

## Occupational risks in a manufacturing company, a case study in Mexico

### Riesgos laborales en una empresa manufacturera, un caso de estudio en México

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#### Abstract

The objective of this investigation was to recognize the occupational hazards to which operators in the manufacturing production area are exposed in order to subsequently seek to establish a safety program. Carrying out the collection of information through semi-structured interviews, to later collect and find the frequency of the most recurrent words, with the subjective point of view. The result was to find that the operators most recognize the risks in the mechanical category, representing 23.07%, while the ergonomic risk category is the lowest with 3.84% together with the chemical one. Concluding that, although the risks that are identified have not been registered as accidents, it is necessary to design preventive measures to avoid possible disabling accidents or be classified as an accident at work.

**Occupational risks, Manufacture, Occupational Safety**

#### Resumen

El objetivo de esta investigación fue realizar el reconocimiento de los riesgos laborales a los que se encuentran expuestos los operadores del área de producción manufacturera con el fin de buscar posteriormente establecer un programa de seguridad. Realizando la recolección de información por medio de entrevistas semiestructuradas, para posterior recolectar y encontrar la frecuencia de las palabras más recurrentes, con el punto de vista subjetivo. El resultado fue encontrar que los operadores reconocen mayormente los riesgos en la categoría de mecánico al representar un 23.07%, mientras que la categoría del riesgo ergonómico es el menor con 3.84% en conjunto con el químico. Concluyendo que, si bien los riesgos que se identifican no han sido registrados como accidentes, es necesario diseñar medidas preventivas para evitar posibles accidentes incapacitantes o ser clasificados como accidente laboral.

**Riesgo laboral, Manufactura, Seguridad Industrial**

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## 1. Introduction

According to the type of work, there are different types of occupational risks, also contributing to precarious jobs as it is said in Mexico, as mentioned by the authors Berumen-Rodriguez *et al.* (2020), these risks are due to the conditions to which workers are exposed.

Occupational accidents are a very important issue for all companies, since they can affect the image or reputation of the company; however, in order to avoid or predict these accidents, an analysis of the existing risks in the company can be carried out in such a way that they can be reduced (Dhalmahapatra *et al.*, 2022). Risk analysis is said to be the first step to be able to establish preventive measures that allow to have a safety system according to the company (Liu *et al.*, 2023), defining the safety system as a tool that allows to inspect and coordinate the risks found in the context of the company.

Although there are defined methods for risk analysis as observed in the regulations applicable in each sector, when starting activities of the company as mentioned in the Federal Labor Law (General Secretariat, 2021), however, there is no specific mention when talking about a company with an existing safety system, so this research aims to give an option on how to identify risks through a descriptive qualitative method, in a Mexican manufacturing company, which allows considering the operators involved in the production processes that are in daily contact.

### 1.1. Factors related to occupational accidents

Recognizing the factors that are related to accidents is imperative to examine those that may occur in the context of the organization as presented below.

The authors Khoshakhlagh *et al.* (2021) conducted a study on work climate and the relationship between accidents, which he classified as experienced and inexperienced in accidents, also work stress (instability between a person's capabilities and job demand) which is divided into physical and psychological stress, drafting the author that 37% of industrial accidents and injuries is caused by stress, such as injuries suffered by firefighters when exposed to high stress according to Kim *et al.* (2016)

While safety climate is composed of management commitment and competence, and workers' commitment to safety and prioritizing risk acceptance. Some researches resulted that stress influences organizational work and responsibility, therefore, low level of job stress and high social support in the workplace can increase commitment paraphrases the author of Haque and Aston (2016). They conclude that having job satisfaction is a relevant element for stress, while a positive safety climate is related to job satisfaction and risk perception, so the information collected in this study shows great relevance in putting together the effective factors that are related to accidents.

In South Korea, to reduce the factors that can cause falls, slips and injuries, an "intensity analysis" of the root cause is performed, because smart technology and robots are immersed in the activities and sometimes it is difficult to minimize fatal accidents due to the complexity. Identifying the sectors with the highest number of accidents were service, construction and manufacturing industries, for this reason the authors Kang *et al.*, (2021) classified the main factors of accidents in the study company in South Korea from these sectors in a "modern root cause representation", where inconsistency, disregard, ignorance, recklessness were recognized as having a higher rate of occupational accidents, while error of judgment, lack of knowledge or awareness, inadequate facility standards, insufficient training, stress, insufficient safety controls in facilities and temporary construction equipment are the best rated, therefore, they suggest promoting an occupational safety and health education plan as well as an equipment lockout system in the context of small and medium-sized enterprises in South Korea.

On the other hand, the authors Kim *et al.* (2021) identified that the main causes of accidents were not stopping the operation of the machine when noticing the presence of workers at the time of maintenance and turning on the equipment as non-routine activities by the company. The accidents also arise from variables identified as fatigue or tiredness causing changes in the use of people's resources, each person has a fatigue limit so that each body may or may not resist fatigue. Fatigue is defined by Norman (1999) as a person's lack of capacity for response or action.

Prolonged working hours can cause stress and is related to fatigue, which causes health problems, also according to the study shows that fatigue can be produced by a high relationship between social support and work demand, also showed that stress and social situation at work affect the quality and lack of sleep (Tàpia-Caballero *et al.*, 2021).

### 1.2. Safety program

A safety program implemented in a company will allow to decrease accidents or risks that are present, however, it can also be difficult to implement one, for example, a study proposed by Arbin *et al.* (2021) explain why workers would put resistance to a safety system with subtle actions such as lack of compliance in tasks or safety actions in which it is necessary to contemplate the context of which they are surrounded, sometimes some literature authors summarize that it is the culture of the worker or collective, such as accountability (taking responsibility for actions).

In addition, the aforementioned authors identified the following factors that allow or not the success of a safety program: labor identity (how to act before norms or rules imposed by the company to fulfill the role of worker), facilitation (implement the system of safety and health at work in a way that will not affect production and recognize how to do an activity properly without accidents), visibility (present the system to everyone in the company and accept the opinions to help the system to improve). Concluding that these are the variables that are presented in the resistance on the part of workers when considering implementing a safety system or program (Arbin *et al.*, 2021).

### 2. Methodology to be developed

Using a qualitative method of the descriptive type, semi-structured interviews were applied, which allow the approach and interaction with people having a purpose in the conversation (Ríos Martínez, 2019), the workers of the production area participated, also the direct bosses, the questions asked were: 1) Have they taken any safety course in the company? and 2) What are the risks to which they are exposed?

The purpose of these questions was to make a diagnosis of the safety situation and identify the risks to which they are exposed and whether they recognize them as such

### 3. Sample

The research was carried out in a metal-mechanical company that manufactures automobile parts, in the production areas of cementing, stamping, welding, maintenance and stamping, with a total of 57 people, including operators and supervisors in each area.

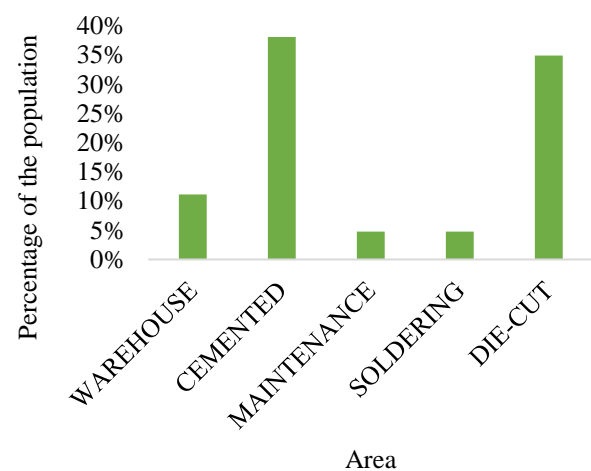
### 4. Data Collection

Data were collected on the company, such as the number of people in each area. The use of semi-structured interviews is a tool in qualitative studies (Merriam & Tisdell, 2015).

The design of the semi-structured interviews will help to review the understanding of the immediate bosses about safety issues, as well as to recognize the awareness they have about the risks they are exposed to, since the safety measures were established more than 10 years ago. The answers were counterbalanced to find a standard as suggested by author Yin (2018) and thus be able to define the variables applicable to the company on the topic of safety.

### 5. Results

The number of people that each production area has is shown in Graph 1, for which 42% of the sample is in the cementing area, while 39% is in the die-cutting area.

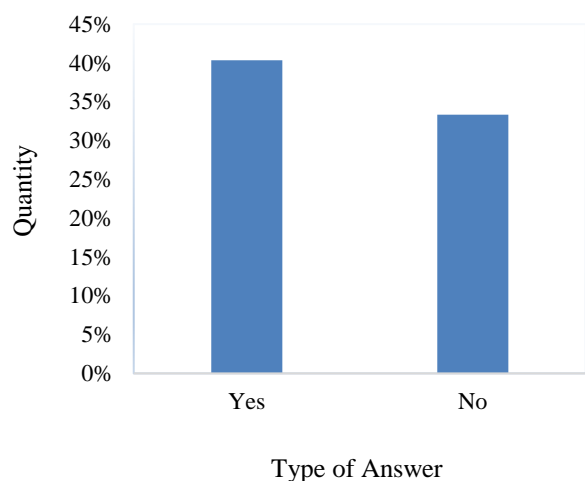


**Graph 1** Graph of the number of people in the production area

Source: Own Elaboration, data provided by the company, 2022

It can also be observed that the area where there are fewer personnel is in welding and assembly, therefore, the high production processes where more attention must be paid is where work is performed on heavy machinery.

For the answer to the first question, regarding any course taken on the subject of safety, Graph 2 below shows that only two responses were considered:



**Graph 2** People who have taken a safety course.

Source: Own Elaboration, 2022

As can be seen in the graph, 40% of the participants confirmed having taken some safety course, however, those who responded negatively contain people with a seniority of 5 to 10 years, because in the interview they responded that they did not perceive that the training taken was related to the safety of their activities.

The topics that most of the personnel mentioned having seen were: how to handle a forklift and self-safety.

Below is a diagram showing the answers given by the operators to question number 2, What are the risks to which they are exposed, this from an empirical point of view, the answers are shown in Figure 3 below:



**Figure 3** Risks identified by the workers

Source: Own Elaboration, 2022

In the following table, according to the literature, it is advisable to classify them by mechanical, physical, ergonomic and chemical risk, as shown below:

Risk category	Risk identified by workers	Frequency %
Physicist	Burns	9.61%
	Cuts	11.53%
	Falls of material or tools and slipping falls	25%
Ergonomic	Injuring your back	3.84%
Chemist	Solvent splash on the face	23.07%
	Eye irritation from chemicals	3.84%
Mechanic	Crushing of hands and fingers	23.07%

**Table 1** Classification of risks identified by personnel

Source: Own Elaboration, 2022

Then the above indicates that the risks identified by the operators in the company are in the category of physical risk followed by chemical risk, having 2 or more risks mentioned by the operators, according to the interview responses most of the workers recognize these risks because, at some point they were present in an accident or some unfortunate event happened to them.

Also the risk that was less identified, the ergonomic risk, according to the interviews, is due to the fact that few people load boxes or heavy material, since they are in the warehouse area. In addition to using support equipment such as skates or forklifts.

## 6. Discussions

To observe how the process of risk perception is, it should be taken into consideration that it starts with the interaction of people and the activities they perform daily (Castillo, 2013), agreeing with what Znajmiecka Sikora & Sałagacka (2022) mentions, the older the worker is, the more positive attitudes to take care of themselves increase due to the acquired experience.

The interviews conducted were structured in two parts, one focused on recognizing how they identify or understand a risk in their area, due to the fact that risk perception is an open process that can come from one's own knowledge or character, therefore, the perception has to consider the human being as a person who has faith, stereotypes, qualities and own stimulations as mentioned by Alonso Morillejo & Pozo Muñoz (2002). While the second part of the interview is to recognize if the training provided by the company gives them a different perception of security.

The way in which each person understands risk is very important because this is how self-care will be sought, in addition, operators perceive that a risk is "when we put our person and health at risk with the activities we do" (Operator 38, 2022), which is very close to the definition mentioned in the Federal Labor Law (General Secretariat, 2021).

Risk perception, according to Vera Calzaretta *et al.* (2010) is found at two levels: the first, empirical, which arises from an experience of risk and the second, natural, from the social point of view, i.e., that which we are taught as dangerous since our childhood. For this reason, the risks identified in the area (Figure 3) by the workers are perceived and understood from the empirical point of view, since they arise from the experience of each individual, because they have had the experience of seeing an accident or having suffered one.

The concept of risk perception, as mentioned above, has a wide field, since it is studied from various points of science (Carbonell-Siam & Torres-Valle, 2010). For this reason, this work was carried out from the subjective risk, considering the point of view of each of those involved in the area.

Likewise, it is said that the perception of risk, although it is different for men and women, the existence of theories that try to understand this interprets that people are exposed to risks for two reasons: the first is an objective such as satisfying a need, the second can be related to a pleasurable stimulation.

The way of receiving training is superficial according to the response of the operators, but training with veteran personnel to learn good practices and avoid accidents, is only a part not contemplated, since the operators do not perceive this training as a safety issue coinciding with what the authors Goodbrand *et al.* mention, (2021), it is also worth mentioning that incidents in a company are always latent, due to working with the human factor, for that reason the author Ahumada Villafaña *et al.* (2019) also supports understanding and investigating through interviews with personnel to recognize the risk and their point of view.

## 7. Acknowledgement

We are grateful for the support from CONACYT that made this possible, as well as to the University of the National Polytechnic Institute, UPIICSA, for its approach to the company and for being able to collect the information.

## 8. Conclusions

The risks obtained from an empirical point of view based on the experience of each operator, made it possible to identify those that, despite having preventive measures in the operational area, the operators continue to be aware of in their activities.

Having the point of view of the workers will also allow them to feel heard so that they can express those incidents or accidents that, because they are minimal, are not considered dangerous; however, it is necessary to take measures, as is the case with the splashing of solvents on the face, which, although they do not exist in the company's records, have happened and adequate measures have not been taken. This work opens the way for a more in-depth study of each risk identified and thus avoid incidents that could later become disabling accidents.

In addition, a deficient training on safety issues specific to the activities performed was noted, since, although several operators have been trained, they do not see the relationship between safety and their work.

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