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Article

Methodology for a safe work environment

Metodología para contar con ambientes seguros de trabajo

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Abstract

This article has as its theme: "Methodology to have safe work environments" was developed to make available to the people involved in occupational safety, whether technicians or employers and have a set of well-directed actions and interacting with engineering tools will result in a safe work environment. This methodological proposal is based on the Lean 5s Tool. This tool has been successfully implemented by many professionals in different organizations, achieving an increase in labor productivity in the first instance and generating other benefits such as the reduction of occupational accidents. What is proposed in this research are short,

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medium and long term actions that comprise firstly the improvement of the organizational image of the company or work area and secondly to create in the worker a change of culture or work discipline. Since these two approaches involve all the human resources of the company and therefore the employer, all actions are of course feasible in all areas of work, generating a minimum investment in exchange for a greater benefit.
Keywords: Methodology, leam manufacturing, occupational safety, organization, organizational image, safe work

Resumen

El presente artículo tiene como tema: "Metodología para contar con ambientes seguros de trabajo" se desarrolló para poner a disposición de las personas involucradas en la seguridad laboral, ya sean técnicos o empleadores y dispongan de un conjunto de acciones bien direccionadas y que interactuando con herramientas de ingeniería se tendrá como resultado un ambiente de trabajo seguro. Esta propuesta metodológica se sustenta en la Herramienta Lean 5s. La cual ha sido implementada por muchos profesionales en distintas organizaciones de manera exitosa, logrando incrementar la productividad laboral en primera instancia y generando otros beneficios como lo es la reducción de accidentes laborales. Lo que se propone en esta investigación son acciones a corto, mediano y largo plazo que comprende primero la mejora de la imagen organizacional de la empresa o área de trabajo y en segundo lugar crear en el trabajador un cambio de cultura o disciplina laboral. Pues estos dos enfoques comprometen a todo el recurso humano de la empresa y por ende a su empleador, todas las acciones son desde luego viables en todo ámbito de trabajo, generando una mínima inversión a cambio de un mayor beneficio.
Palabras clave: Metodología, manufactura leam, seguridad laboral, organización, imagen organizacional, trabajo seguro

Introduction

Safe work environments are essential for the health and well-being of workers, as well as for the productivity and efficiency of companies. This article presents a methodology to have safe work environments, also based on the need to prevent accidents and occupational diseases, and to comply with the corresponding norms and regulations. (Céspedes Socarrás & Martínez Cumbrera, 2016; Otero Gorotiz et al., 2018; Patlán Pérez, 2020).

For Enderwick, (2018) in his research states that at the end of the Second World War, Japan had to take on a great challenge to rebuild its economy. Therefore, the manufacturing sector gave a boost to its productive matrix being necessary other strategies to improve and be more competitive. It was thus that Edward Deming was invited to participate in some conferences on continuous improvement and other topics focused on quality, becoming a great pillar for the Japanese industry, who took full advantage of these principles. With a country committed to sustainable growth, TOYOTA MOTOR CORPORATION was officially created in 1937. With the beginning of the war (1940 - 1949) its production was only of trucks, and in the period (1950 - 1959) began its worldwide expansion, being led by Mr. Toyoda Kiichiro.

For (Liker, 2021; Mohan Prasad et al., 2020; Oudhuis & Tengblad, 2022)Lean manufacturing has been considered from the beginning as a work philosophy in the automotive industry. Toyota becomes the pioneer in using the lean concept in its working methods driven by its creator, the engineer Taiichi Ohno. Today the Toyota production system is a model for all companies around the world, achieving benefits such as: increased productivity, quality improvement, waste reduction and reduction of accidents at work.

Many companies in Ecuador, in the last two decades have been very interested in the implementation of continuous improvement and with much emphasis on the application of lean tools focused on reducing waste and therefore accidents at work. The Constitution of the Republic of Ecuador "Reforms", (2008)In its third section, forms of work and its retribution, Article. 326 Lit. 5 states the following: "Everyone shall have the right to develop their work in an adequate

and conducive environment that ensures their health, integrity, safety, hygiene and welfare". In addition, this same article in paragraph 2 states: "Labor rights are inalienable and intangible. Any stipulation to the contrary shall be null and void. Therefore, it is the responsibility of every natural or legal person to enforce and comply with the provisions of the Constitution.

This right of dependent persons in Ecuador has allowed many public and private employers to provide workers with safe work, the latter being a corporate policy and most of all promulgated by the International Labor Organization (ILO). Safe work not only means providing the worker with social security coverage from the first day of work, but also that the worker carries out his/her work activities in an adequate and conducive environment, as well as being informed in an obligatory manner by the employer of the occupational hazards to which he/she will be exposed during the 8-hour workday, as established in Chapter IV of the Rights and Obligations of Workers in Art. 19 of the Andean Safety and Health Instrument of the ILO. Andean Instrument on Safety and Health at Work. DECISION 584, (2006)

It must be recognized that not all countries comply with labor safety and Ecuador is not exempt from this. According to evidence of indicators published in their yearbooks by the General Directorate of Labor Risk Insurance of the Ecuadorian Institute of Social Security (IESS). Each period the rate of occupational accidents grows, which during the period 2017 - 2021 the year 2019 is considered the highest peak in relation to occupational accidents reported to the division of risks of the IESS. These annual records are described by city and province, with Guayas leading with a high accident rate and in second place Pichincha. For international organizations such as the ILO, the root cause of these work accidents is due in a higher percentage to substandard acts and in a lower proportion to substandard conditions, the same that occur or originate in the usual workplace. For this reason it is necessary to carry out actions in the work stations.

In view of the above, the main contribution of this methodology will be to propose two fundamental steps that will allow the employer or

technician to have safe working environments and therefore will contribute to reduce accidents at work in the company and finally cause a change of culture in the worker. Leam Manufacturing represents a set of tools that contribute to continuous improvement and are easily adaptable to any production or service environment.

The structure of this research is given by an abstract, introduction, background, methodology, results, discussion and conclusions. This is expected to cover the purpose of the paper related to the methodologies given for safe work within organizations.

According to the Pan American Health Organization (PAHO, 2004), Latin America was registering between 5 and 10 percent of all occupational accidents on average. Thus, the number of accidents interrupts work for two, three and up to five days.

According to Juan Carlos Hiba, ILO consultant for Latin America and the Caribbean, stated in an interview in 2004. That when one looks at the indicators of work accidents and occupational diseases in the world these statistics are significant to the point that it has been considered that about 5000 people a day in the world are dying. And that the figures handled by the ILO are not updated and incomplete since many countries do not report occupational accidents and diseases.

Ecuador's constitution contemplates the right of workers to carry out their activities in a safe environment, and to this end provides legal regulations that leverage all the pillars of occupational safety and the order established in Art. 425 of the Constitution. Currently there is a convergence in terms of standards related to labor safety as a result of the integration of the Andean countries allowing to provide decent and safe working conditions.

Ecuador has an Inter-institutional Committee that, according to Executive Decree 2393 - 1998, is made up of the Ministry of Labor, the Ministry of Health and the Ecuadorian Institute of Social Security (IESS), as well as representatives of workers and employers. It is the employer's responsibility to maintain its facilities in good condition for safe work. To instruct its workers about the risks in the different work positions and the way and methods to prevent them.

Change for the better is a Kaisen philosophy, focused on continuous improvement, therefore companies today cannot put their investment at risk, which is why by establishing a security policy within them they are committing resources to minimize substandard acts and conditions. Achieving effectiveness in change management will depend largely on the strategies used for each leam tool to be successful, which is why it is necessary to collect the experience of some researchers as a baseline for this research.

To understand the importance of having safe work environments, it is necessary to know the key concepts related to the methodologies used for continuous improvement that can be used in work environments, as well as the norms and regulations that apply in each country. In addition, it is essential to know the background and state of the art in research on safe work environments presented by different authors such as:

Barraza & Dávila, (2008)mentions that the methodology to elaborate a continuous improvement plan is based on the third concentric sphere of Kaizen where its purpose is to eliminate waste in order to improve the quality of processes and products.

In relation to the article published by Proaño Villlavicencio et al., (2017) who describe the methodology to develop a continuous improvement plan. it consists of the analysis of the areas to be improved, defining the problems to be solved, and based on these to structure an action plan, which is formed by objectives, activities, responsible parties and management indicators that allow constant evaluation, this process must be achievable in a given period.

For Aguilera Hintelholher, (2013)in an article on Identity and differentiation between Method and Methodology, explains the distinction between methods and methodology, scientific research requires that these topics be understood as useful tools, which allow the understanding and argumentation of the different problems of study.

Vargas Crisóstomo & Camero Jiménez, (2021) in their research considered it necessary to apply an improvement strategy based on the Lean manufacturing methodology, so the Kaizen methodology and the 5s were selected.

Morles, (2002)in his research on methodology as a science and the scientific method in a polemic space, gives a non-traditional approach to methodology as a science, not only for the search for new knowledge (today's dominant approach) but as a discipline that guides to solve complex human problems of all kinds in a rational and optimal way. In this sense, it is expressed that methodology is a science with a well-defined object, rules and structure.

In addition, Proaño Villlavicencio et al., (2017)present a methodology to develop a continuous improvement plan, which consists of five levels: analysis of the causes that provoke the problem, proposal and planning of the improvement plan, implementation and continuous monitoring, and finally an evaluation of the entire methodology applied. As a result of this, there are some benefits for both the internal and external customer

Materials and methods

This exploratory study was directed to micro, small and medium enterprises located in zone 8 of the city of Guayaquil, for which a group of 40 students of the University of Guayaquil (UG), were trained to conduct field work in which each student had to locate the company in which they would develop their work which is related to their academic syllabus. The theoretical foundation of this work is based on Kaisen's philosophy of "Change for the better", transferring knowledge to an environment in which the lack of organization prevails. Therefore, this qualitative methodology is oriented to the analysis of case studies in which answers to the questions (how and why) are sought. In this research and given the nature of the methodology, we were able to count on a number of 35 companies, of which we will omit their legal or commercial names because we are not authorized to do so; but Table 1 identifies the economic activities that were used for this work as well as the number of companies by number of workers.

Table 1. *Register of work centers under study*

ECONOMIC ACTIVITIES	MICROEMPRESA	SMALL COMPANY	MEDIUM ENTERPRISE
Industrial mechanics workshop.	# of Workers: 1-9	# of workers: 10-49	# of workers: 50-99
Automotive mechanic shop	**Registered: 24**	**Registered: 10**	**Registered: 1**
Locksmith workshop	Informant: Owner or manager	Informant: Owner or Manager	Informant: Workers
Sewing workshop			
Wood craft workshops			
Food supply centers			
Aluminum and glass workshop			

As shown in Table 1, the largest number of workplaces that allowed the field study were micro and small enterprises, the only medium-sized enterprise that had access to this study is because the student was part of the internal clients of the medium-sized enterprise. As can be seen, their economic activities are related to the transformation of raw materials and therefore correspond to the manufacturing sector for the most part. This sector is considered in the field of occupational safety, of greater vulnerability for the division of labor risks of the Ecuadorian Institute of Social Security (IESS) due to the high presence of unskilled labor and that gives rise to a high rate of substandard acts that result in occupational accidents.

Once the authorization of the owner of the business or company (Natural or Legal) was obtained, the study process had to follow the following steps:
Step 1. Prepare a company resume, which should include information such as: economic activity, detailed description of the company's main process, number of employees and geographic location.
Socialize with the workstation owner and workers about the purpose of the field study and the tools to be used.
Step 3. Perform an analysis of the workstation processes for this will be done: Plant and Route Layout, Process Map, Current Process Flow Diagram, Analytical Cursogram and Process Sheet.
Identify the waste generated (MUDA, MURA and MURI).
Design a problem prioritization matrix and apply a screening tool (PARETO).
Step 6. Conduct a causal analysis of the problems of greatest impact
Step 7. Conduct a situational diagnosis

Results

After the field work carried out by the UG students at the 35 work stations following the proposed methodology, the following results were obtained, which are also shown in Table 2 and Table 3:
High: Corresponds to a rating assigned to workstations that are not committed to improving their processes.
Medium: Corresponds to a rating assigned to workstations that have little interest in making improvements to their processes.
Low: Corresponds to a rating assigned to workstations that are somewhat committed to making improvements in their processes.

Table 2. *Results of field management*

PROBLEMS DETECTED	MICROEMPRESA	SMALL COMPANY	MEDIUM ENTERPRISE
1.DO NOT HAVE MANAGEMENT SYSTEMS	ALTO	ALTO	UNDER
2. POOR ORGANIZATIONAL	ALTO	ALTO	MEDIO

IMAGE AT WORKSTATIONS			
3. LACK OF MANUALS AND WORK INSTRUCTIONS	ALTO	ALTO	ALTO
4. DISORGANIZATION IN ITS PROCESSES AND WORKING ENVIRONMENTS.	ALTO	ALTO	ALTO

With these results obtained after field management, the general purpose of which is to document the management of MSMEs at their workstations, the next step is to determine the root causes of these problems and their consequences, as described in the following table. Having identified the problems of greatest impact, the next step is to determine the root causes of these problems and their consequences as described in the following table.

Table 3. *Analysis - causes and consequences in relation to detected problems*

TYPE OF COMPANIES	CAUSES	CONSEQUENCES
MICRO ENTERPRISES	Lack of resources 2.- Ignorance of standards 3.- Human talent	- Low competitive level - Loss of customers - Labor inefficiency - Occupational hazards
SMALL COMPANY	Lack of resources 2.- Ignorance of standards 3.- Human talent	- Low competitive level - Loss of customers - Labor inefficiency - Occupational hazards
MEDIUM ENTERPRISE	Lack of resources Lack of government support 3.-Human talent	- Low competitive level - Low productivity - Low effectiveness in its processes - Occupational hazards

With these results obtained: Lack of resources, lack of knowledge of standards and poor selection process of their workers has resulted in a low level of competitiveness in the current market, which limits the number of their customers allowing them to serve their work

sector, the failure to comply with their work orders and the lack of quality of their processes leads to this sector considered highly vulnerable, to be unsuccessful in their management.

Discussion

Taking into account the results obtained from the field study, it is concluded that these economic sectors require prompt attention to prevent them from disappearing with the passage of time, therefore, being their current situation completely critical, it is necessary to intervene through public or private organizations that can provide free advice to improve their management.

The study group raises the need to implement a Lean tool, 5s. After the experiences of many organizations in the world on the benefits granted in the application of 5s, there is full confidence that its implementation will allow the following benefits: Improve the organizational image, Create a culture of quality and make the most of the resources achieving safe working environments.

The field work in general terms shows that these micro-companies maintain a high rate of work accidents according to IESS statistics, in the companies under study it is concluded that the main cause is the lack of resources and in second place the lack of knowledge of the legal norms in the matter of labor safety. To this end, the need to leave in the hands of each one of them a chet list of the management that should be done to raise awareness in the worker about occupational safety and its importance within their scenarios was raised, at the same time the existing employer responsibility within the legal framework in case of non-compliance with the regulations was detailed. Applying leam tools to have safe work processes and environments will require each employer to progressively allocate resources to generate the recommended actions, therefore these results will be seen in the short and medium term.

The results obtained through the implementation of the methodology presented demonstrate a significant decrease in the incidence of occupational accidents and occupational diseases expressed in the accident rates of the organizations. In addition, the implementation

of preventive measures improves the productivity and efficiency of the companies, which translates into economic benefits for them. The discussion of the results focuses on the importance of the identification of occupational risks and the implementation of preventive measures in order to have safe work environments.

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