MAGAZINE INCAING
ISSN 2448 9131

Development of a manual of good practices for sawmills with a view to the safety and health of workers

Marco Vinicio Félix[1, *], Benjamín Villalvazo R[2], Celerino Mendoza A[3], Maribel Robles G[4] José Luis Ceja Anaya[5]
Tecnológico Mario Molina, Campus Mascota. Ameca - Mascota Km 100, Chan Rey, (CP 46900) Jalisco, Jal. Tecmm.edu.mx
1,2,3,5: teachers of the Tecnológico Mario Molina, Campus Mascota.
4: student of the Tecnológico Mario Molina, Industrial Engineering Career, Campus Mascota.
*Corresponding author: marco.felix@mascota.tecmm.edu.mx

Summary – Job security in the workplace is required not only by the federal laws of Mexico but is also required from a socially responsible business **philosophy. Safety and productivity are two closely** linked **industrial concepts, although not always recognized in this way. The risks and occurrence of accidents that take place in** productive **activities, and in particular, in the sawmills of the Sierra Occidental region of Jalisco, require a** governmental commitment and **responsibility of the sector private to strengthen the safety and health of workers. At the Tecnológico Mario Molina, Campus Mascota (located in the geographical region of this study), during the courses** Research **Workshop I and II, research inspired by** the work environment was developed in the local and **regional sawmills that led to the development of a Manual of Good Hygiene and Safety Practices linked to NOM-008-STPS-2013. This manual** aims to inform and prevent**workers of the risks arising from activities within sawmill workplaces and of the effective preventive measures** to **be applied to avoid any type of accident. It is developed with the firm will** to **be an effective and practical tool** to manage **to** modify incorrect**behaviors and control**unsafe conditions in the **different jobs. The implementation of this manual is** a **factor in an effective re-management of productive practices in the region where this** study was carried **out, and surely, its application in other regions with forestry activity where it is necessary to rethink the organization of production.**

Keywords - Community **forestry companies, NOM-008- STPS-2013, Occupational prevention in sawmills,** Occupational Health **and Safety.**

I. INTRODUCTION

The Sierra Occidental de Jalisco presenta como una of its main productive vocations the forestry industry. The figures of the national forest production of recent years, place Jalisco among the first five states with the highest maximum production, contributing around 9% of the national production [1]. This economic activity represents a contribution to the state GDP in a small percentage compared to the quantities of wood that are processed in a primary way. In the region of interest of this research, the productive practices of the primary wood processing units, commonly known as sawmills and formally as community forestry enterprises (CFEs), were considered. These types of companies have meant collectivist economies based on the extraction and primary transformation of forest raw materials. It has been estimated that CFEs generate between 25 000 and 30 000 permanent and temporary jobs in their sawmills and small secondary industrialfactories in the country [2]. These activities generate permanent and temporary jobs in its sawmills and small factories of secondary products in the state of Jalisco.

It is important to mention that it can be directly observed that the safety and hygiene measures in the wood processing work centers are unsatisfactory since they do not have the adaptations relevant or equipment to safeguard the integrity of workers.

It is clear that the incorporation of good production practices is undervalued by regional EFCs that are reluctant to invest in modern and safe equipment. In this sense, what was expressed by Navarro et al. [3], who states that, in current companies, the largest

Business growth results are obtained by focusing changes towards the incorporation of technologies and the improvement of the capabilities of its human resources, a result that is essential to improve the productivity and competitiveness in companies.

Likewise, Sáez de Viteri Arranz [4], emphasizes that companies that recognize and value their human resources with their productive capacities and practices, are more competitive in the long term.

In reference to the disadvantages and limitations existing at the managerial level in sawmills, Tañski et al., express the need for profound attitudinal changes in the owners, to enable more dynamic management processes that allow to face an increasingly unstable and volatile market, to the possibility. The incorporation of new competitors in the timber sector [5].

It is possible to affirm that the forestry companies of the Sierra Occidental region of Jalisco are reorganizing and migrating towards a community-corporate model that applies business competitiveness tools to reduce the physical-psychological risks in their workforce, while seeking the decrease in production costs. In this way you can get the increase in productivity and job security at the same time. This research assumes that guaranteeing occupational safety in the workplace favors the productivity and competitiveness of companies,due to the recognition and care of humanresources.

It is of vital importance to clarify that the analysis carried out for the elaboration of this manual is based on the Official Mexican STANDARD NOM-008-STPS-2013[6] that relates to the activities, requirements and conditions of safety and health at work to prevent risks to workers who develop activities of profiteery or timber forestry and in storage and processing centres in their primary activity.

The purpose of the manual prepared is to be useful for the development of preventive policies in the workplace with a permanent training support for workers.

Moreover, it is a practical guide for the prevention, protection and promotion of health and safety at work. This manual is composed of 8 sections, which are described in a flowchart. This breaks down each activity carried out in the sawmillinto3 blocks. The first block contains the risks to which workers are exposed when carrying out the activity. The second block suggests the good practices with which operators should work, as well as the protective equipment that is required for each activity and finally, the third block exposes compliance or not. compliance with each of the activities in accordance with NOM-008-STPS-2013. This standard is based on this rule since it is mandatory in all work centers where timber and sawmill forest harvesting activities are carried out, since it establishes safety conditions for the protection of workers against the risks of the place.

II. WORK METHODOLOGY

A. Method L. E.S.T.

The aim of this method is to assess all factors relating to the content of work that may have an impact on the health and even personal lives of workers. The main contribution of the Method of Analysis of Working Conditions developed by F. Guélaud, M.N. Beauchesne, J. Gautrat and G. Roustang, members of the Laboratoire de Economie et Sociologie du Travail (L.E.S.T.), of the C.N.R.S., in Aix -en- Provence,is that it allows toquantify, and consequently measure, variables that are often treated as un objective way [7].

To determine the diagnosis, the method considers 16 variables grouped into 5 aspects (dimensions): physical environment, physical load, mental load,psychosocial aspects **and** working time. The evaluation is based on the scores obtained for each of the 16 variables considered [8].

The method is of a global nature considering each aspect of the job in a general way, and it is a good method to obtain a first assessment of the position that will allow to establish if a deeper analysis is required with other more specific methods. The L.E.S.T. method is intended to be a tool that serves to improve the working conditions of a particular position or a set of positions considered in a globalized way. It should also be noted that it is a method that does not require specialized knowledge for its application and that it is designed to involve all the personnel involved in all phases of the process.

To this end, it has an Observation Guide that, quantifying the information collected to the maximum,guarantees the greatest possible objectivity, so that the results obtained in a specific situation are independent of the person who applies the method. The observation guide is a questionnaire containing a description of the task, a series of questions as indicators that refer to 16 variables (numbered from 1 to 16), grouped into 5 blocks of information (A, B, C, D and E), related to the job and a breve companyquestionnaire.

TABLE 1
OBSERVATION GUIDE FOR JOB EVALUATION

TASK DESCRIPTION

Try to reflect as accurate a description as possible of the task performed by the operator at his or her job before addressing each of the tasks in detail.
elements of their working conditions.

A. PHYSICAL ENVIRONMENT

1. Thermal environment:
- -Temperature in the workplace.
- -Level of effort of the worker in performing a task.
- -Exposure time to the temperature of the stall.
- -Temperature variations if the worker moves.
- -Handling of materials (hot or cold) and use of means of protection.

2. Noise:
- -Global sound level.
- -Sound level by frequency band.
- - Impact noises.

3. Lighting:
- - Lighting level in the workplace.
- -General lighting level.
- -Degree of contrast between the object to be observed and the background.
- - Glare.
- - Type of lighting (artificial, natural).

4. Vibrations:
- - Frequency, amplitude and duration of the same.

B. PHYSICAL LOAD

5. Static charge:
- - Postures and duration of the same in the development of the task.

6. Dynamic loading:
- -Expenditure on Kcal/day.
- -Sex.

C. MENTAL LOAD

7. Time constraint: (Repetitive work)
- -Mode of remuneration (fixed salary, premium, etc.).
- -Chain work or not.
- - Number of breaks during the working day.
- - Obligation to recover or not the Delays.

7. Time constraint: (Non-repetitive work) In addition to repetitive work:
- -Possibility of being absent from the work post.
- -Possibility to stop the machine.

8. Complexity-speed:
- - Average duration of each operation.
- - Duration of each cycle.
- - Number of elections by cycle.

9. Attention: (Repetitive work)
- - Level of care required.
- - Duration and continuity of care.
- - Risks of accidents, frequency and severity of them.
- - Possibility of rejection of the product.
- - Possibility to talk to colleagues.
- - Possibility of distracting the eye and for how long.
- - Risk of deterioration of the material.
- - Value of the parts or product.
- - Physical characteristics of the

9. Attention: (Non-repetitive work) In addition to repetitive work:
- - Number of machines to watch.
- - Average number of signals per machine.
- - Duration of interventions.
- - Nº of interventions.

10. Thoroughness:
- - Level of perception of details.
- - The dimension of objects.

D. PSYCHOSOCIAL ASPECTS

11. Initiative:
- - Possibility of organizing the operator his work.
- - Possibility to control the rhythm (self-control).
- - Possibility to retouch parts.
- - Possibility to regulate the machine.
- - Possibility of intervening in case of incident.

12. Status social:
- - Duration of learning.
- - Level of training required for the position.

13. Communications:
- - Possibility to talk to colleagues.
- - Possibility to move.
- - Number of people nearby.

14. Cooperation:
- - Types of labour relations (cooperative, functional, hierarchical).
- - Frequency of relationships.

15. Identification with the product:
- - Situation of the worker in the production process.
- - Importance of the transformation carried out on the part or product.

E. WORKING TIME

16. Working time:
- - Type of schedule (fixed, shifts, etc.).

Weekly duration of work.

B . Evaluation

The evaluation is based on the scores obtained for each of the 16 variables considered in the observation guide. The data relating to the description of the task and the question of the company, although not valued, serve as a support tool for the overall description of the job observed and to facilitate analysis and discussion.

III. RESULTS

The results obtained can be evidenced in the elaboration of the manual of good productive practices in sawmills. This manual is being considered for official registration. These results can be presented as the application of the L.E.S.T. methodology for the realization of the manual, together with the consideration of application of the NOM-008-STPS-2013 standard. One of the main advantages of the method is

which allows to obtain a score for each of the variables studied. In this sense, it proposes an assessment between 0 and 10 that determines the situation of the position or group of jobs in relation to each of the variables and that corresponds to the following criteria:

TABLE 2

SCORING SYSTEM FOR THE EVALUATION OF THEASPECTS CONSIDERED IN THE GUIDE OF OBSERVATION

SCORING SYSTEM	
0, 1, 2	Satisfactory situation.
3, 4, 5	Weak discomfort. Some improvements could bring more comfort to the worker.
6, 7	Medium discomfort. There is a risk of fatigue.
8, 9, 10	Strong discomfort. Fatigue. Harmfulness.

C OMPANY QUESTIONNAIRE

General information about the company regarding the date of construction of the premises, sanitary equipment, social equipment, organization of schedules and maintenance (cleaning) of the various parts of the company.

These assessment criteria do not correspond to existing legislation on the subject; since for most of the variables studied there are no reference values, they are based on specific scientific studies and aim to be an internal instrument to the company to enable an improvement in working conditions.

A. Measuring devices

The following instrumental equipment should be used when taking measurements:

- Anemometer to measure air velocity.
- Psychometer to measure dry and wet temperature.
- Sound level meter to measure noise levels.
- Luxometer to measure lighting levels.

- Stopwatch to measure cycle times, postures, etc.
- Tape measure to measure displacements, heights, etc.

B. Graphical analysis of the data obtained

Through the assessment tables provided by the method, all the parameters reviewed are quantified according to the established scores, which are likely to be reflected in bar diagrams or histograms.

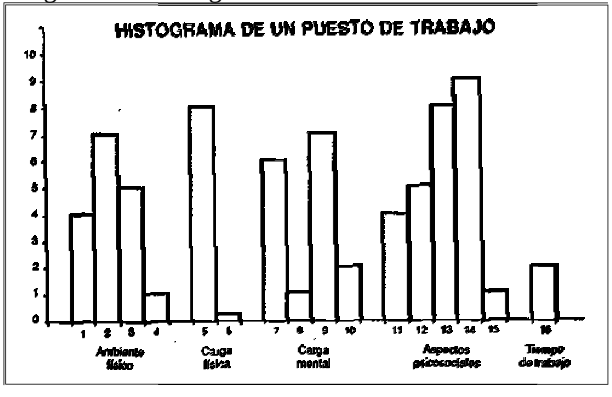

Figure 1. representation of job evaluations by means of a frequency histogram.

This graphic representation in the form of a histogram allows to have a quick view of the working conditions and thus establish a first diagnosis.

In a second phase you can study each job within the whole section, the departamento, or the company.

Centro de trabajo / Departamento / Nº de operarios		Entorno Físico				Carga Física		Carga Mental				Aspectos Psicosociales					Tiempos
PUESTO DE TRABAJO	Operarios	Ambiente Térmico	Ruido	Iluminación	Vibración	Postura	Carga Dinámica	Apremio Tiempo	Complej.- Rapidez	Atención	Minuciosidad	Iniciativa	Status Social	Comunicacion	Cooperación	Identif. Producto	
Total Depart.																	
Promedio																	

Figure 2. Evaluation table of jobs in a global and comparative environment.

in this tab the different ones are considered simultaneously elements that have been observed for a whole set of Posts of work the What Allows know which sound the more unfavourable elements of working conditions in globalized form and, thus, establish priorities when it comes to intervene envelope thes Different factors observed.

IV. CONCLUSIONS

The conjunction of the L.E.S.T. method for the evaluation of jobs, with the application of NOM-008-STPS- 2013 to the observation of productive practices in the sawmills of the Sierra Occidental region of Jalisco, leads to the elaboration of a hygiene manual and occupational safety. Currently, the digital manual is ready to be printed and officially registered.

A qualitative observation of production practices was carried out to make an adequate assessment of sawmills, based on NOM-008-STPS-2013 which establishes the requirements and conditions of safety and health at work.

The results of this research work represent a contribution to any process that is oriented to technological management in the field of small sawmills, from a strategic perspective of the business, using and improving its technology, so that it enables greater productive efficiency of the establishment and contributes to a better competitive positioning in the market.

V. REFERENCES

[1] Territorial ecological planning of the state of Jalisco. http://siga.jalisco.gob.mx/moet/Forestal/secfoja(URL).

[2] Manual of good practices in sawmills of forest communities. Barrera Juan Manuel et al, CCMSS, Mexico 2010.

[3] Study on technological and knowledge management in an organization, Navarro et al, Revista Venezolana de Gerencia, year 11, number 34 (2006).

[4] The competitive potential of the company: resources, routines and value-added processes. Sáez de Viteri Arranz, European Research in Business Management and Economics, Vol. 6, number 3 (2000).

[5] Analysis of capacities that can contribute to the strategic thinking of entrepreneurs who own small sawmills: study of cas in Misiones, Argentina. Mario José Mantulak et al; XXI Research Conference (2012).

[6] Official Mexican STANDARD NOM-008-STPS-2013. Timber harvesting activities and in storage and processing centres in their primary activity-Conditions of safety and health at work. Secretaría del Trabajo y Previsión Social, Diario Oficial (31 October 2013).

[7] NTP175 Evaluation of working conditions: the L.E.S.T. method, Ministry of Labour and Social Affairs of Spain, editor Francisco Pérez Morral, 1987.

[8] Diego-Mas, Jose Antonio. Global ergonomic analysis using the LEST method. Ergonautas, Polytechnic University of Valencia, 2015.

ANNEX´S

Annex 1. Cover of the manual

Annex 2. Contents and contents of the manual

INDICE

INDICE DE ANEXOS

INDICE DE TABLAS

THANKS

The support of the Mario Molina Technological Institute, Campus Mascota, as well as the management and work plant of the sawmill "Los Volcanes" which contributed substantially to the achievement of this research project is appreciated.