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ANALYSIS AND IDENTIFICATION OF COMMON ACCIDENTS AND INCIDENTS IN MOZAMBICAN ORGANIZATIONS

EDSON NARCISO SIMAO

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ANALYSIS AND IDENTIFICATION OF COMMON INCIDENTS AND ACCIDENTS IN MOZAMBICAN ORGANIZATIONS.

Master's dissertation in Health, Safety and Environment Engineering, course of the Chemical Engineering Department of the Eduardo Mondlane University in cooperation with Troyes Technological University, as a requirement for obtaining the Master's degree

EDSON NARCISO SIMÃO

Professors:

Dr Raed Kouta

Dr Marcelino Rodrigues

Supervisor:

Dr Borges Chambal

Context

The present work is prepared with the perspective of identifying weaknesses in the Occupational Health sector in public and private organizations in Mozambique, with the aim to provide reliable solutions to the Mozambican reality.

Among several issues discussed related to Occupational Health and Safety, the main topic fall in the assessment of accidents and incidents in Mozambican organizations. It also demonstrates how implementing the occupational health system can contribute in preventing accidents and diseases, making all employees and visitors aware of hazard situations.

Abstract

Hygiene, Health, Safety and Environment are crosscutting issues that covers various parts of engineering and other sciences. Mozambique, in addition being a developing country, a fact that places the country with a level of perception of occupational safety unfavorable in relation to developed countries, conduct the country to a deficiency in terms of commitment and assessment of realistic data. This weak perception raised the need to contribute to the awareness on the accidents that have been occurring and their consequences. Deficiencies were detected in the system for data collection in relation to the number of accidents that occurred in Mozambique, lack of communication with public and private institutions, a fact that negatively influences the assessment of the realistic number of accidents.

The study attempted to inventory public and private institutions for the data collection and sought to provide a more realistic quantitative method. Thus, the study also aimed to contribute to the search for more realistic data.

The objective of the study was to analyze among the accidents that occurred, the associated risks and to know which are the most common in the Mozambican workplace.

Special attention was paid to accident prevention and possible risk reductions. It was also verified the extent to which companies are committed to occupational safety and also the identification of the most common factors that play an important role. On the other hand, an assessment was also carried out on the accuracy in the delivering of annual reports on safety.

The data presented in this report clearly show that the number of accidents in Mozambique is higher than published. Therefore, it is recommended that the Mozambican government works with hospitals and private organizations to collect accurate data.

Key Words: **Environment, Employee, Accident, Training, Risks**

Table List

List of Acronyms

INCAF: Continuous survey of households

HSE: Health and Safety Environment

OHS: Occupational Health and Safety

CP: Competent Person

PPE: Personal Protective Equipment

GLI: General Labor Inspection

FTA: Fault Tree Analysis

FMEA: Failure Mode and Effect Analysis:

FMECA: Failure Mode, Effects and Criticality Analysis

PHA: Preliminary Hazard Analysis

HPIP: Human Performance Investigation Process

MORT: Management Oversight And Risk Tree

SRP: Savannah River Plant

QFD: Quality Function Deployment

SOC: Safety Operational Centre

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1 INTRODUCTION

The topic of Occupational Health and Safety is relatively new for Mozambique; however, many workers suffer accidents and lose their work activities. The present work arises from the perspective of analyzing the frequency of accidents reported in Mozambique and analyzing how companies have positioned in terms of occupational safety and the implementation of ISO45001 and also the treatment given to accident reporting.

This work addresses issues related to the most common accidents and incidents in Mozambique. Around the theme, the project brings a vision about the Mozambican problem in relation to the methods used to report accidents.

The gap between the way accidents are treated and the notion of the implications of unsafe work becomes visible in this report. In this way, this work not only identifies the most common accidents, but also makes the reader better aware by seeking concepts that already exist in the literature in order to take a more responsible position in the face of dangerous situations or situations that can expose both companies and employees.

With the identification of the most common accidents in Mozambique, the present work seeks to contribute not only in terms of data but also to the crucial institutions that the Labor Inspection can effectively coordinate for better data collection and subsequent data analysis.

An accident is an unforeseen occurrence that happens during the working activities and causes physical injury or compromises the physical capacity of the employee. It can be avoided when the HSE professional or department is aware of the danger situations and committed with HSE culture and procedures. The accident can also affect the company's equipment or affect the company in other aspects, while, an incident is an unexpected occurrence that is milder than an accident, which has no significant consequences for either party, the employee or the company.

1.1 General Objective

The general objective of this work is to assess the common accidents in different organizations in Mozambique, and the respective safety and hygiene practices.

1.2 Specific Objectives:

- Conduct an assessment of annual accidents and the respective implications;
- Compare the number of accidents and the size of the organization;
- Assess how companies are implementing ISO 45001;
- Verify the correlation among the most common occupational risks in different organization associated with the annual registered accidents;
- Assess the need for training in various topics Occupational Health and Safety;

1.3 Problematization

The problem is centered on identifying the most common accidents in the Mozambican workplace and also the need to compare the index on reported accidents when compared worldwide or with neighbor countries.

Taking into account the situation in which Mozambique opens up to an exploration of mineral resources, it is expected that the number of incidents be to some extent comparable to other countries that have already been exploring the mining industries.

1.4 Justification

The project was designed with the aim of contributing to a good implementation of HSE standards, especially ISO 45001 in Mozambican companies, respecting the organizational culture of each company, and of each region. It means that all these factors must be taken into consideration when analyzing Safety Environment in Mozambican organizations.

1.5 Expected Results

- Mapping regions in Mozambique by level and class of accidents.
- Understand the organizations pattern exhibiting higher level of accidents and determine the extent to which cultural, social and psychological aspects affect proper compliance of Hygiene, Health, Safety and Environment standards.
- Get insight of the applied organizational management structure and compare to, for example: the strategic vertex, the hierarchical line, the operational center, the techno-structure and the support staff.
- Correlations of common accidents with the length and frequency of exposure to dangerous situations established.

1.6 Methodology

The present work is based on a quantitative approach analyzing the performance of Mozambican organizations in the field of HSE, that is described as follows:

- A bibliographic research and literature review were carried out with contents relevant to the topic;
- An interview conducted by an online questionnaire for data collection;
- Presentation, analysis and discussion of the results obtained from the questionnaire and comparison with existing data;
- Presentation of conclusions and recommendations for future research on the topic under study.

2 THEORETICAL REFERENCE

Occupational Health and Safety is a topic of great importance and with the aim of promoting a safe and healthy work environment, it is important to differentiate these two concepts. Healthy environment is not necessarily the same as a safe environment, although healthy environment is always a safe environment, but not the opposite (Melo, 2012).

Danger is a situation that contains “a source of energy or physiological and behavioral/conduct factors that, when not controlled, lead to harmful/noxious events/occurrences”, while Risk is the probability or chance of injury or death (Shinar, Gurion and Flascher, 1991, p. 1095, apud. Grimaldi and Simonds, 1984, p. 236).

The causes of accidents for Mozambicans are directly linked to the working conditions found in many companies, ranging from physical conditions of the work environment to behavioral issues that lead workers to take inappropriate attitudes in the workplace. Both workers and companies can be the biggest culprits in a given accident, and it is necessary to develop an investigation to ascertain the facts.

The identification of common accidents in Mozambique could significantly help companies as well as workers to adopt proactive measures to avoid future accidents. Due to the problem of dealing with a new topic for most workers, it becomes necessary more work on the part of occupational health and safety professionals, investing more time for training in order to make workers and employers aware of the hazards present in the workplace.

This situation can contribute to both employees and employers be more focusing on searching for solutions for any particular hazardous event, which starts from a deep analysis of the system that interacts with several factors. Such thinking, accompanied by accident prevention methods may directly affect the company's earnings, having a positive impact on the company's economy.

The Occupational Health and Safety professionals must start developing approaches that does not focus on expenses, but on gains that the company may have by investing in a good occupational health and safety system

2.1 Safety Orientation for new employees and its importance to avoid incidents and accidents

Mozambique is a developing country and poverty is still a threat, challenging the whole society and therefore it also affects directly the HSE Practices. Because of this condition, safety practices have been seen as useless and expensive procedures or even time-consuming activities. However, the consequences of not following the HSE practices are more expensive than the proactive actions.

Therefore, the implementation of an Occupational Integrated System is seen as a way of mitigating the impact of incident in all the companies. But it is very important to mention that should be paid attention as Mozambique is an underdeveloped country.

Personal motivation is also a key factor for a good performance of employees and is directly linked to a good orientation on Occupational Safety. It is crucial to make employees aware of the concern that the organization has in respect to safety at work and, therefore, it is necessary to create an environment that keep employee well framed to safety standards.

The personal motivation can contribute to good organizational performance. In this way, the HSE officer, responsible for safety management should, therefore, orient all new workers and clearly present the organization's profile, history and effort to ensure a good working environment and also feel responsible for the other employees.

A good teamwork results not only in individual success, but in a collective success. The first good impression received from the company and the motivation are good indicators for the success of HSE.

It is the duty of the safety professional when inducing new employees to explain in detail the terms and conditions of the organization and the HSE employee responsibilities. It is important for collaborators to get clear at this point, so that uncomfortable situations are well address and where to appeal.

Employees should be aware of certain dangerous situations and know how to react toward such events. Although ISO 45001 is focused on the employees, the employees have to fulfill their obligations in respect to the company's HSE policy.

2.1.1 Competent Person role in Safety Guidance

The supervisor or competent person must be able to show that the organization has the greatest interest to keep the employees safe. In the orientation it is the ideal place to expose the company's values, and orient the employees that safety values are not negotiable.

The competent person CP must be responsible for making clear the main objective of the orientation, the goals, the expected results and the role of employees in the success of the organization. A CP can show the number of employees in the organization and how the role is distributed of each function and the dangers involved in the activities developed.

A competent person can show the number of accidents that have already occurred in the organization, the causes, the most common accidents, the places in the workplace that represent the greatest dangers. It is up to the supervisor to show the serious implications of not compliance with HSE rules and standards and how they can be a means that lead to a dangerous condition and accidents. The orientations make the employee aware of his/her importance in the organization as well as the role in society.

The CP must present all these aspects to employees so that they consciously prioritize the HSE observances. Therefore, will be able to know how to avoid and reduce risks, and also how to eliminate or communicate the existence of hazardous situations and hazards in the workplace. The CP must be able to clearly use a language that is easily absorbed by employees, so that they can apply the knowledge acquired in the orientation, for good success and make it possible to implement the standards.

2.2 Health and Safety and its Social Impact

Mozambique as a developing country, education plays a fundamental role, so most families depend on one to two family members to be able to support themselves. This phenomenon is more clearly seen in cities and in suburban areas, but according to the INCAF (Continuous Household Survey), in the study carried out in **2012/2013**, the economically active Mozambican population was **88.7 percent**.

According to data collected from **INCAF2012/2013**, the employment rate or the occupation rate in Mozambique was **61.3%**, being slightly higher among women **(62.7)** against **60.7% of men**.

According to the area of residence, the rural area presents itself as the one with the highest employment rate **(70.4%).** Therefore, there is a great concern in adopting safe work practices, for this it is necessary to identify the potential accidents, as protecting an employee is protecting the entire family.

Analyzing the fact that the economically active or working class is mostly the class with the lowest academic level and the class with high academic level being mostly unemployed or not performing some task leads to the conclusion that there is a risk in terms of absorption of information in what it concerns safety measures.

However, it is necessary to carry out the research with scientific data to verify to what extent the absorption of information is related to the academic level, and also to verify whether this relationship directly or indirectly affects occupational accidents in Mozambique.

For the case of Mozambique, the importance of education within occupational safety is verified, where it is crucial to differentiate between education and instruction, where for the case of occupational safety education is more necessary.

Education and instruction are different, education is liberating, instruction is intended to meet a certain instant need. In the case of HSE the objective is to liberate, or it is to make employees understand the importance of good HSE practices. It is not to instruct the employee to only memorize the rules but to understand and comply with them.

Instruction on one hand, make the employee only comply with the rules in front of the Health, Safety and Environment officer, this kind of phenomena makes the employee not aware of the deep importance of HSE and this behave will lead the employee not assuming as a responsibility exposing to high risks the employee as well as the company.

2.3 Accident and it’s costs

The word 'accident', according to the Aurélio Dictionary (Ferreira, 2002), is a masculine noun that means 'casual, fortuitous, unforeseen event'.

In this work, an accident is defined as a phenomenon caused by the presence of dangerous situations associated with a lack of awareness about the danger that can culminate in a fatal

accident, or that creates injuries to workers, in some situations the work accident may be associated with noncompliance with safety measures.

Occupational accidents are the enemy of the development and continuous progress of Companies and can interrupt the normal course of activities and consequently affect the economy of the company and also the economy of the country in general.

As for the costs that can impact the organization's performance as well as the employees, they can be defined as direct or indirect costs, the direct ones being the most notable and easy to quantify, the indirect ones can be 4 to 10 times more than the direct ones, the direct costs that may affect the organization may be:

- Repair or replacement of damaged equipment
- Large remuneration for work not carried out
- Indemnities
- Low production and reduced quality of services or products
- Discrepancy in teamwork

The investment in a good work policy that guarantees a safe and healthy environment is beneficial for the company as well as for employees. Specially for employees, the indirect cost can have a great negative impact, mentioning some that can be identified in the following:

- Job loss
- Family affected which can affect the education of children
- Social problems
- Mental problems
- Loss of values in medical treatment of health problems arising after the occurrence of the accident
- Disability and depression

Organizations may also incur some indirect costs such as:

- Low motivation
- Replacement of workers and waste of time looking for another worker to occupy a certain position
- Necessary training and adaptation time for the new employee
- Loss of reputation and trust with customers

As it can be seen accidents happen all over the world, for the case of Mozambique being a developing country, the perception of occupational safety may differ greatly from industrialized countries. The differences may be due to several factors such as experience in certain sectors, the lessons that industrialized countries have already had in the damage caused due to the lack of care in the HSE, the concern with quality.

The level of human development may be one of the reasons to influence the concern with safety because the level of human development comes accompanied by the level of intellectual development,

2.4 Political will and involvement

Who directly controls the accidents are the companies, in turn, the companies must report the total number of cases of occupational accidents to the competent authority that is the ministry of labor.

It is necessary for the government to adopt measures to better monitor cases of occupational accidents; this fact involves the political will of each country to be concerned with the health and safety of workers. Mozambique is a country with many challenges to face and poverty still plagues the country in various aspects, for the Health, Safety and Environment professionals.

In this project is shown the gap between the reported accidents and the occurred accidents, this should call for attention to the Ministry of labor in terms to find better paths to track the accidents.

It is a huge challenge to be able to follow the social development of the population and insert health policies HSE in the market and the workplace as HSE is itself an invasion of the existing

market, where they are faced with experienced workers with many years of experience coming to develop their activities without the care provided in HSE.

2.5 Psychology within the Health, Safety and Environment

For Mozambique it is necessary that the Health, Safety and Environment officer act as a true didactic person capable of understanding the other factors that may lead the employee not to follow the Health, Safety and Environment standards. These factors may arise from cultural, anthropological factors, social and personal, the HSE officer must always seek a balance between the objectives and goals of the company and the HSE goals. And in this work is referred the **transtheoretical model** that was used for smokers and it makes a correlation with the difficulty in assimilating some norms by the employees.

2.5.1 How the concepts of the transtheoretical model can be adopted in Health, Safety and the Environment

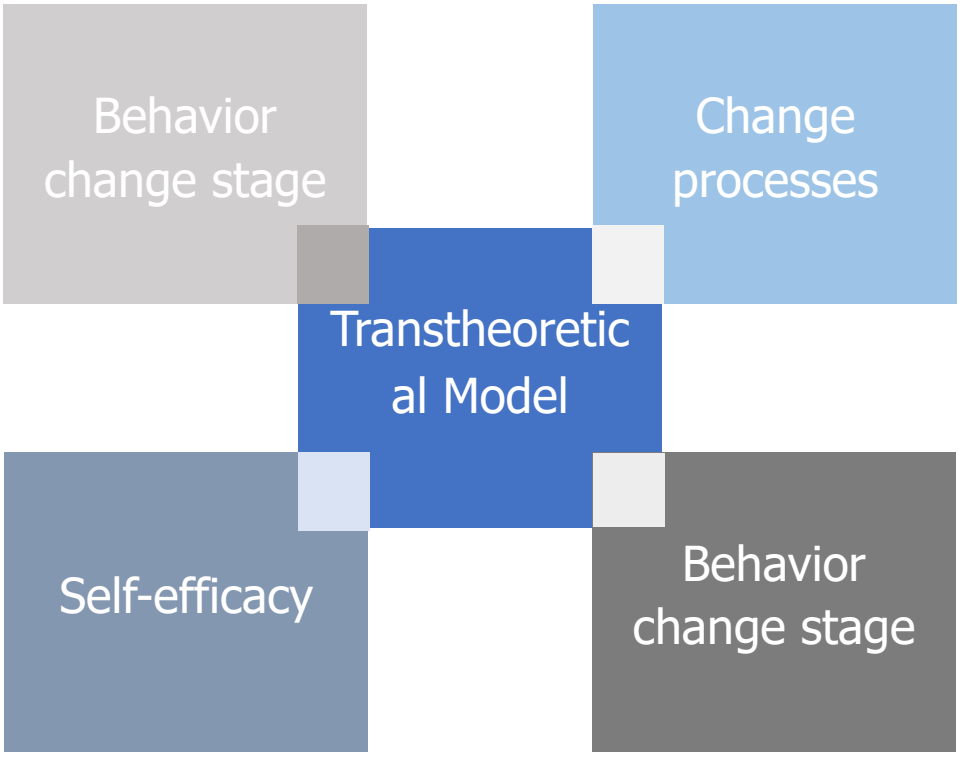
The transtheoretical model encompasses several concepts of social psychology, and these concepts can be adapted and implemented in the field of Health, Safety and Environment.

This model was developed by American researchers in the 80s, James Prochaka and Carlo DiClemente, they acted in a study involving smokers. It was observed that some smokers were able to quit tobacco addiction more quickly than other smokers, and this fact aroused researchers' curiosity to understand this phenomenon, as a certain number felt motivated to quit the addiction.

The other group of smokers although motivated to quitting the addiction, it was difficult for them to quit the addiction, and these phenomena are directly linked to the behavioral factor. However, the researchers concluded that there is a phase called **behavior change**, and this phase of behavior change can be framed in occupational safety, a phenomenon that deserves special attention to verify the performance and availability of employees to follow good safety practices at work.

The transtheoretical model fits four main components that can be adapted to HSE which are: the stages of **behavior change**, the **change processes**, the **self-efficacy** and the **balance of decisions**.

Therefore, in the implementation of Health, Safety and Environment practices it is important that the HSE management team pay attention to the behavior of its employees and adopt effective measures that do not compromise productivity as well as occupational safety.



The Health, Safety and Environment team must be aware when giving training to various workers in different areas to take into account the stages of behavior change that involve the

- Pre-contemplation
- Contemplation
- Decision
- Action
- Maintenance

2.6 Pre-contemplation

As the HSE area is new for some organizations and for many employees in Mozambique, this stage can occur for the employee as well as for the company before the implementation of an Integrated OHS System.

In this step the employee or company recognizes that the health Safety and Environment practices used in the company are not adequate and expose to potential risks, but the employees as well as company are not willing to change their behavior because they believe they are using the same practices for a long period and there had never been a serious accident. Both the company and the collaborators are resistant to implementing effective means for a good HSE practice.

2.6.1 Contemplation

The company or employees assume that it is necessary to change attitudes in relation to HSE practices, but when implementing HSE practices they implement without **serious commitment**. The company can recognize the benefits of a good HSE practice, but still undecided due to several factors such as fear of change, fear of some costs in acquiring certain individual and collective protection equipment, fear of reducing production while opting for an HSE practice.

2.6.2 Decision

At this stage, the organization or employees decide to follow HSE practices, for the organization, there is already an Accident Prevention plan (the company is well concerned in terms of OHS, a plan to implement good practices, attention to risk assessment, but the implementation is not real effective because there is no a real action in the workplace.

2.6.3 Action

There is an involvement in behavior change and it is turned into action not by influence or obligation, but above all, there is an involvement driven by reason and interest in ensuring Health, Safety and Environment, and at this stage the barriers and impediments are overcome that could lead to not implementing HSE methods.

2.6.4 Maintenance

At this stage, HSE practices are maintained, and there is greater concern to improve practices in order to ensure greater efficiency and bring a balance between the well-being of employees and production

All these steps can be taken into account in **PDCA** Plan DO Check and Act

2.7 Most common accidents

The occurrence of occupational accidents are reasons of concern for companies, workers as well as for third parties or stakeholders, according to data from the United States, Portugal, Brazil, South Africa and the ILO the most common accidents are:

- Fall from height
- Shocks against objects
- Electric shocks
- Blows caused by tools
- Fractures
- Repetitive strain injuries
- Work-related musculoskeletal disorder

2.8 Ergonomy

Remaining in inappropriate positions for too long can lead to injuries to the body, pain in the lower back and neck. It is necessary that employees pay attention to the posture taken when performing tasks, especially if the execution of tasks that requires the employee to be exposed to the same position for a long period.

In more severe cases, repetition of movements and spinal overload can even generate scoliosis (curving of the spine) and herniated discs. This happens due to muscle tension, caused by lack of care with posture and also by a series of risk factors.

2.8.1 Back pain and association to other ergonomic diseases

Back pain can be associated with several factors such as occupational stress, which can be associated with a burnout crisis, overweight, smoking and alcoholism can be factors aligned with back pain or even vibrations where employees are exposed to activities where it occurs excessive vibrations that can compromise the health of the employee.

From these problems it is possible that the employee begins to have problems in the neck, shoulders or wrists and other parts of the body, hindering blood circulation and contributing to the emergence of diseases such as Repetitive Strain Injuries and Work-Related Musculoskeletal Disorders

According to the Safety Operational Centre SOC (in Brazil), two studies showed that low back pain is one of the biggest causes of occupational disability in the world and affects 9.4% of the world population. The study gathered data from 187 countries and, although Latin America is not among the regions with the highest incidence of this type of problem, in Brazil they are associated with back pain. Therefore, it is necessary to make employees aware of the importance of taking care of their posture both in their personal and professional lives.

2.8.2 Back pain and overload

Eight out of ten individuals will suffer from back pain at some point in their lives, according to data from the World Health Organization (WHO). And even though the problem is very common, little is done to prevent it.

A Brazilian neurosurgeon doctor *Paulo Porto de Melo* explains about back pain that can also be verified in Mozambique that these pains are the result of overloads directed at the spine, applied in all situations in our routine, especially at work, where we usually spend more time during the day.

For this reason, it is necessary to make employees aware of the ergonomic risks that they may be exposed to in the workplace. Investing in ergonomics is investing in the employees' well-being and thus contributing positively to the company's growth and production.

It is recommended that companies invest in training points (workplace gym) where they can perform physical exercises, as this way they can avoid muscle pain and consequently avoid a

posture with tragic consequences for the employee, for Mozambique, companies could invest in partnerships with gymnasiums where their employees could have access to workouts and personal trainers.

2.8.3 Some examples of jobs that can cause back pain**:**

Work in an office that requires being connected to the computer **as typists, receptionists, secretaries, designers, designers:** These activities require the employee to work hours under the same position and this directly affects the posture of workers exhausting the intervertebral discs (spine discs), causing fatigue and increasing the load on the spine, the shoes that some professionals use especially affects women directly in posture.

Dentist, Athletes and Machine Operators:

Because these professionals perform their activities with the trunk bent forward, they tend to be affected by cervical disc herniation, the fact that they perform the activity with the trunk bent forward they overload the intervertebral discs.

According to SOC, in dentists this problem lies in performing flexion and rotation efforts of the spine several times a day. In these cases, according to Melo, the hernia is located at the cervical level and there may be pain in the neck, shoulders, scapula, arms or chest, associated with a decrease in sensation or weakness in the arm or fingers.

Only 10% of herniated disc cases require surgery. For professionals who already suffer from spinal problems and do not want to undergo surgery, conventional treatment can provide good results. Physical therapy treatments combined with exercises to strengthen the postural muscles can be effective. In addition, rest and use of analgesics, anti-inflammatory drugs and anesthetics may be recommended for these patients (SOC2010).

Drivers: This activity due to its long period on the wheel, which in turn implies an effort on the spine, putting pressure on the sciatic nerve and in this way makes drivers the most affected by sciatica, which is characterized by pain that starts in the lower back, passing through the buttocks and extends to the legs and sometimes to the feet. The ailments of sciatica pains can be controlled by periods of rest and reduced activity, accompanied by physical exercises that can

improve the body's well-being and similarly these ailments can be reduced by reducing the period of activity.

2.8.4 Repetition of movements

According to studies carried out by INAE Mozambique, it points out that the main consequence of Repetitive Strain Injuries is the loss of the ability to perform movements, which directly interferes with the individual's social and psychological condition. This occurs when the injury temporarily or permanently prevents the worker from carrying out his activities, as this action becomes an element of physical and emotional degradation.

2.8.4.1 Disability and repetition of movements

The literature shows that 61.4% of patients with Repetitive Stress Injuries develop temporary disability (Hoefel, 1995). Prietro et al (1995) also mentions the change in mood, irritability, insomnia and nervousness, which are a consequence of pain, as factors that directly reflect on the family life of patients with Repetitive Stress Injuries Couto (1997), also states that the cost-benefit ratio of a company suffers from a deficit, resulting from the loss with employees on leave due to Repetitive Stress Injuries, to more complex aspects of compromising the organization's financial result.

Repetitive movement activities develop an exacerbation of compressive neuropathies or non-specific extremity disorders. In 1891, Fritz de Quervain associated tenosynovitis of the thumb with laundry activity and named this pathology as "washwoman's sprain".

Repetitive Strain Injuries. Browne et al (apud Assunção, 1995) defined this terminology as: "muscle tendinous diseases of the upper limbs, shoulders and neck, caused by overloading a particular muscle group, due to repetitive use or maintenance of contracted postures, resulting in pain , fatigue and decline in professional performance",

In the United States, the terms "Cumulative Trauma Disorders" (CID) and "Repetitive Trauma Disorders" (RTD) are frequently used and are called "soft tissue injuries due to movements". and repetitive efforts of the body" (Armstrong, 1986).

Some authors contest this nomenclature and Couto (1996) states that RSI is an outdated term, used only by Australia and Brazil. The most correct would be "Painous Syndrome in the Upper

Limb of Occupational Origin", as this is a denomination that follows a more specific construction of the disease.

Japan was one of the first countries to give due importance and recognize Repetitive Strain Injuries (RSI) as a work-related musculoskeletal disorder of multicausal origin, already in the 60s. This interest arose due to the high incidence of cervicobrachial disorders in calyan punchers, cash register operators and typists. In order to study this problem, the Committee of the Japanese Occupational Health Association (ibidem) was created.

Sorock & Courtney (1996) consider work factors such as: excessive exposure to repetitive movements due to task demand; incorrect postures; use of force; low temperature; vibration and psychosocial factors such as stress are closely related to musculoskeletal disorders in occupational groups exposed to these work situations.

Upfal (1994) also considers that the risk factors for the onset of R.S.I. include repetitive movements (repeating tasks for many hours), strong movements (such as gripping or squeezing), stressful postures (lateral wrist deviation, neck extension), soft tissue mechanical impact (edges of tools that press the palm of the hand), vibration and occasionally low temperatures.

Attaran (1996) further states that R.S.I. it is caused by poorly designed work environments that do not contemplate a harmonious relationship between man and work.

According to Higgs & Mackinnon (1995) the maintenance of abnormal postures are the main causes of R.S.I. for causing muscle imbalance and nerve compression. They report that if certain muscle groups are underused, there is an indication that others are suffering from overuse, and this situation leads to a vicious cycle of posture and muscle balance. Certain positions also increase pressure around the nerve or stretch it, which can lead to a chronic condition of compression.

Guidotti (1992) lists the types of R.S.I. most commonly found: in the neck refers to neck tension syndrome and cervical syndrome; in the shoulders, he mentions thoracic outlet syndrome, biceps tendinitis, supraspinatus tendinitis, adhesive capsulitis and acromioclavicular syndrome; and in the elbow, wrist and hand, he mentions epicondylitis, De Quervain's tenosynovitis, carpal tunnel syndrome and ulnar nerve compression.

Oliveira (1991) states that the symptoms of R.S.I. it is often complex and difficult to identify, as the patient may not present any physical signs initially, but their complaints are persistent and always related to the muscle mass involved in static tension, due to a forced or vicious position or more used in the exercise of occupation.

In view of this, Guidotti (1992) concludes that the diagnosis of R.S.I. it is suggested by persistent and recurrent musculoskeletal pain within six weeks, without an immediate traumatic cause and influenced by the work situation.

The ILO (1993) itself explains that the characterization of R.S.I. it does not depend on laboratory data, but only on the correlation between the injury and the exercise of work, it is difficult to truly stipulate in what degree of impairment the patient is, since the problem related to the diagnosis is complex and involves credibility in peculiar data and intrinsic of the patient himself.

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2.8.5 Causes of Repetitive Strain Injuries

- Repeatability
- Vicious postures of the upper limbs, especially those with constant muscle contraction
- Mechanical compression of the nerves by postures

- Vibration, which can generate micro-trauma
- Cold, due to vasoconstriction that can lead to circulatory deficit
- Static postures of the body during the work period, during static contraction the blood supply to the muscle is impaired, which may favor the production of acid that is able to stimulate pain receptors, triggering it, maintaining it or aggravating it .
- Tension at work - demands for productivity and work rate can increase muscle tension, impairing the blood nutrition of muscles with the possibility of occurrence of muscle pain, fatigue and predisposition to repetitive strain injuries
- Displeasure: feeling pleasure triggers the release of endorphins (internal analgesic)
- Psychological Profile: people with tense personalities, negativists and those who do not tolerate repetitive work are more prone to Repetitive Stress Injuries

The development of Repetitive Strain Injuries in some professional categories is related to scientific studies by Armstrong (Apud Oliveira 1991), who demonstrated that the risk of tendonitis of the hands and wrists in people who perform highly repetitive and forced tasks is 29 times higher than in people who perform tasks slow, little repetitive and little forced.

2.8.6 Treatment of Repetitive Strain Injuries

The conduct of treatment for Repetitive Strain Injuries depends on the stage of the disease, and the earlier the diagnosis and intervention, the less invasive the treatment will be. Hoefel (1995) emphasizes that this disease is worrisome, as the treatment hardly has positive results after the chronicity, which occurs due to relapses of the employee's return to work episodes, which exposes himself again to the same occupational risks that determined it.

The main objective of the treatment plan is to eliminate or minimize the intensity of the physical factors that caused or aggravate the Repetitive Strain Injuries, as once eliminated they give rise to the body's natural recovery process. This often requires a long period, during which there must be restrictions on normal activity, usually treatment involves a combination of conservative methods such as medication and physical therapy.

When these methods do not show positive results, the behavior can lead to surgical solutions. Initially, whatever the method implemented, it requires, first of all, an education of the employee victim of this type of injury regarding the postures to be adopted during the work as well as in the normal period when he does not perform any work function.

This proposal comes in an attempt to avoid further damage and reduce those already installed. The restriction of movement and the rest of the affected region are important criteria that must be obeyed, as it is the first and perhaps the most important procedure for patients with Repetitive Strain Injuries.

The immobilization, when necessary, is done through the use of splints that keep the joints in a neutral position, thus minimizing local stress and preventing additional trauma. In addition to immobilization, it is also possible to use heat and ice to relieve pain, and compression and elevation to better drain local edema, when it is present.

However, other methods of physiotherapeutic treatment can be used, and the purpose will always be to reduce pain, edema and inflammation, thus providing a situation in which muscle strength can be normalized and return to activities, when possible.

As for the drug treatment, this includes the prescription of drugs with potent anti-inflammatory effects but that, eventually, can lead to gastric irritation, which can restrict its use to those patients who do not have gastric problems or have them in a small proportion. In this case, additional use of anti-acid drugs is necessary. This method of treatment is important because it not only reduces pain, it also reduces inflammation.

To Avoid Repetitive Strain Injuries, because by its nature it leads to aggravating conditions, the most effective conduct continues to be prevention. Changes of an ergonomic, organizational and behavioral nature can reduce or eliminate the offensive action, as, according to Thompson & Phleps (1990), prevention reduces the incidence of Repetitive Stress Injuries more than medical treatment.

2.8.7 Accelerated pace of work

The place of work in industry has accelerated significantly with the advent of assembly lines and the requirement for production quotas per unit of time. These new forms of production increased the burden on the body and on cognitive and psychic abilities in the work environment.

Certainly, all these changes reflected in the illness profile of workers who experience them. There is, however, still a lot of resistance to accepting the possibility that some diseases are linked to work, such as musculoskeletal disorders (MSD), psychological distress, among others.

But every day it has become more evident that the profile of illness among modern workers has changed.

It is also important to consider for this study the variability of the work context. During the development of the task, the employee routinely experiences situations of disturbance in the work process that make the employee create strategies to continue achieving the desired goals.

Sometimes it's small adaptations that have almost huge impact on work. However, in restrictive situations, under time pressure, the development of the task imposes itself at the expense of hyper-requesting the body, since it is difficult to act on the objectives (changing the deadline for completing the task) or the means (getting help from others) to ensure production targets.

2.9 Different methodologies for investigation and accident prevention

There are several accident investigation methods, where we will highlight some that were taught in this master's degree, it is important to mention that several nations have been developing methods for the investigation of accidents, this involves technology and also the human factor.

The methods are divided into proactive and reactive; the proactive methods are those that foresee a certain situation that could lead to a possible accident and thus implement actions that reduce or eliminate the risk. The reactive methods are those used after the accident occurs, they are important because it is based on them that the cause of the accident is investigated and, in this way, possible future dangerous situations can be avoided, for a better explanation we will mention some of the methods.

I could say that reactive actions if better understood as opportunities can lead us to proactive actions, but because a method is vulnerable of errors, after the errors occur then we again reactive actions adopt proactive actions, and this will be a cycle.

2.9.1 FMEA: Failure Mode and Effect Analysis:

Is a tool that allows detailing the failures of the components of a given equipment and estimating the rate of these occurrences. It can analyze qualitatively or quantitatively, determining the effects of each failure on the entire system.

2.9.2 FMECA: Failure Mode, Effects and Criticality Analysis:

Is the extension of the FMEA together with an assessment of the probability of occurrence and the degree of criticality of failures. The method can detail the root cause that is identified as the most critical for the system.

2.9.3 FTA: Fault Tree Analysis:

Is a technique used in the area of reliability, to improve the reliability of products and processes through the systematic analysis of possible failures and their consequences, guiding the adoption of corrective or preventive measures allowing to obtain information such as the causes, the degree of failure, the index of occurrences and is used for the global analysis of the system.

2.9.4 PHA: Preliminary Hazard Analysis:

Is used to diagnose hazards that may be present in systems where similar conceptions do not exist and that do not present hazard histories, are innovative. As the complexity of the system increases, it is necessary to use other methods. The PHA performs a cursory security oversight.

2.9.5 HPIP: Human Performance Investigation Process

It consists of six tools that can be used in the accident investigation process, being them to plan, collect data, identify difficulties involving man, identify organizational weaknesses, organize and understand the causes and understand the event as a whole to ensure the full understanding of the facts that caused the accident.

2.9.6 MORT: Management Oversight And Risk Tree

It is an analytical method that seeks to determine the causes that contribute to the occurrence of major accidents. It can be used as a tool to assess the quality of the existing program, it was designed to prevent accidents at nuclear power plants in the United States, it is a reactive method] as it uses as a research base ‘Preconceived Fault Trees. Its use is in the public domain.

2.9.7 SRP: Savannah River Plant

The SRP structure is similar to MORT, using a pre-defined cause tree where the investigation is focused on aspects related to human performance in nuclear power plants. The difficulty in using it lies in the fact that it was specifically for a nuclear materials transformation center, Savannah River Plant, incorporating the company's organizational forms. However, it can be adapted to suit other Organizational structures.

2.9.8 QFD: Quality Function Deployment:

The methodology is structured to take into account the points of view of customers, the organization, production areas and development sectors according to technological needs. The technique presents results through graphics and can easily determine which aspirations require the introduction of safety items as a priority in a given project of new products.

3 EXPERIMENTAL METHOD

A questionnaire was prepared containing 16 questions for data collection in order to achieve the specific objectives. The questions designed for companies were divided into 3 groups as follows: questions related to company profile, questions related to accidents that occurred within the company, and questions related to employees.

The questions addressed to companies include the company's profile, its location, the area of activity and how acquainted with the ISO 45001 standard are.

Accident-related question include the number of annual reported accidents, typification of hazards and accidents, and its severity.

Issues related to workers include the type of training provided, the level of perception with regard to awareness and the groups of employees with difficulties in complying with safety standards.

For data collection, an online questionnaire was sent to Insite (company that contributed with internship for the elaboration of this report) and also CTA. In turn, these two organizations shared the questionnaire with their clients and partners.

After the elaboration it was sent to the companies, which was answered by the management team of the companies, covering departments such as Human Resources, Health and Safety and Environment, Quality Control, Construction, Maintenance, Electricity, Production, among other departments involved.

4 DATA PRESENTATION, ANALYSIS AND DISCUSSION

The existing data produced by the General Labor Inspectorate is presented on table 1, 2 and 3, the data collected in this study is presented the graphic 1, 2, 3, 4, 5 and 6. Additional data collected by the General Labor Inspectorate is placed in the attachments.

Table 1- Representation of injured employees in the country by provinces, 2015 to 2019

Province	**2015**	**2016**	**2017**	**2018**	**2019**	**Percentual Variation**
Country	663	495	399	496	573	15,5
Niassa	19	6	1	6	0	..
Cabo Delgado	10	11	4	28	30	7,1
Nampula	22	41	28	18	57	216,7
Zambezia	14	4	12	6	11	83,3
Tete	76	53	27	59	18	-69,5
Manica	41	31	34	22	46	109,1
Sofala	192	101	79	146	67	-54,1
Inhambane	3	4	6	3	5	66,7
Gaza	2	1	15	17	10	-41,2
Maputo Provincia	213	148	97	85	178	109,4
Maputo Cidade	71	95	96	106	151	42,5

Source: (IGT, 2020)

Table 2- Representation of injured employees in the country according to field of activities, 2015 to 2019

Activity	2015	2016	2017	2018	2019	Percentual Variation
Total	663	495	399	496	573	15,5
Agriculture, Forestry and Fishing	45	41	61	40	142	255,0
Extractive industry (Mining)	29	27	50	68	70	2,9
Manufacturing industry	346	114	70	90	90	0,0
Electricity, water and gas	8	1	5	9	10	11,1
Civil Construction and Public Works	105	112	40	49	76	55,1
Commerce, restaurant and hotels	22	40	70	54	47	-13,0
Transport and communications	70	48	40	33	46	39,4
Banks, insurance and property transactions	0	3	0	2	31	...
Services provided to the community	101	109	63	151	61	-59,6

Source: IGT, 2020

Table 3-Representation of injured employees in the country according to consequence, 2015 to 2019

Consequences	2015	2016	2017	2018	2019	Percent Change
Total	663	495	399	496	573	15,5
Fatality	11	14	15	11	7	-36,4
Temporary Disability (TD)	566	415	334	460	523	13,7
Partial Permanent Disability (PPD)	85	63	32	21	41	95,2
Total Permanent Disability (TPD)	1	3	18	4	2	-50,0

Source: IGT, 2020

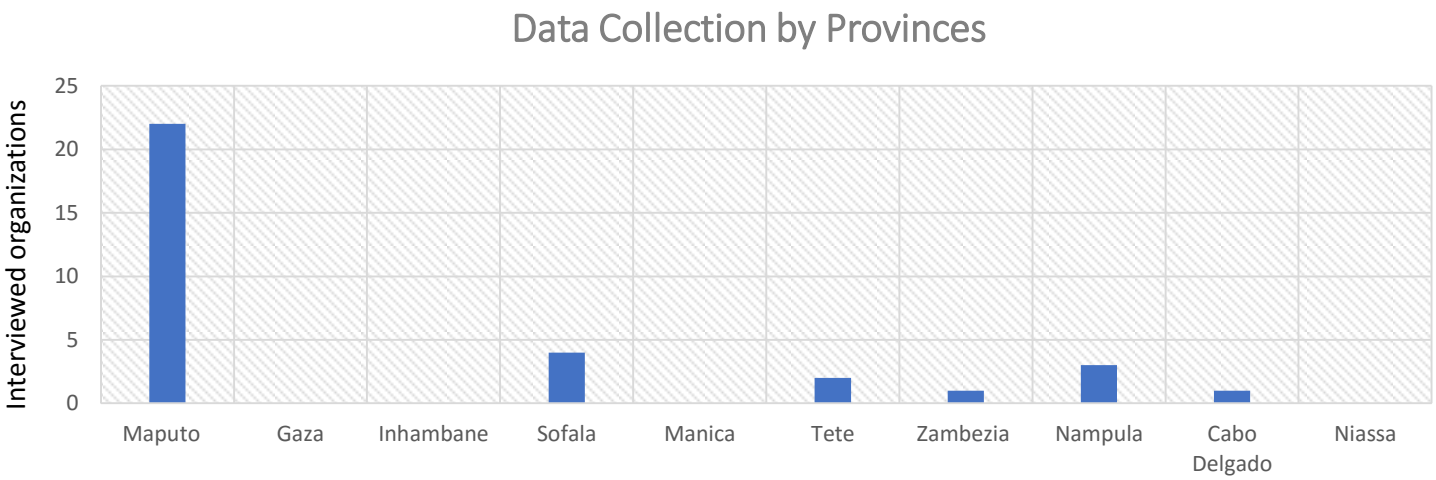
According to the data from General Labor Inspection, the maximum number of accidents was 663, these created a certain expectation on identifying the types of accidents and their frequency. Analyzing the data, it is observed that Mozambique has a low number of accidents, on one hand this fact may be associated with the high level of concern and commitment in relation to occupational health that Mozambican organizations assume. But on the other hand, these data may express the lack of rigor in data collection, failing to achieve realistic data on occupational accidents.

In turn, these data can influence companies to take a comfortable position in relation to the concern of accident prevention, thus worsening the number of unreported accidents. On the one hand organizations, need to feel pressured to comply with the established standards, for this it is necessary that competent authorities carry out audits of organizations in relation to occupational health.

According to the questionnaire, the data were collected and the respective analyzes as following:

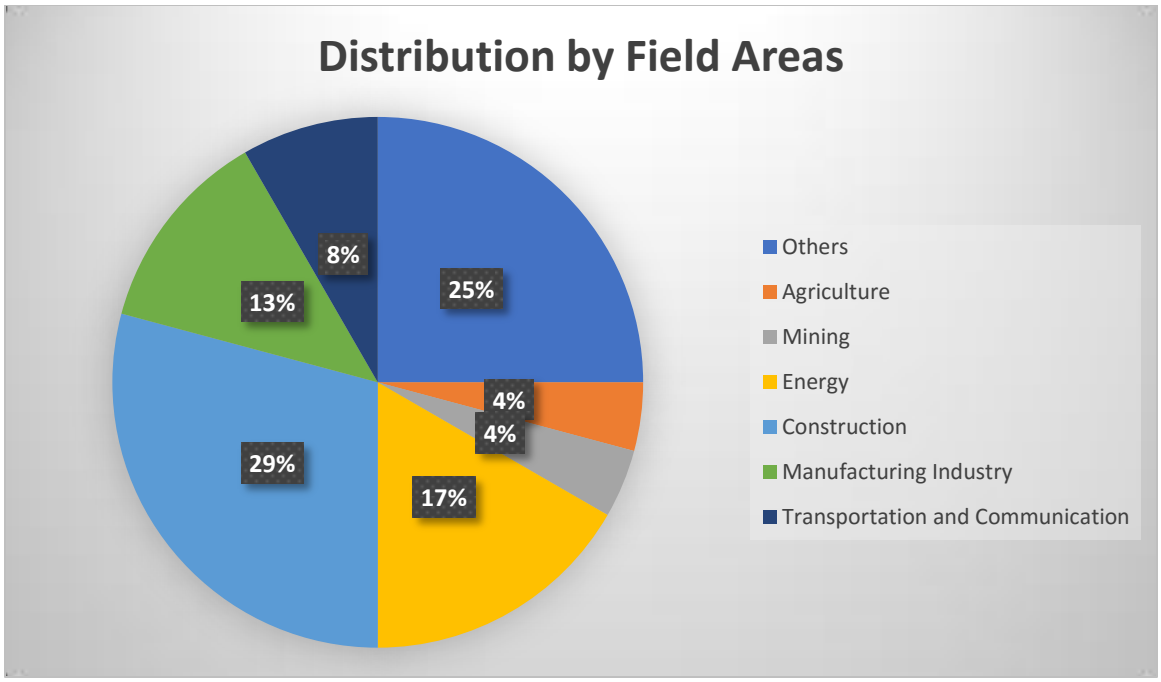
Of the 25 companies interviewed, 72% of them were the first time to receive a questionnaire related to Occupational Safety, and the remainder were not. This indicator shows that from occupational health point of view there are some progresses. On the other hand, it shows that there is still a lot of difficulty in involvement and awareness about Occupational Safety.

According to the **figure 1**, the location of the companies that were interviewed 88% are located in Maputo, 16% are located in Sofala Province, 8% are located in Tete province, 12% correspond to companies located in Nampula, 4% are located in Zambezia, and 4% located in Cabo Delgado. These data show that there is a social and cultural aspects that influence a decentralization in terms of employment opportunities. This factor may influence organizations to invest in hiring employees from Maputo because of more involvement and acquaintance in OHS.



Graphic 1- Interviewed companies by provinces, Source: Author.

The forms were sent to CTA and InSite, where it is estimated a universe of 250 companies that have received the survey. Only 25 companies responded to the survey, perhaps this situation was influenced because of the fact that was an online survey, and for this reason, some organization may not have opened the e-mail, or if they did, the companies did not have time to respond to it, or it may have been fact of forgetfulness or lack of interest on the responsible person for the occupational health department.



Graphic 2- Distribution of interviewed companies by field, Source: Author.

Figure 2 and 3 shows the distribution of companies by fields and accident frequency. It is verified that the **construction sector** is the one with the most responses to this questionnaire, from the same sector in a total of 7 companies, 5 companies offer training in occupational health and of which 3 have the occupational health system based on ISO 45001:2018.

It is verified that even if some companies in **civil construction** do not have the occupational management system, this situation does not preclude them from being able to comply with the system. As for the number of accidents in the sector leads in the number of accidents, with 2 companies registering between 5 and 20 accidents per year, 3 companies registering less than 5 accidents and two companies with zero accidents. This shows that the civil construction sector is the target of accidents due to the nature of the work, but also because occupational safety is a relatively new topic and therefore requires greater awareness of the need for safety at work in organizations.

In the Manufacturing industry, a total of 3 companies responded to the survey, 2 have an occupational health management system based on the **ISO 45001:2018** standard and only one provides training. It is observed that, due to the nature of the sector, certifications are extremely important, but it does not guarantee that they are really committed to having the system working properly. Regarding the number of accidents, 1 company registers 5 to 20 accidents per year, and

two register less than 5 accidents, Evidencing the need for greater commitment to the management system and that must be working properly to contribute in reducing the number of accidents.

In the Energy sector, a total of 4 companies responded, 3 have an occupational health management system based on ISO 45001:2018, and two offer training. With these data we can affirm that the energy sector, due to its nature and the type of projects that characterize the sector, requires from companies to be duly certified and comply with occupational health requirements. Regarding the number of accidents, 3 companies reported less than 5 accidents per year and one company recorded 5 to 20 accidents per year. The sector is balanced in terms of the number of accidents and the number of companies certified with the ISO 45001.

In the Transport sector, a total of 2 companies have answered the interview, all of them have the management system based in ISO 45001, and all offer training in occupational health, registering a number of annual accidents for all companies less than 5. These data show the importance of having the occupational health management system implemented and functioning properly, both training and the number of accidents verified in this sector show the level of effectiveness that ISO 45001 can offer organizations.

In the Mining sector, only one company was interviewed, and it has an occupational health management system and offers training in occupational health and safety, which in turn records 20 to 50 occupational accidents per year. It is verified that the more companies are involved with the occupational management system based on ISO 45001, the more openness they have to provide real data with regard to recorded accidents.

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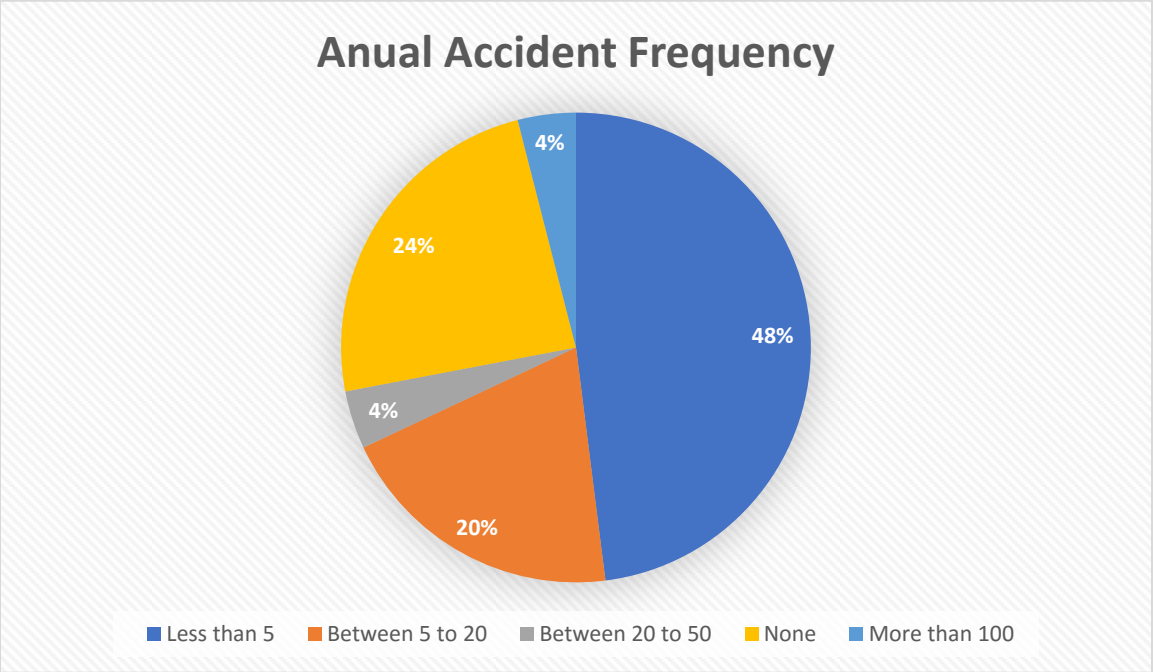
In the Agriculture sector, there was only one company responding to the questionnaire, the same has not implemented the occupational health and safety management system based on the ISO 45001:2018, but offers training in occupational health. The fact that it was only one company in the field of agriculture and without an occupational management system based on the ISO 45001 standard, is due to the fact that in Mozambique most of the population involved in this sector has a low level of education, a factor that makes it impossible to access tools such as the internet, or even resources to implement ISO 45001.

The questionnaire has a part reserved for **other organizations**, which are organizations that carry out activities not specified in this questionnaire but that are not limited on participating in the survey. In total, there were 7 companies, of which 3 have implemented the occupational management system based on the ISO 45001 standard, and 4 offer training in occupational health and safety. A company records more than 100 accidents per year, 4 with zero accidents, one between 5 and 20 accidents and 1 with less than 5 accidents.

It is notable the need to make the ISO 45001 standard more comprehensive for all companies.



Graphic 3-Accident Frequency, Source: Author.

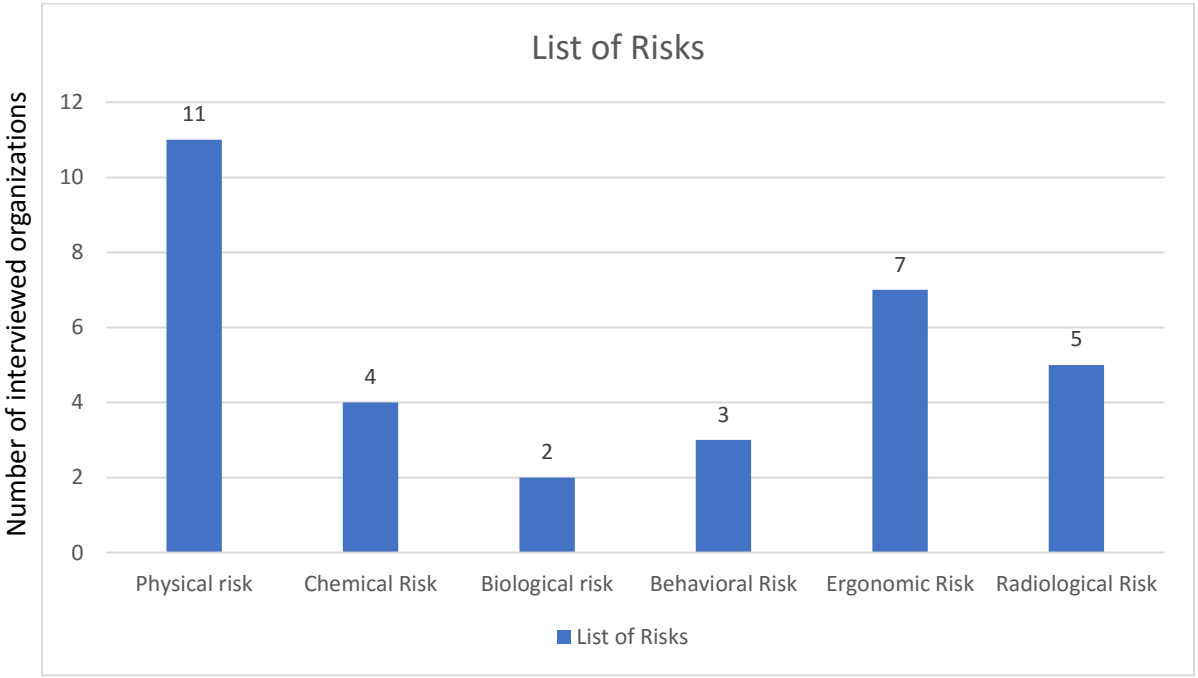
Analyzing the answers provided by the companies, it is clear that there is an interest in occupational safety, this fact can be influenced by the reason that it is a requirement to be certified by ISO 45001:2018 in certain projects. Many international projects by nature oblige contracted companies to be duly certified with ISO45001. This is an advantage for occupational safety, but it is necessary to do a more comprehensive work that raises awareness of companies about the real importance of occupational safety.

These data basically show that reported accidents in Mozambique transmits lack of a certain observance in the method used for data collection. If, with a study involving 25 organizations, it

is possible to estimate more than 200 accidents, this fact conducts the study to realize that it would not be a comfortable number to record per year around 600 to 800 accidents.

On one hand, it can be seen that companies are afraid to provide real data, on the other hand, the deficiency in data collection is remarkable, a fact that apparently favors companies as recorded reduced accidents can contribute to raise the reputation, but in fact this can contribute to deficiency on the implementation of ISO 45001.

Hiding the real number of accidents that have occurred can, in turn, lead the company to neglect safety standards and in turn, in terms of damages, present significant economic losses for the organizations. For the employees, it can expose them to greater risks that can have catastrophic consequences that can affect not only the employee life but also his family. For the nation, lack of transparency in reporting accidents can harm in budgetary terms with regard to the stoppage of certain companies.



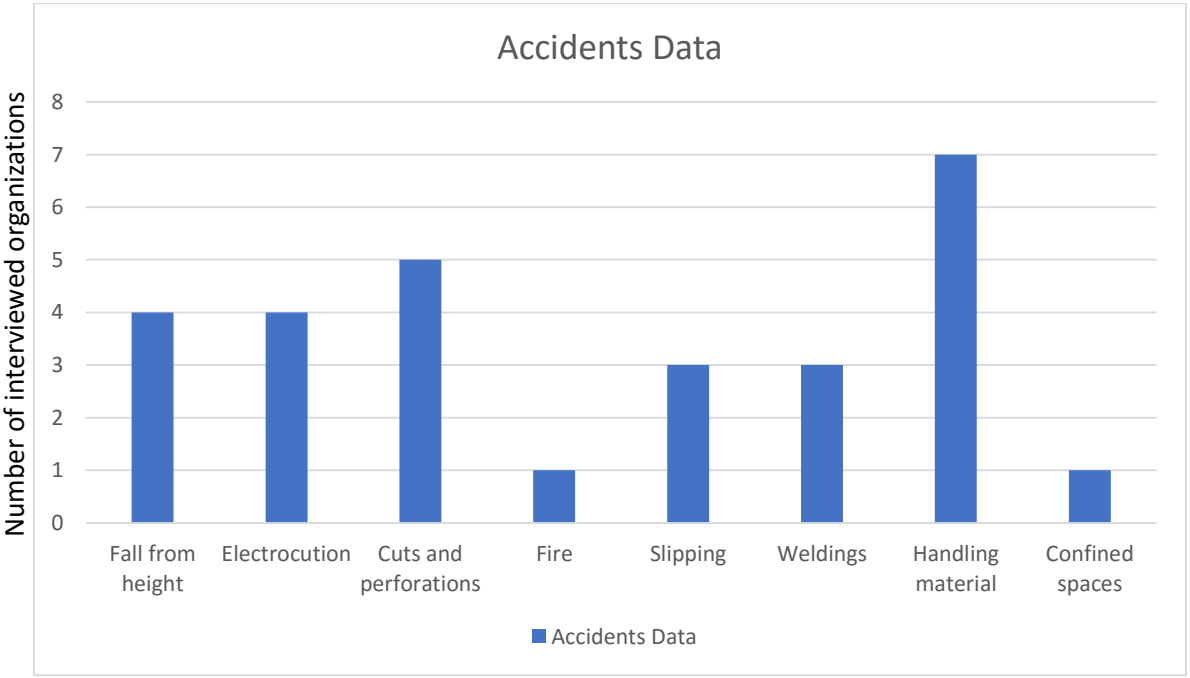
Graphic 4-Associated risks Source: Author.

The types of frequent risks are: physical risk with 45.8%, chemical risk corresponding to 16.7%, biological risk with 8.3%, behavioral risk with 12.5%, ergonomic risk with 29.2%.

Physical risks despite being the easiest to identify, they are also the ones that occur most frequently due to their nature, these risks can in a certain aspect be associated with behavioral risk, or rather, have its beginning in the behavioral risk.

Behavioral risks require further analysis by the occupational health and safety team. In this study was possible to identify as common risks because the questionnaire was sent not only to the occupational safety team, but also to other professionals, such as human resources and psychologists, who are the ones who can best help to identify this type of risk.

As for the **ergonomic risks**, it is clear in this study that despite apparently being negligible risks, they are present in practically all activities carried out, requiring greater attention. For the present study, it may not have been considered by the interviewees as potential risks due to the fact that it is difficult to notice the consequences of this risk, which may appear after long years.



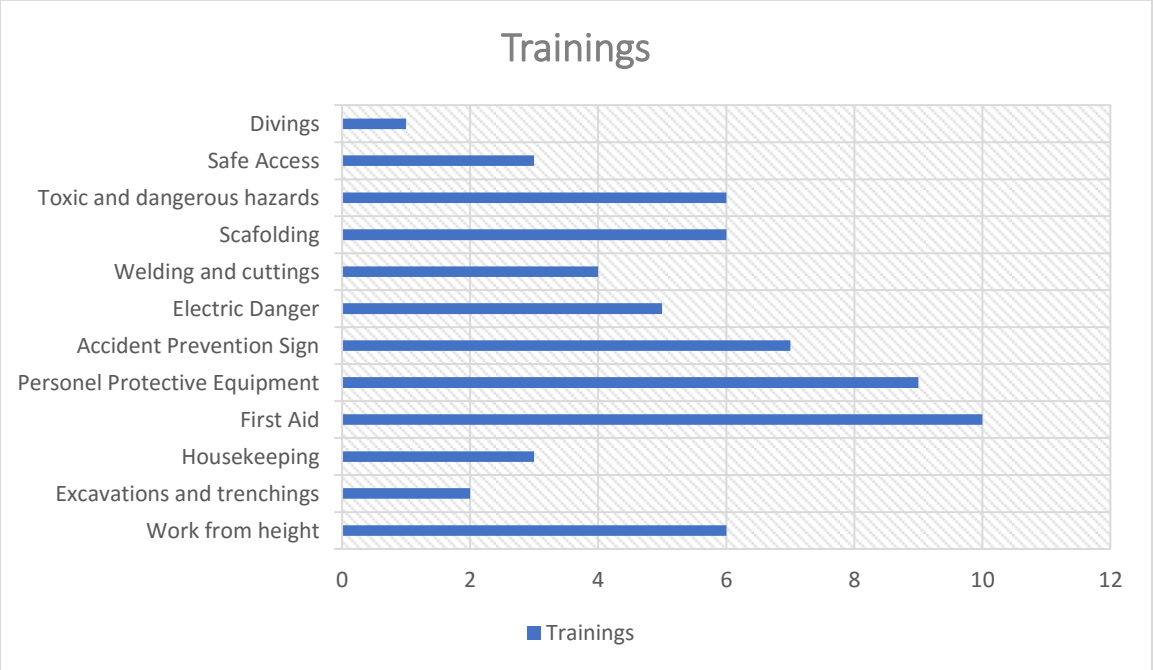
Graphic 5- Types of common accidents, Source: Author

As for accidents, data collection points to: falls from a height with 21.1%, electric shocks corresponding to 21.1%, cuts and perforations 26.3%, fire with 5.3%, Inappropriate protective equipment with 15 .8%, slips 5.3%, welding is 15.8%, cargo handling with 36.8%, confined spaces correspond to 5.3%.

In the case of occupational accidents caused by falls from heights, it is necessary to point out that it is a common type of accident worldwide and has been occurring more in the civil construction industry. It is necessary that companies pay attention to this detail, especially at negligible heights such as 1.8 meters. Although in this study was not carried out an investigation about the height where accidents occur more frequently, but it is necessary to take into consideration the minimum height because the main objective of this work is to contribute for the improvement of the Occupational Health and Safety in Mozambique.

For the case of cuts and perforations, these accidents are more accessible in terms of detection, and which in many cases are conducted directly to hospitals, for this reason data collection can be done in coordination with provincial and central hospitals.

39.1% corresponding to 9 companies recorded the level of negligible severity, 60.9% corresponding to 14 companies had the records of marginal severity, and 8.7% corresponding to 2 companies had the record of critical severity. 8 of the companies with a moderate level of severity offer training in occupational health and safety, which means that companies that offer training in occupational safety are less likely to have workers in serious accidents.



Graphic 6-Types of trainings given by organizations Source: Author.

Regarding the type of training, 6 companies provided training for work at heights, corresponding to 31.6%, 10.5% that correspond to 2 companies offer training in excavation and trenches, 3 companies that are 15.8% offer training in general housekeeping, 10 companies corresponding to 52.6% offer training in first aid, 47.4% corresponding to 9 companies offer training in the use of personal protective equipment, 36.8% corresponding to 7 companies offer training on signs of prevention of accidents, 26.3% corresponding to 5 companies offer training in electrical hazards, 21.1% corresponding to 4 companies offer training in welding and cutting, 31.6% corresponding to 6 companies offer training on scaffolding platforms, 31.6 % corresponding to 6 companies offer training in Toxic and Hazardous Agents, 5 companies corresponding to 26.3% offer training in Vehicle Inspection, 3 companies corresponding to 15.8% offer training in safe access and 1 company that corresponds to 5.3% offers training in diving and swimming.

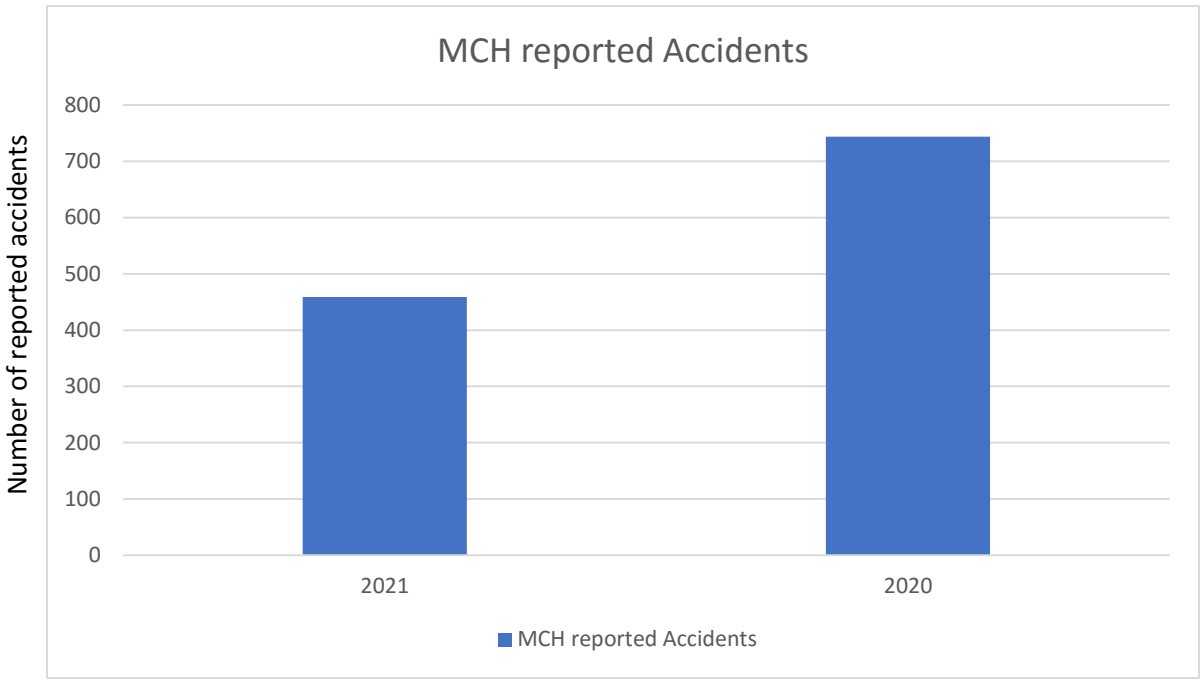
According to Figure 6, data were extracted in relation to companies that have management system based on ISO 45001 and compared with the frequency of training and the type of company. It was found that in a total of 25 companies, 14 are duly certified with the management system based on ISO 45001, of which 11 offer training in occupational health, eight of which are large companies, **4 are medium** companies and two are small companies.

There is a proportionality between the type of company that have ISO 45001 certification and the concern with training, which is an indicator that guarantees the implementation of the system is effective. The **Bigger** the company is, greater is the chance of being ISO 45001 certified, and the greater the chance of concern about occupational health training.

In the universe of 25 companies interviewed, **11 are not certified** with the management system based on the ISO 45001:2018 standard, of which only 5 offer training in occupational health. Among the 11 companies without ISO 45001 certification, 6 are small companies, 3 are medium-sized companies and 2 are large companies. It shows that companies without the management system based on the 45001:2018 standard have not been concerned about occupational health and thus not offering training to workers. This fact is due to the type of companies, as they are **small and medium-sized** companies, the economic factor can influence the concern for workers' health, and the top leadership may not be knowledgeable in occupational safety issues.

It is observed that in Mozambique first aid training has been the domain of companies, but this type of training is of a reactive nature as it prepares a certain team to respond to an emergency. However, it is necessary that each company prioritize the type of training according to the needs. Companies must take into account that training is a gain and not only loss of money, because it is a proactive measure that prevent future accidents and thus avoiding damages that can be very expensive for the company.

Data collected by HCM in relation to occupational accidents



Graphic 6- Maputo Central Hospital reported accidents, Source: Author.

For the year of 2021, the Maputo Central Hospital received 459 cases of occupational accidents, and in 2020 it received 744 cases of occupational accidents.

It supposed that among the various factors that have contributed to the decrease on the number of accidents on the years 2021 and 2022 is the Covid-19 pandemic, which highlighted the stoppage of activities, rotating work, reduction of projects in various sectors. For this study, the number of accidents reported only in the Maputo Central hospital is very high compared to annual accidents reported.

According to statistics, the central hospital in Maputo receives fewer patients compared to general and provincial hospitals, which means that only in the Province of Maputo the number of occupational accidents can triple the number of accidents reported by the IGT. If, with only the data from the central hospital in the year 2020, they can surpass the published data from 2015 to 2019, it can be concluded that there is a large discrepancy in the method used by the IGT for data collection. This fact may be associated with the source that the IGT uses for data collection, another aspect that may influence the deficiency in data collection may be the lack of transparency on the part of companies, but it may be unlikely, since with a questionnaire that covered only 25 companies, data were obtained that exceed 200 accidents per year.

It is important to mention that this work is intended to contribute to solutions that may be crucial in the development of the country in the field of occupational safety, and the comparisons made are as a reference and to meet the reality in the field of occupational safety.

As a result of the collected data, a Swot Analysis was elaborated as following:

SWOT ANALYSIS

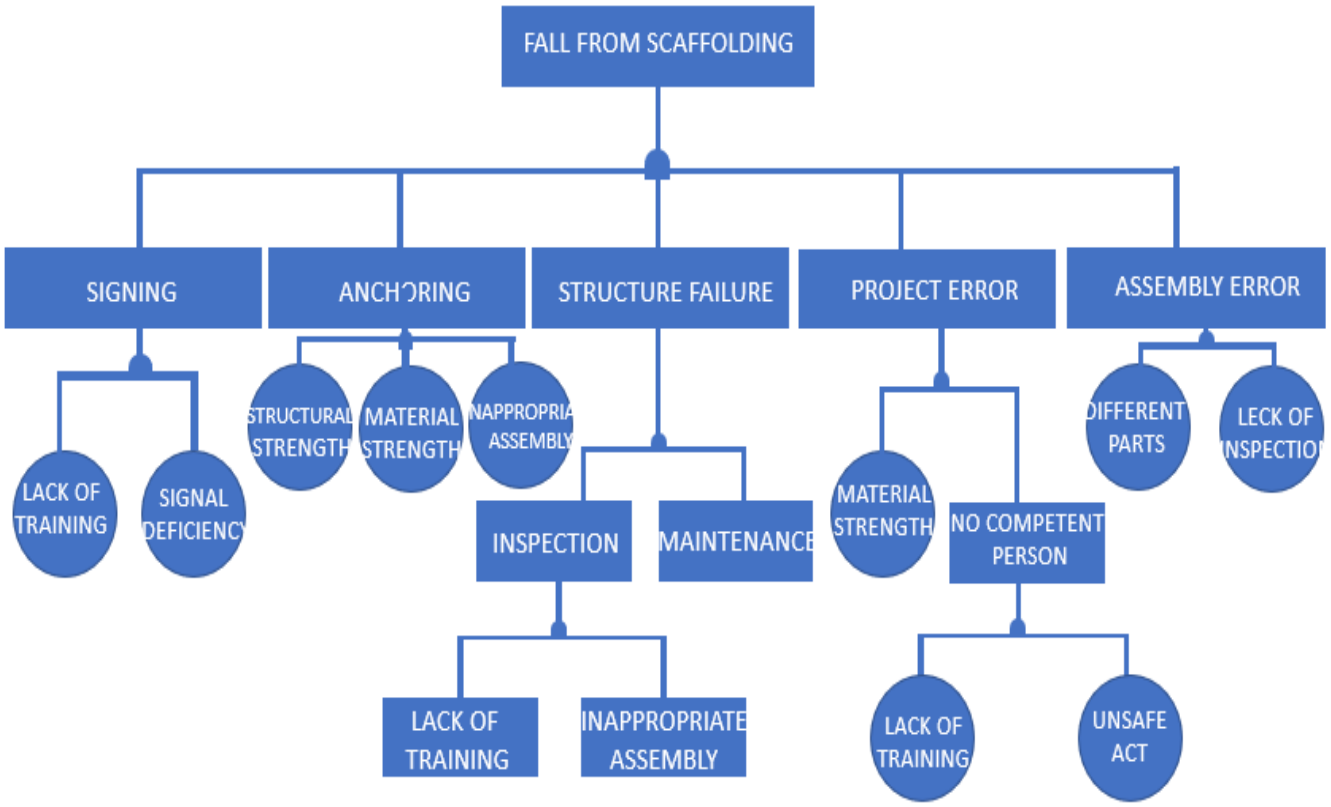
The SWOT analysis performed describes the situation of the Mozambican companies interviewed in this study in relation to the identification of common risks and accidents and internal auditing.

Table 11. Source: Author

Strengths	Weakness
• **Improvement of Employee Satisfaction and Motivation by promoting and ensuring a safe and healthy work environment** • **Improving the image and the internal and external relationship with stakeholders** • **Reduced lost work days and hours** • **Participation of all workers, including**	• Lack of transparency in the presentation of accident and incident data by companies • Low knowledge and awareness in the field of Health, Safety and Environment by workers and managers • Difficulty in investing financially in Health and Safety and the

top management	Environment considering an additional cost and without much relevance • Lack monitoring and evaluation system
Opportunities	**Threats**
• **Present methods that can contribute to the search for realistic data on accidents that have occurred;** • **Better Interconnection between Private and Public Institutions;** • **More Interest in ISO 45001:2018;** • **Software for recording accidents**;	• Negligence by competent authorities; • Direct influence on company structure, where workers can confuse their rights with duties • Financial and human costs that cause uncertainty associated with the implementation of the Health Plan, Safety and Environment

After identifying common accidents in Mozambican companies, the following tree was created



This fault tree was created after identifying the common accidents in Mozambique, in this case fall from height. It was found that when there is a malfunction in the anchorage the problem may be associated with the type of scaffolding material, which directly affects the structure of the scaffold already assembled, and may also be associated with a lack of competence on the part of the assembler or the assembler group. The worker involved in the activity in which the scaffold is useful may be responsible for the fall resulting from unsafe acts as these may be associated with a deficiency in training which in turn may leave the worker unaware of the existing danger.

For accidents originating from cuts, a functional analysis was taken into account.:

The employee: human being is needed for cutting wood, in particular the human being's hands interacting with the woodworking saw and the electric circular saw

The machine: The machine is activated and starts to rotate, in this way any object that intercepts the circular saw is cut according to the man's ideals to cut following the dimensions he establishes.

Danger: There is a danger that the man fails to hold the wood and, by slipping, subject his hand to the saw, in this way a cut occurs:

Suggestion to eliminate the danger: It is suggested that devices be integrated into the circular saw so that the wood is held by the devices and not with the human hand, in this way it would not be the human hand interacting with the wood and the circular saw, but the integrated devices, which can be flexible so that they adjust to the desired dimensions

5 CONCLUSION

Taking into account what has been presented and analyzing this work, it is concluded that:

- The most common accidents in Mozambique are: related to the handling and transport of cargo, electric shocks, falls from heights and cuts and punctures.
- The lack of involvement of public entities responsible for the audit opens the opportunity for companies in general to have less commitment in the implementation of occupational safety standards. This factor leads to non-transparency on the part of companies regarding the reporting of accidents, as hiding data in a way reduces companies' penalties.
- The big sized companies, are more concerned with the implementation of an integrated management system based on ISO 45001 standard.
- Companies with an integrated management system based on ISO 45001:2018 are more transparent, and have greater financial gains for the company, as well as increasing the prestige of the company, increasing its reputation.
- Companies that offer more training in Occupational Health and Safety have recorded fewer accidents.
- The methodology for data collection can be used in state institution for more realistic data.
- Through the use of the method, it was possible to provide subsidies for improvements in the work environment with regard to occupational safety.
- With the present method it is clear that each company must adapt an occupational safety culture that goes in accordance with occupational safety.
- The most common accidents in Mozambique are in agreement with the common accidents analyzed worldwide.

6 RECOMMENDATIONS

According to the needs and objectives of the Ministry of Labor, it can be defined and agreed on how hospitals can prescribe or prescribe patients who are victims of occupational accidents.

The Ministry of Labor must develop better means of carrying out audits in companies, for this purpose, it must train auditors.

The Ministry of Labor can coordinate with the National Institute for Standardization and Quality to better understand how ISO 45001:2018 is being implemented.

The organizations must report the real data of accidents, and this will not decrease the reputation but it shows that there is a deep understanding and commitment on HSE policies.

Companies should not standardize the measures that were analyzed in this report, but it can be a useful guide for reference and, depending on the reality of the organizational culture of each company, adapt the measures that were addressed in this project. All companies must implement the safety system in their workplace and this measure should not be limited to obtaining certification but in a real implementation.

The company must know how to define the company's culture and the occupational safety culture and from this point on, take the occupational safety culture as an integral part of the organizational culture, in this aspect the company's leadership has a crucial role in implementing the occupational safety culture as strong pillar for organizational culture.

Every Occupational Safety Health professional must have a minimum of humility to know how to work together and learn from mistakes, that are lessons learned, it is necessary to look at occupational health and safety as a field where there is a constant learning.

In future researches can be investigated the companies with implemented system based on ISO 45001 and the number of accidents; cost and gains in terms of implementing OHS System.

Similar questionnaires should be sent either by organizations in the occupational safety field, either by organizations representing International Standards as well as governmental institutions

References

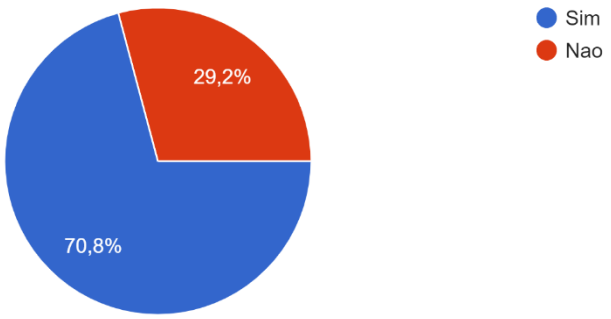
1. Andriani, D. P., Setyanto, N. W., Kusuma, L. T. Desain dan Analisis Eksperimen untuk Rekayasa Kualitas. Universitas Brawijaya Press, Malang (2017).
2. ALMEIDA, L. R. O incidente crítico na formação e pesquisa em educação. Revista Educação e Linguagem, v. 12, n. 19, 181-200, jan./jun. 2009.
3. AIRES, D. M; GÁMEZ, C. R; GIBB, A. Prevention through design: The effect of European Directives on construction workplace accidents. Safety Science, v. 48, p. 248 – 258, 2010.
4. AKSORN, T; HADIKUSUMO, B. H. W.. Critical success factors influencing safety program performance in Thai construction projects. Safety Science. v. 46, p. 709 - 727, 2008
5. ARAUJO FILHO, J. T; GOMES. M. L. B. A customização em massa na construção civil: Um estudo no subsetor de edificações. Revista Produção Online, v. 10, n. 2, jun. 2010.
6. ASSUNÇÃO, A. C. et al. Gerenciamento de Riscos de abertura de uma estrada em uma pequena hidrelétrica utilizando o método de análise preliminar de riscos. Revista Ingepro – Inovação, Gestão e Produção, v. 1, n. 10, dez. 2009. AZEVEDO, R. P. L. Acidentes em operações de movimentação manual de cargas na construção. 2010. Tese (Doutorado Engenharia Civil). Universidade do Minho. Escola de Engenharia. Portugal.
7. Patil, R.B., Waghmode, L.Y., Chikali, P.B. and Mulla, S. An Overview of Fault Tree Analysis (FTA) Method for Reliability Analysis & Life Cycle Cost (LCC) Management. IOSR Journal of Mechanical and Civil Engineering Special Issue (SICETE) 1, 14-18 (2013).
8. Pandey, A., Singh, M., Sonawane, A.U., and Rawat, P.S. FMEA Based Risk Assessment of Component Failure Modes in Industrial Radiography. International Journal of Engineering Trends and Technology 39(4), 216-225 (2016).

CIEP+UTT Professor :	**UEM Professor:**	***Student :***
Name & Surname : Raed Kouta *visa*	*Name & Surname : Marcelino Rodrigo Borges Chambal* *visa*	*Name & Surname : Edson Narciso Simao* *visa*

ATTACHMENTS

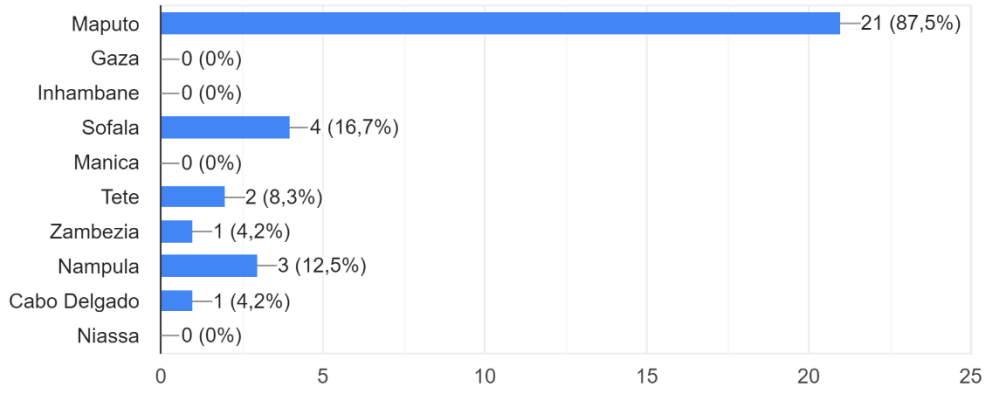
Esta é a primeira vez que sua empresa é solicitada a participar de uma pesquisa de Higiene Saude, Segurança e Meio Ambiente?

24 respostas



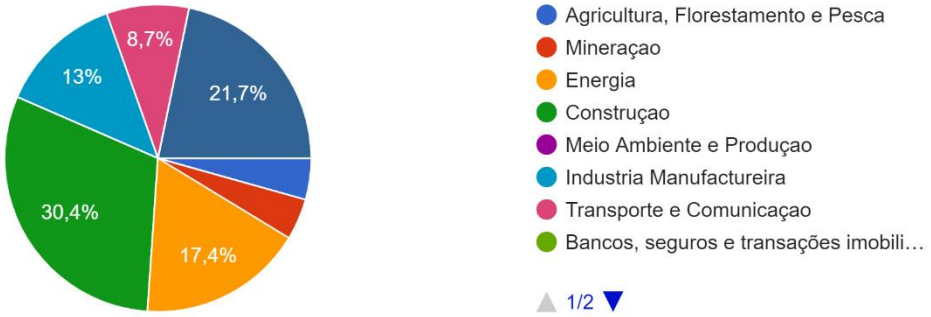
2. Onde está localizada a empresa?

24 respostas



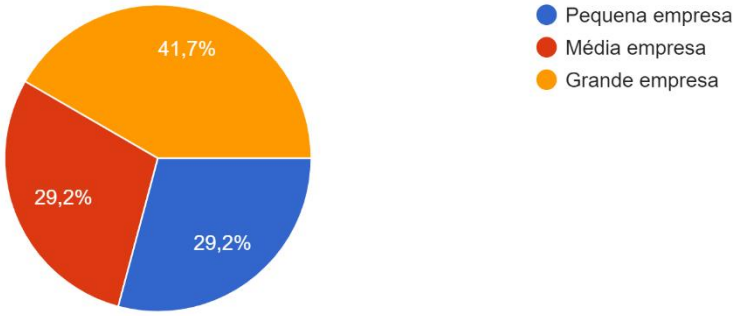
3. Qual é a área de atuação da empresa?

23 respostas



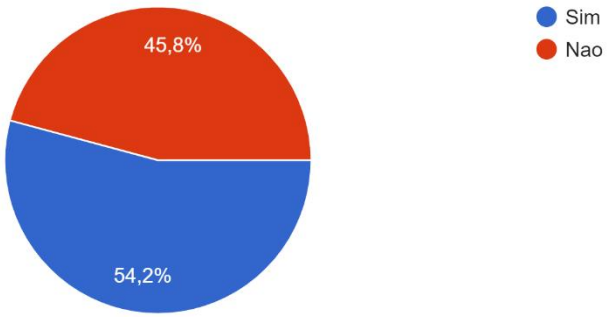
Tipo da empresa?

24 respostas



5. Sua organização possui um Sistema de Gestão de SST, baseado na norma ISO 45001: 2018

24 respostas



6. Quais são as vantagens que associa ao Sistema de gerenciamento de Saude Segurança no Trabalho, padrões ISO 45001: 2018?

14 respostas

Não tenho uma resposta a dar.

Redução de riscos

Percepção de condições inseguras,
Prevenção de acidentes de trabalho
Salvar vidas

Garantir a segurança no ambiente de trabalho

Maior clareza no que é boas practicas e no é necessário para alcança las

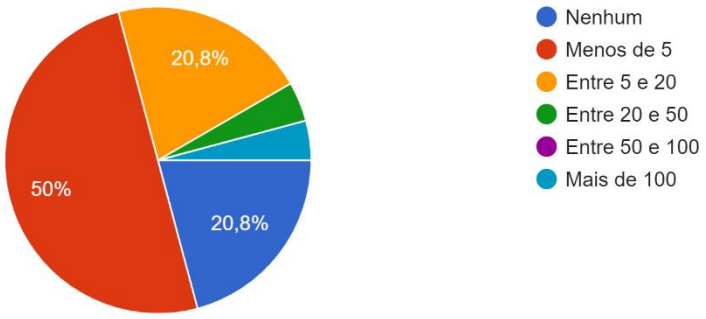
Zero acidentes

Ter a produtividade sempre em alta com isso aumentando as receitas.

Permite melhoria e optimização dos sistemas de SST

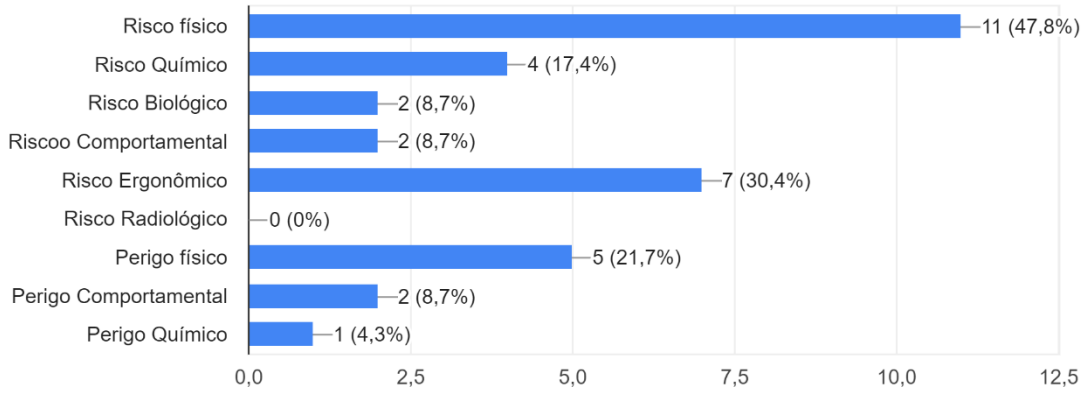
7. Por favor, quantifique quantos acidentes ocorrem anualmente na sua empresa?

24 respostas



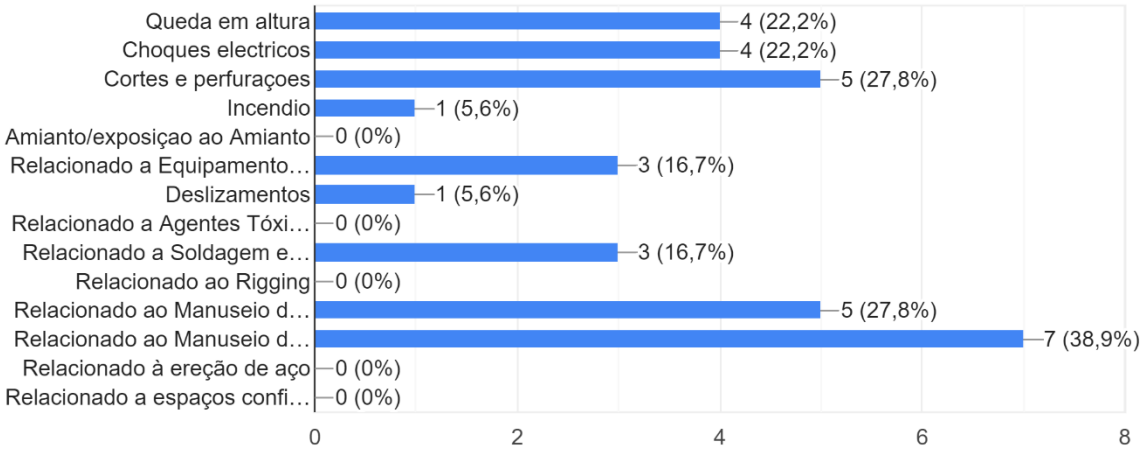
8. Por favor, especifique que tipo de risco é encontrado com mais frequência em sua empresa?

23 respostas



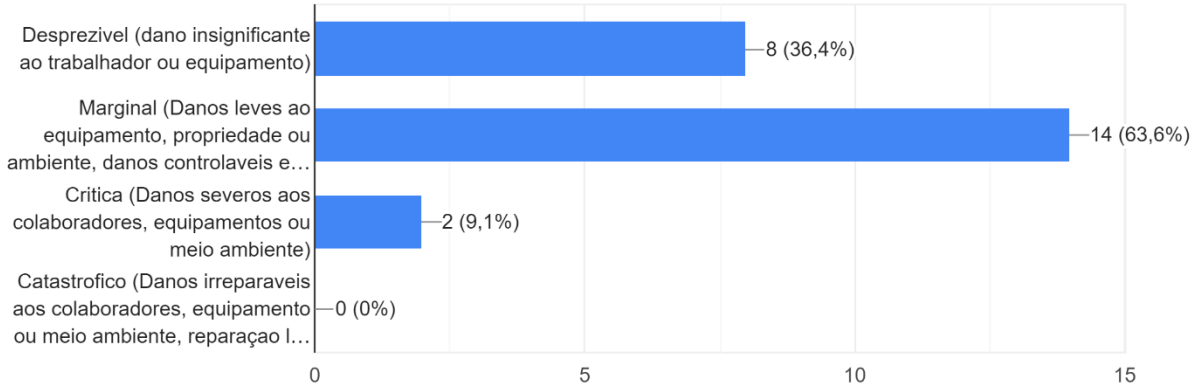
9. Quais dos seguintes acidentes ocorrem com mais frequência?

18 respostas



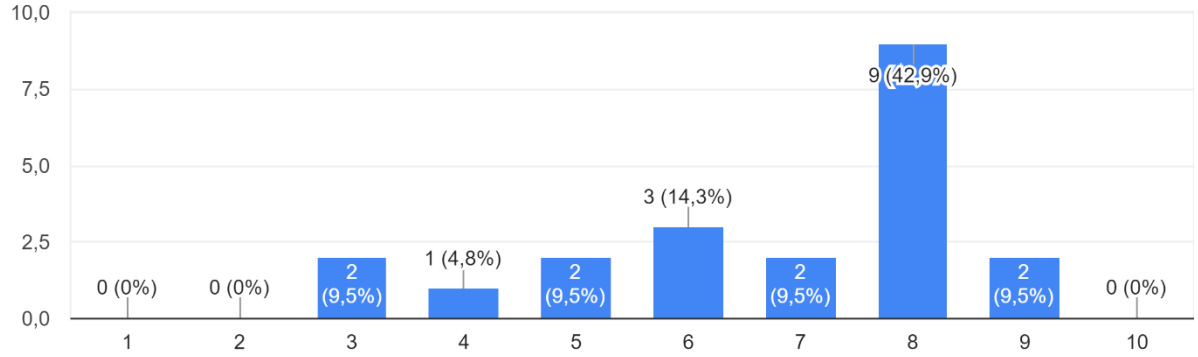
10. Qual é o nível de gravidade dos incidentes / acidentes?

22 respostas



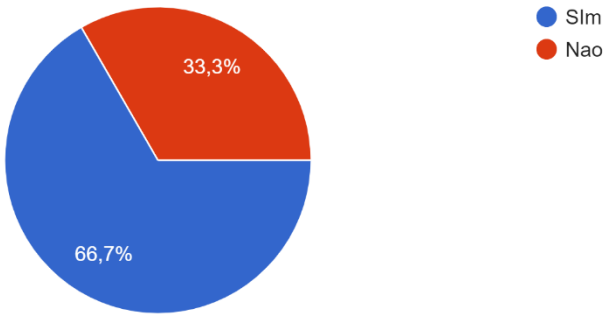
11. Em uma escala de 0 a 10 como classifica a implementação de SST em sua organização?

21 respostas



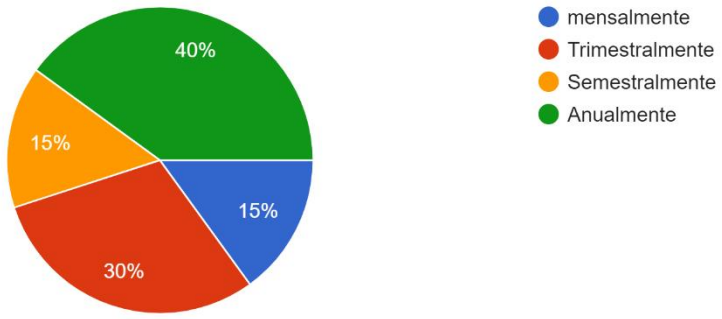
12. Sua organização oferece treinamento específico de Segurança do Trabalho?

24 respostas



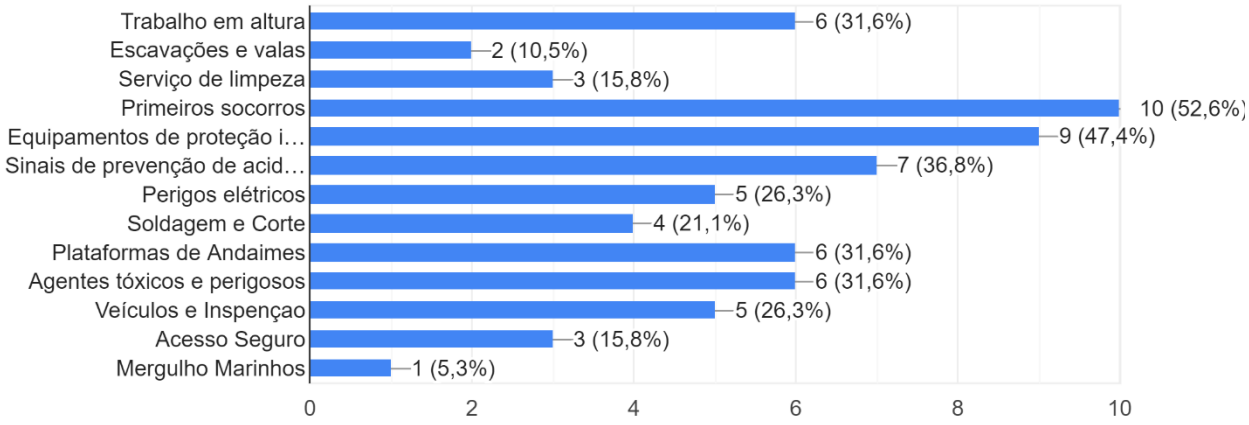
13. Com que frequência a empresa oferece treinamento ocupacional?

20 respostas



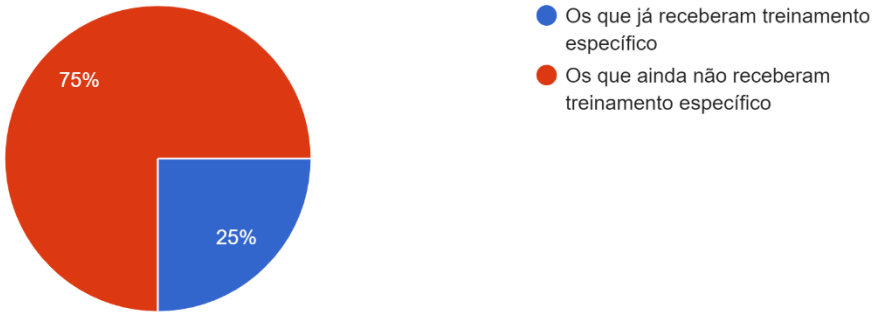
14. Na lista abaixo, marque os treinamentos oferecidos por sua Organização

19 respostas



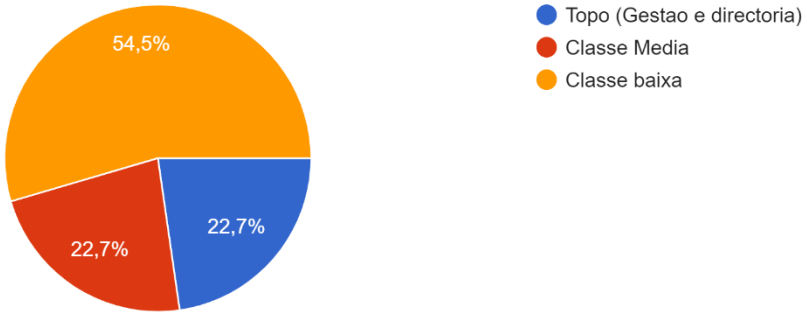
15. Dentre os trabalhadores que receberam treinamento específico e os que ainda não receberam treinamento específico, qual grupo apresentou ...dimentos de Saúde e Segurança e Meio Ambiente?

20 respostas



16. Dividindo os trabalhadores na pirâmide hierárquica, à qual grupo os trabalhadores tendem a resistir o cumprimento das normas de Saúde, Segurança e Meio Ambiente

22 respostas



Insite

Insite is a company recognized in Mozambican territory as Internationally, recognized by INNOQ in the list of the best Small and Medium Enterprises at SADC level. Insite has helped to contribute to the development of governmental and non-governmental institutions, implementing systems that meet the needs of customers, highlighting the Safety and Environment and Quality Management systems, improving the capacity of organizations, thus enabling a economic and sustainable growth for organizations, as well as for the economic and sustainable development of the country in general (Mozambique).

In order for InSIte to obtain the expected results, Insite not only drew up strategies and plans for the implementation of a good and effective Health, Safety and Environment system, but also in the formation and training for a good use of know-how and doing know, InSIte participates fully in the quality of its employees and customers for joint success, annually renewing the certification in terms of the QES Integrated Management System, and because InSIte believes and has as its main objective the improvement of the services offered, Insite in this sense aims at the development of skills, as well as professional and interpersonal skills. Whenever possible, in order to meet the demands and needs of customers, Insite has sought international technical support to meet national and international needs.

With Insite's diverse team of professionals, Insite seeks to satisfy the needs of customers in accordance with the business culture of the customer and its employees, thus seeking to create a favorable balance for both organizations. Insite's mission is to help Organizations find, develop and implement solutions that allow them to be more efficient and competitive in all markets. Insite bets on specialization to better respond to the needs of our customers, currently Insite provides services through 5 specialized business units. The Insite team is united by a culture that promotes cooperation to satisfy our customers and continuously improve their satisfaction. This culture is expressed in our Values: Excellence | Professionalism | Innovation | Competence | Optimism | Gravity.

Five Units where Insite operates:

- Quality and Sustainability
- Forest and Agribusiness

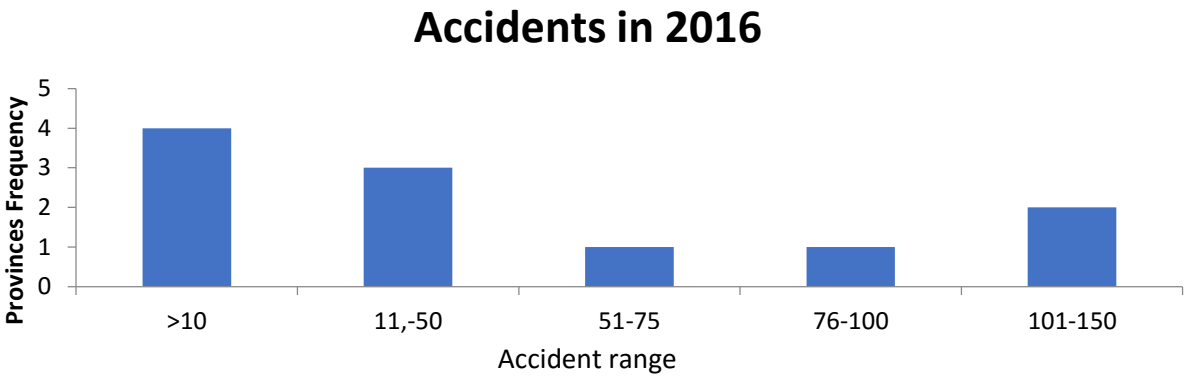
- Energy, Health, Safety and Environment
- Emergency Preparedness and Response
- Nutrition and Food Safety

Table 4- Statistical analyses of reported accidents in the year of 2016

Accidents in 2016		***Statistical Analysis*** ***Descriptive Statistic (2016)***	
Country	495	Mean	45.00
Niassa	6	Standard Error	14.92
Cabo Delgado	11	Median	31.00
Nampula	41	Mode	4.00
Zambezia	4	Standard Deviation	49.49
Tete	53	Sample Variance	2449.60
Manica	31	Kurtosis	0.16
Sofala	101	Skewness	1.08
Inhambane	4	Range	147.00
Gaza	1	Minimum	1.00
Maputo Province	148	Maximum	148.00
Maputo City	95	Sum	495.00

	Count	11.00

Table 4. Source: Adapted from IGT



Graphic 7- Year of 2016 frequency by provinces, Source: Adapted from IGT

For the case of data analysis in 2016, there were 4 provinces with less than 10 accidents, in the interval between 11 accidents and 50, there were records in 3 provinces, one province recorded in the interval from 51 to 75 accidents, and in the interval between 76 to 100 there was a province with that number and from 101 to 150 were 2 provinces that registered accidents in this interval, the limit was in the interval between 101 to 150 accidents, specifically 148 accidents in Maputo Province

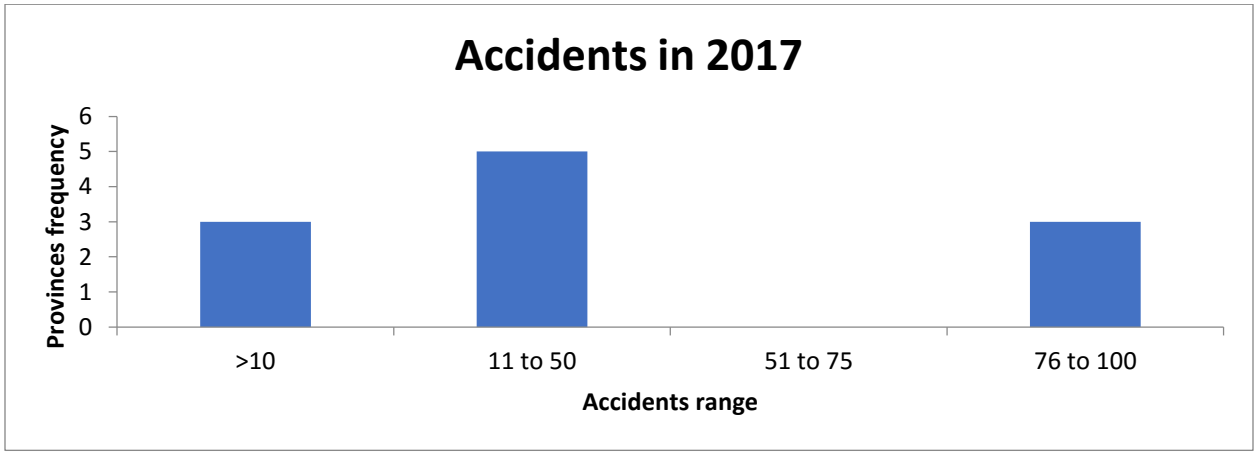
2017 Data Analysis

Table 5- Statistical analyses of reported accidents in the year of 2017

Accidents in 2017		***Statistical Analysis*** ***Descriptive Statistic (2017)***	
Country	399	Mean	36.27273
Niassa	1	Standard Error	11.07174

Cabo Delgado	4	Median	27
Nampula	28	Mode	#N/A
Zambezia	12	Standard Deviation	36.72081
Tete	27	Sample Variance	1348.418
Manica	34	Kurtosis	-0.76915
Sofala	79	Skewness	0.949041
Inhambane	6	Range	96
Gaza	15	Minimum	1
Maputo Province	97	Maximum	97
Maputo City	96	Sum	399
		Count	11

Table 5. Source: Adapted from IGT



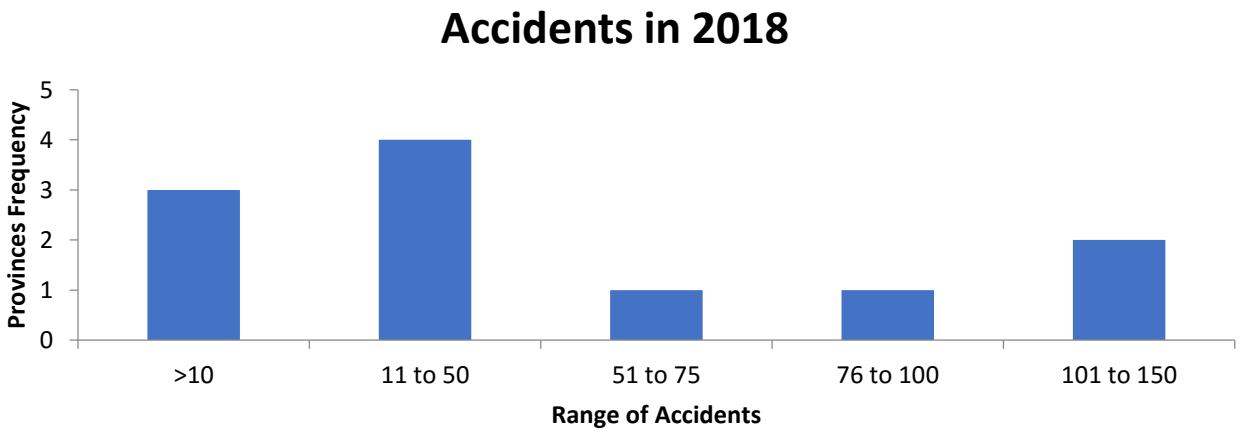
Graphic 8-Year of 2017 frequency by provinces

In 2017 less than 10 accidents were registered in 3 provinces, in the interval between 11 and 50 accidents there was this record in 5 provinces, no accident was registered in the interval between 51 accidents to 75, in the corresponding number of accidents between the interval from 76 to 100 were recorded in 3 provinces, this was the limit interval for the year 2017, specifically 97 accidents in Maputo Province

Table 6- Statistical analyses of reported accidents in the year of 2018.

Accidents in 2018		***Statistical Analysis*** ***Descriptive Statistic (2018)***	
Country	496	Mean	45.09
Niassa	6	Standard Error	14.41
Cabo Delgado	28	Median	22.00
Nampula	18	Mode	6.00
Zambezia	6	Standard Deviation	47.81
Tete	59	Sample Variance	2285.49
Manica	22	Kurtosis	0.37
Sofala	146	Skewness	1.19
Inhambane	3	Range	143.00
Gaza	17	Minimum	3.00
Maputo Province	85	Maximum	146.00
Maputo City	106	Sum	496.00
		Count	11

Table 6. Source: Adapted from IGT



Graphic 9- Year of 2017 frequency by provinces Source: Adapted from IGT

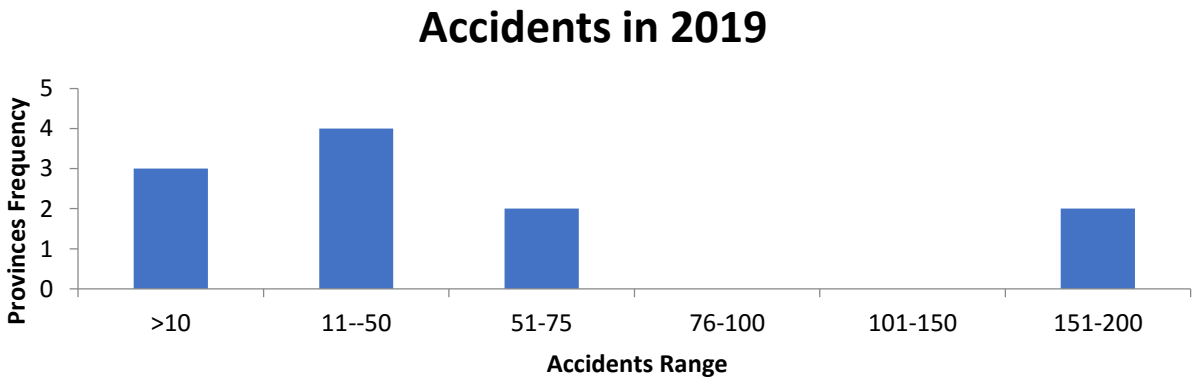
In 2018 less than 10 accidents were registered in 3 provinces, in the interval between 11 and 50 accidents there was this register in 4 provinces, between 51 accidents to 75 in only one province, in the corresponding number of accidents between the interval of 76 to 100 there was a record in only one province and in the range of 101 accidents to 150 there was a record in two provinces, this was the limit range for the year 2018.

Table 7- Statistical analyses of reported accidents in the year of 2018.

Accidents in 2019		***Statistical Analysis*** ***Descriptive Statistic (2019)***	
Country	573	Mean	52.09091
Niassa	0	Standard Error	18.08086

Cabo Delgado	30	Median	30
Nampula	57	Mode	#N/A
Zambezia	11	Standard Deviation	59.96742
Tete	18	Sample Variance	3596.091
Manica	46	Kurtosis	1.035366
Sofala	67	Skewness	1.432083
Inhambane	5	Range	178
Gaza	10	Minimum	0
Maputo Province	178	Maximum	178
Maputo City	151	Sum	573
		Count	11

Table 7. Source: Adapted from IGT



Graphic 10- Year of 2017 frequency by provinces Source: Adapted from IGT

In 2019 there was a record of 3 provinces with less than 10 accidents, four provinces were in the range between 11 and 50 accidents, two provinces were recorded with accidents in the range between 51 and 75, there were no accidents in the range between 76 and 150 accidents, two provinces had a record of the number of accidents in the range between 151 to 200.