the field of industrial safety and in most of them there are no occupational accidents.

Hypothesis 1: The MSME's in the state of Colima are not aware of the Self-Management System available from the Ministry of Labor and Social Welfare (STPS) to increase the level of occupational safety.

Hypothesis 2: The MSME'S of the state of Colima have not been audited in terms of safety, therefore they do not identify the need for a tool that efficiently processes work safety management.

The verification of the hypothesis raised as well as the relation of the variables of the same was carried out by means of the application of face-to-face surveys to a significant sample of MSME'S in the state of Colima according to the universe raised in the most recent data of the [11]. The variables to consider in the research project are:

Monthly investment in Occupational Safety in companies in the state of Colima. Accidents recorded in the MSME in the last 5 years. Security audits recorded in the last 5 years to MSME's in security. Knowledge of the self-management system. Knowledge of some technological tool for industrial safety management.

Features of efficient tool for security management.

A. Sample size calculation.

For this we use the following formula [12]:

$$n = \frac{N \times Z^2 \times p \times (1 - p)}{(N - 1) \times e^2 + Z^2 \times p \times (1 - p)} \quad (1)$$

Where:

n: Sample size we want to calculate

N: Population size.

Z: Deviation from the average value we accept to achieve the desired level of confidence.

Depending on the level of trust that is required, a certain value will be used. The most frequent values are:

90% confidence level with $Z = 1,645$

95% confidence level with $Z = 1,96$

Confidence level: 99% with $Z = 2,575$

e: Maximum error margin allowed (e.g. 3%)

p: Expected proportion.

According to INEGI data, in the state of Colima the business register amounts to 34,955 companies, of those 34,955 companies only 1,343 are companies with more than 10 workers. According to a pilot sampling of 70 companies, a reliable sample size of 276 companies was defined with a 95% confidence level and a 3% margin of error. A survey format was carried out to collect information according to the size of the identified sample and said surveys were carried out with companies in the state of Colima in order to gather significant information about the impact of Health and Safety in the region, how often inspections and accidents at work have been had and how complex are the administration of legal requirements. All the data collected also constitute a quantitative support for the development and design of the automated process for self-management of industrial safety. Table 1 shows the distribution of the different drafts in the companies surveyed in the state of Colima.

Table- I: Distribution of drafts in the companies surveyed in the state of Colima

Business sector	Quintito
Building	87
Services	46
Commercial	41
Food	37
Material Handling	17
Automotive	12
Industrial	8
Mining	4
Education	4
Renewed Plant	4
Recycling	4
Distributor Dairy	4
Others	8

III. RESULTS

According to the results of the surveys, 100% of companies agree that Industrial Safety and Health (SHI) is extremely important within their organization, it is also observed that 63% of companies in Colima invest 5 thousand pesos per month in industrial security, 24% invest between 5 and 10 thousand pesos; 7% between 10 and 20 thousand pesos per month and 6% invest more than 20 thousand pesos per month. The percentage of occurrence of accidents registered in Colima companies in 2015 is expressed as follows: 66% of them had at least one accident (corresponding to the sum of 55% + 9% + 2%), without however, it can also be seen that 60% (54% + 6%) of these companies have been audited at least once, so it can be inferred that there are companies that have had accidents despite having received audits.

When asking the companies about the collection of the information corresponding to the NOMS of the STPS, it is concluded that the majority (71%) agree that it is handled in a simple way, but they consider that validable time is wasted that could be used in another work activity, besides being a very cumbersome activity. Similar y, it was inquired about the importance of having an automated software or tool to help manage security management. In this regard, 93% of the companies surveyed agreed that it would be useful if it exists. It was asked in the same way what would be the characteristics that such software should have, to which the companies surveyed responded according to what is shown in Figure 1.

Taking into account the results obtained by the respondents applied, it is observed that most companies agree that they know the process of self-management, consider the collection of information corresponding to the NOMs of the STPS, as a simple but lost process a long time, and it becomes very cumbersome. There is agreement that they do not have references of a software or technological tool that administers and verifies said information and that they consider that such a tool can be useful, there is total consensus on this aspect and they also consider it favorable, since it facilitates the management of company information in the field of hygiene and industrial safety, in order to make compliance with the regulations established by the STPS effective, efficient, technological and sustainable; In addition to the fact that the company can have a system capable of detecting any deviation in time, evidence or performance of activities and, consequently, will be more precise in complying with the indications established by the regulations.

In addition to the aspects referred to in the previous paragraph, it is considered desirable that this tool allows customization according to the company's turned, for this purpose they make the suggestion to select the standards that apply for each type of organization, and that in the same way there is option to add some (s) other (s) that apply due to the particular situation of the same. The possibility of keeping electronic records (documents and / or photographs) as documentary evidence of each of the parameters was considered very favorable, allowing automatic registration of the compliance date when it is next. Finally, a highly valued point is the need that it be oriented to comply 100% with the requirements indicated in the safety self-management system

defined by the STPS and that it can be updated in different versions when these requirements have some modification.

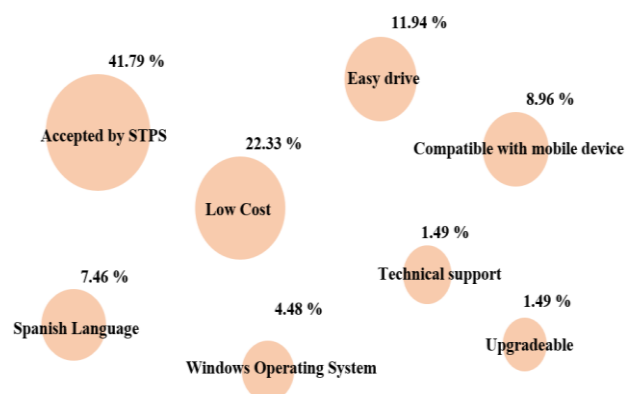


Fig. 1. Characteristics of a technological tool according to opinion of Colima companies.

In addition to the aspects referred to in the previous paragraph, it is considered desirable that this tool allows customization according to the company's turn, for this purpose they make the suggestion to select the standards that apply for each type of organization, and that in the same way there is option to add some (s) other (s) that apply due to the particular situation of the same. The possibility of keeping electronic records (documents and / or photographs) as documentary evidence of each of the parameters was considered very favorable, allowing automatic registration of the compliance date when it is next. Finally, a highly valued point is the need that it be oriented to comply 100% with the requirements indicated in the safety self-management system defined by the STPS and that it can be updated in different versions when these requirements have some modification.

Making some combination of the findings found through the application of the survey, it is considered that the technological tool for the process of self-management of occupational safety must meet the following design characteristics:

- Effectiveness in regulatory compliance responding to Mexican legal requirements according to what is stipulated in each of the NOMs that apply to the corresponding turn of the company.
- Efficiency in the administration of legal requirements so that you can know in real time what are the actions, evidences or requirements that are pending, in process or completed to give them the corresponding follow-up.
- Efficient use of the human resource minimizing the use of man hours dedicated to activities that do not add value such as document searches, selection of requirements in standards, interpretation, etc.
- Easy handling and focus on reducing errors by allowing to identify, manage, operate and manage those missing requirements on committed dates.
- Reduction of costs due to regulatory noncompliance, making it easier to use it at the time the federal labor audits are decided.
- Increase in business productivity focusing on an adequate use of the resource and facilitating decision making.

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- Minimize the use of paper promoting sustainability.
- Low cost considering that most companies spend five thousand pesos a month on security matters.
- Compatibility with mobile device and designed in the Spanish language.
- Windows operating system.

IV. CONCLUSION

The majority of small and medium-sized enterprises (MSME'S) in the state of Colima know about the Self-Management System that is available from the Ministry of Labor and Social Welfare (STPS) to increase the level of job security.

Of the MSME's in Colima, only 6% invest more than 20 thousand pesos per month in industrial security matters, since 63% of the companies surveyed only invest five thousand pesos and 24% more between five and ten thousand pesos and in the vast majority of companies surveyed (66%) if at least one work accident occurred in 2015..

According to the survey applied, 60% of the MSME'S in the state of Colima have recently been audited for safety, and 93% of them identify the need for a tool that efficiently manages or manages work safety.

Design characteristics were defined for an automated tool for the industrial safety self-management process in Mexico.

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

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