Occupational risk management in construction supply chain

Gestão de riscos ocupacionais na cadeia produtiva da construção civil

Gestión de riesgos laborales en la cadena productiva de la construcción

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Abstract

The building is historically a driver of the economy, creating thousands of direct and indirect jobs, moving a huge chain of suppliers of raw materials, supplies and services, besides building a country’s infrastructure and the homes of millions of people. But working conditions in this sector that is so important to the country are not the best, exposing workers to risks of work accidents and occupational diseases. Therefore, this study sought to present the main occupational hazards in the construction industry, discussing alternatives for effective risk management by reducing the rates of accidents and illness among workers. In this research, case studies were done in small and medium-sized construction sector facing the residential construction market. It was also proposed solutions for the implementation of risk management and occupational health and safety for businesses to succeed and lower the rates of accidents at work, health and safety, and quality of work life in these companies.

Keywords: Risk Management. Occupational Health and Safety. OHS. Construction.

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Resumo
A construção civil é historicamente um impulsionador da economia, gerando milhares de empregos diretos e indiretos, movimentado uma cadeia enorme de fornecedores de matérias primas, insumos e serviços, além de construir a infraestrutura do país e as moradias de milhões de pessoas. Porém as condições de trabalho neste setor tão importante para o país não são as melhores, expondo os trabalhadores a riscos de acidentes de trabalho e a doenças ocupacionais. Assim este trabalho procurou-se apresentar os principais riscos ocupacionais no setor da construção civil, discutindo alternativas para a gestão eficaz do risco com a redução do índice de acidentes e adoecimento dos trabalhadores. Nesta pesquisa foram feitos estudos de caso, em empresas de pequeno e médio porte do setor da construção civil voltadas para o mercado de obras residenciais. Também foi proposto soluções para que a implantação da gestão de riscos de saúde e segurança ocupacional para que as empresas tenham êxito e melhorem os índices de acidentes no trabalho, a saúde e segurança, além da qualidade de vida no trabalho destas empresas.

Palavras-chave: Gestão de Risco. Saúde e Segurança Ocupacional. SSO. Construção Civil.

Resumen
La construcción es históricamente un motor de la economía, creando miles de empleos directos e indirectos, moviendo una enorme cadena de proveedores de materias primas, suministros y servicios, además de construir la infraestructura de un país y los hogares de millones de personas. Pero las condiciones laborales en este sector tan importante para el país no son las mejores, exponiendo a los trabajadores a riesgos de accidentes laborales y enfermedades profesionales. Por lo tanto, este estudio buscó presentar los principales riesgos laborales en la industria de la construcción, discutiendo alternativas para una gestión efectiva de riesgos mediante la reducción de los índices de accidentes y enfermedades entre los trabajadores. En esta investigación se realizaron estudios de caso en el sector de la pequeña y mediana construcción de cara al mercado de la construcción residencial. También se propusieron soluciones para la implementación de la gestión de riesgos y seguridad y salud en el trabajo para que las empresas tengan éxito y reduzcan los índices de siniestralidad en el trabajo, la salud y seguridad y la calidad de vida laboral en estas empresas.

Palabras clave: Gestión de Riesgos. Seguridad y Salud en el Trabajo. SST. Construcción Civil.
Introduction

Accidents and occupational diseases for their harmful consequences, go beyond the boundaries of enterprises causing great damage social, becoming the responsibility of governments, the business sector and society as a whole. According to the International Labor Organization (ILO, 2022), in the last decades there has been a significant acceleration in construction activity in various parts of the world.

These activities have provided employment for thousands of workers, creating jobs of fundamental importance. However, the construction industry shows a positive image of the social point of view, but also shows a side that is not always seen with the same magnitude, as accidents have occurred despite efforts to prevent them.

The risks which accompany the operation of construction engineering, which also exist in other industries, should not be considered as factors which inevitably result in accidents and illnesses. Experience proves that if there is probability of an accident with serious injury, it can be eliminated by recognising the existence of the risk and its consequences and adopting preventive measures to eliminate them or mitigate their effects.

Both from the human and economic point of view, the need for a major effort to reduce the number of accidents in various spheres of activity are urgent and important. According to ILO (2021), the main risks in the construction industry could be listed as: breakage of walls, parts of the works, stakes, massive land, collapse and fall of ladders, scaffolds, stairs, beams, falling objects, tools and work pieces, people dropping from steps, stairs, roofs, scaffolds, falls from windows and in openings on level loading, unloading, lifting, cargo transportation, on or in contact with vehicles of all kinds; operation in railways, in power plants and power transmission machinery, working with machines, loading and transporting equipment, equipment for welding and cutting; on compressed air equipment, in contact with fuels, hot or corrosive materials; in contact with hazardous gases; during blasting with explosives, using or handling hand tools; involvement with traffic on the site under construction, form and origin of the work.

This work aims to make a contribution on the subject, showing in a clear way, the management of occupational hazards in the construction industry, discussing the factors that can lead to accidents at work and occupational illnesses, in order that the firms have subsidies to implement satisfactorily and effectively provide such a system and their workers can have all the benefits of managing occupational health and safety (OHS) in the workplace.
Therefore, we tried to present and describe what it is and how a Risk Management System Occupational Safety and Health works, discuss the difficulties and problems faced by small and medium enterprises in the construction industry and suggest ways to improve the management of occupational hazards in construction companies.

**Literature Review**

**2.1 Health and Occupational Safety**

The definition of the ILO and the World Health Organization (WHO) on OHS is: The goal of occupational health is to promote and maintain a high degree of physical, mental and social wellbeing for the workers, in all their activities; prevent any damage to health caused by working conditions and to protect them against the risks arising from presence of agents harmful to health; put and keep workers in jobs consistent with their physiological and psychological skills, and finally, adapting the work to the person and each person to their tasks.

According to Bendrikow (1994), the ILO definition by extension leads inevitably to consider issues not directly related to the company, including the external environment, and life in society.

And also, that the activities of occupational health comprise as assumptions three main focus areas, which are: a promoting and maintaining the health of the worker and his fitness for the job b improving the conditions and environment work to ensure the safety and health at work c adoption of systems of work organisation and corporate culture, capable of contributing to the safety and health at work, with a positive social environment.

Also Bendrikow states, with respect to construction, that there are indications that the knowledge of industrial hygiene used in construction, are applied empirically, usually looking up simplistically identify problems through the most frequent complaints of the workers, requiring them to use personal protective equipment, without a careful study of working conditions and their organisation, without a technical evaluation of the type of protection offered and the discomfort provided to the employee user. Heineck (1996) states that in the construction sites of some construction companies, it is already possible to find a number of changes in the production process and its organisation. Such measures have been complemented by more radical changes, such as rationalisation and integration of the projects,
using different technologies and also a total change in labour relations in the construction sites, with the enhancement of the workers and their involvement in decisions about the conduct of the work and increasing the level of communication and inter-relationships between people.

This is a vision that involves the workers in planning the work and during its execution, giving them responsibility for the actions in their protection. Lima (2001) states that the prevention of occupational diseases in the general management of the building project must be integrated with specific programmes for the prevention of occupational risks, prevention and control of diseases at work set out in specific legislation.

2.2 Nearly Accidents and Injuries

According to Benite (2004), the term ‘accident’ naturally suggests a vision of a sudden event that occurs by chance and that results in personal injury. However, this view is inadequate and ultimately generates difficulties in the field of accident prevention because it facilitates the concept of the following incorrect ideas: a accidents occur by chance b the consequences occur immediately after the event c the accidents necessarily result in personal damage.

Dictionaries define accident as “Unfortunate happening, casual or not, and that results in injury, harm, damage, ruin, etc.; disaster” [Benite, (2004), p.65].

Still according to him, the legal definition of an accident at work is provided by Law 8213 of July 24, 1991, namely: “What is the performance of work in the service of the company, or by the exercise of the special work of the insured, causing injury or functional disorder that causes death, loss or reduced work ability, permanent or temporary.”

In the accidents prevention view, aggregated to standards and guides of SGSSO, being inserted in the definition of accident presented by OHSAS 18001 and BS 8800: “Accident is an undesirable event that results in death, health problems, injuries, damages and other losses”.

Another term that will be used throughout this work is ‘near accident’ that is equivalent to the term ‘incident’, and that, according to the standards BS 8800 and OHSAS 18001, is defined as: “an unforeseen event that had the potential to generate accidents”. This definition is intended to include all events that do not result in death, health problems, injuries, damages and other losses.
According to Benite (2004), the knowledge of near accidents provides information for organisations to identify weaknesses and establish appropriate control measures, allowing to eliminate or reduce the likelihood of accidents to become real in a future situation.

According to Viégas et al. (2002), those who believe that most accidents happen simply as a result of carelessness, miss a golden opportunity every time an accident or near-accident (incident) happens. Still according to him, when they do not examine the real and basic reasons that occurred, they fail to gather valuable information on how to prevent the event from occurring again.

2.3 Concept of Occupational Risk Management

Risk management can be defined as the science, art and function that seeks the protection of human, material and financial resources of an organisation, in relation to the elimination, reduction or funding risks, if economically feasible, says Santos (2005).

According Marinho (2020, p.4): “In recent decades, particularly in developed countries, there have been changes in the focus of the professionals who work with the risks in the workplace. The preventive aspect has been more emphasized, acting on the control and elimination of hazards and risk reduction at its source, to reduce accidents and diseases.

It is recognized, not without much debate and struggle, that the forms of work organization and the management practices are important factors to be considered as causes of accidents, illness and suffering. Safety and health policies in companies that take into account these aspects have been recognized as the most effective and recognized worldwide.”

According to British Standard, BS 8800 (2023), in risk assessment: “A hazard is a source of potential harm or damage, or a situation with potential for harm or damage” and the “risk is the combination of the probability of occurrence and the consequences of a specific hazardous event (accident or incident).”

According to Marinho (2020), the modern conception of analysis and risk management is far distant from the practice of Brazilian companies, especially regarding micro enterprises and service providers in general. Still according to him, few attitudes are taken before accidents and occupational diseases, and very often workers are accused as the main responsible for them.

The British Standard, BS 8800 (2023) further comments that the risk also has two key elements, the probability that a hazard may occur and the consequences of the hazardous
event. Thus, it becomes necessary to use the procedure for risk assessment activities at work everyday, in order to preserve health and safety of workers and meet legislation.

According to British Standard, BS 8800 (2023), the risk assessment procedure is intended to be used:

a) In situations where the dangers seem to constitute a significant threat and it is unsure whether planned or existing controls are adequate;

b) By organisations seeking continuous improvement in its SGSSO systems, beyond minimum legal requirements.

Risk assessment involves three basic steps (British Standard, BS 8800, 2023):

a) Identify the danger;

b) Estimate the risk, the probability and severity of the hazard;

c) Decide whether the risk is tolerable.

For many years the risk assessment of OHS has been conducted, in general, on an informal basis. It is now recognised that the risk assessments are fundamental to managing proactive OHS, and that systematic procedures are necessary to ensure its success, describes the British Standard, BS 8800 (2023).

The British Standard, BS 8800 (2023) proposes the following risk assessment process:
Figure 1

Risk assessment

The following criteria are required for the organisations carrying out an effective risk assessment:

a) Classify work activities: Prepare a complete diagnosis of work activities covering the enclosures, production, people and procedures;

b) Identify hazards: Identify all hazards in each work activity;

c) Determine the risk: To estimate the risk associated with each hazard, assuming that planned or existing controls are properly sized. One should also consider the effectiveness of the controls and the consequences of their failures;

d) Decide whether the risk is tolerable: To judge whether existing precautions or planned SSO are sufficient to maintain the dangers under control and meet the legal requirements;

e) Action plan for risk control: Prepare a plan to deal with any issues encountered by risk assessment that require attention. Companies should ensure that the new and existing OHS remain active and effective;

f) Review the adequacy of the plan of action: Reassessing the risks based on the revised
controls and verify that the risks are tolerable.

According to Marinho (2020), the ideal is that all work activities are analysed, but given that in many cases this task can not be performed some factors may be considered to prioritise some activities:

a) The frequency and severity of accidents: activities where accidents occur frequently or where an accident has happened with serious injuries or losses;

b) Activities where the potential of serious injury or illness is already known, either for injuries, dangerous conditions or toxic exposure;

c) Recent activities: due to lack of experience in such operations, hazards may not be obvious or not have been properly anticipated;

d) Modified activities: new hazards may be associated with changes in procedures, tooling, raw materials or operations;

e) Activities done infrequently: workers may be at increased risk when performing tasks out of their routine and a risk analysis at work (RAW) provides a means of reviewing these dangers.

The tolerable risk means that the risk has been reduced to the lowest level that is reasonably practicable, according to British Standard, BS 8800 (2023).

The British Standard, BS 8800 (2023) comments in its text that is usually not necessary to make precise numerical calculations of the risk in most cases in small and medium enterprises. The complex methods to quantify risks are normally required only when the consequences or failures can be catastrophic.

Risk assessment in these cases, such as in industries that provide significant risks, relates to the approach required in other places of work, but in most organisations, much more simpler subjective methods are suitable.

According to Barreto (2011b), the assessment of health risks associated with exposure to toxic substances and harmful energies may require, for example, measurements of concentrations of aero-dispersals and metal fumes in the air, noise exposure and chemical exposure among others.

Barreto (2011a) also comments that compliance with labour laws, adoption and implementation of indicators based on studies of costs related to workplace accidents denote the tendency for companies to implement strategies aimed at preserving the integrity of workers, seeking elements that provide the management of OHS within the companies. Some
Occupational risk management in construction supply chain

Indicators of quality of work life can be improved by actions to maintain safe and healthy environments, safeguarding the health and welfare of employees.

Resende (2006) suggests that the modern management of occupational safety and health should be seen as a strategic component which value can represent to the company an important factor to its success or even survival.

**Materials and Methods**

After the literature search, we detected the absence of detailed data and statistics on occupational risk management in the construction industry. For both surveys was done in the form of a case study in building companies from the Midwest region of Minas Gerais, small and medium businesses. A questionnaire was developed with essay questions and multiple choice questions where the respondent answered based on their experience about the company where they work.

We interviewed several types of workers, servant masons, masons, firefighters, carpenters, painters, the workmen, engineers, etc. Other data were obtained from impressions taken by the interviewer in informal conversations about health and safety with the workers. Observe that this last form of data collection was necessary because of the low education of the majority of construction workers.

**3.1 Discussion and Analysis of Results**

In surveys with construction workers were found troubling data on exposures to OHS, as can be seen below.

a) Fall height advent of the coating façade.

b) Fall height arising from the lack of support from scaffolds.

c) Fall height arising from the lack of safety equipment or its misuse (seat belts and proper fixation).

d) Fall height arising from the absence of guardrails.

e) Fall height arising from the lack of security in the activity of painting façades.

f) Brial in trenching.

g) Burial at the opening of foundations and caissons.

h) Damage to hearing arising from the use of equipment (marble saws, table saws,
Occupational risk management in construction supply chain

jackhammers, etc.).

i) Damage to hearing arising from the use of heavy equipment (tractors, excavators, concrete mixer trucks, etc.).

j) Loss of limbs coming from cutting equipment (marble saws, table saws, etc.)

k) Orthopedic damage (spine, knee, shoulder, hands and feet) due to poor posture and repetitive effort.

l) Burns and damage due to various electrical shocks.

m) Damage to the respiratory system (silicosis) due to fine particulate matter inhaled.

n) Damage to the respiratory system due to inhalation of solvents and other chemicals used in painting and cleaning works.

o) Damage to the skin caused by constant exposure to the sun.

p) Crushing caused by heavy equipment or handling materials at construction sites.

q) Damage caused by falls of various objects over Workers.

r) Waterborne diseases caused by poor condition of some construction sites.

The results obtained in the analysed companies match the factors that can lead to accidents with great gravity, which generate permanent disability in the workers or even fatal accidents.

Figure 2

Scale of accidents and near accidents
Above, we have a range of events that precede a fatal accident, found in construction companies through the statistics of the last ten years.

Just watching the case discussed above and the literature on the topic, some steps can be taken in order to make the management of risks to health and safety of construction workers.

These measures are:
a) Planning occupational safety actions along with the development of the work projects.
b) Risk assessment in relation to the stages of the work, anticipating the planning of occupational safety actions at the construction sites;
c) Implementation of periodic health checks and depending on the position held and the risk of work activities;
d) Constant and adequate training in relation to the activity performed by the employee and the use and maintenance of individual protective equipment;
e) Searching for solutions for the use of collective protective equipment to the detriment of the use of individual protective equipment;
f) Integration of the management of occupational risks to the quality of activities routine in the works;
g) Implementation of integration policies and discussion among workers about the collected data in risk assessments;
h) The company must have a strong policy of human resources and workplace safety that values the employee and that can give them a minimum of stability, so that they feel integrated in the company;
i) Have a system that integrates and enter businesses and outsourced workers to the risk management, in order that all workers are involved in the activities of OHS;
j) Deploy an internal audit team that makes complete surveys of risks included in all work activities within the company, researching the risk of accidents and health of the workers and suggesting immediate interventions if necessary. This team should preferably be comprised of employees from all levels and sectors in the company, in order to reach objectively the risk of each sector, producing reports that are easy to understand to all the workers;
k) Focus on immediate risks and in situations with long-term effects, such as stress, occupational diseases, etc.
Possess fundamentally a willingness to change the situation and deploy not only a system of risk management, but rather a preventive culture regarding worker health and workplace accidents.

**Conclusions**

We conclude that risk management is an important tool in the prevention of occupational accidents and prevention of OHS of the construction workers.

But, we see the difficulties faced by companies in the implementation of risk management and prevention of occupational hazards in general, whether for the lack of investment by the firms in training and qualification policies, lack of organisation and planning the works, the workers not being aware of their labour rights and working conditions, seasonality of work and high turnover of workers.

In this sense, the construction industry is an important lever in a country’s economic growth, creating jobs and developing infrastructure in the country, but its workers are exposed to high risks of occupational accidents and diseases and this problem must be faced by the construction companies, with the use of OHS and risk management tools.

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Occupational risk management in construction supply chain


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